A SCIENTIST WALKS INTO A BAR:

exploring science communication through science comedy

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I, Edward Thomas Bankes, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Date:

Signature:

Abstract

Science comedy has gained increasing interest within science communication and public engagement [SC/PE], as a tool that might benefit both the public and SC/PE practitioners, providing new ways for the public to engage with science and offering practitioners new opportunities to perform science in public and become socialised into the world of SC/PE. This thesis focuses primarily on the role of science comedy in the development of SC/PE practitioners, through an ethnographic case study of a cohort-based SC/PE training scheme that taught SC/PE through comedy. Through observations of performance nights, training events and the group's online communication over a 14-month period, as well as interviews with participants, the study focuses of three facets of training that emerged as concerns for participants' learning: how to be a 'good' science communicator, how to manage the role of the 'public' in SC/PE and the notions of change, transformation and purpose in narrating practice. Through a theoretical lens drawing from science and technology studies, Bourdieu and Communities of Practice, the thesis characterises training as part of broader project to build a world for science communicators. The findings of this study suggest that the process of learning science communication consisted primarily in learning how to belong within a local community and to adhere to its rules, rather than a technical enterprise of skill acquisition or more abstract engagement with 'publics', 'science' or 'society'. The meaning and use of the 'public' or the 'purpose' of SC/PE emerged as means of regulating this local space, as means to negotiate positions within the field and their relationships with one another. The contribution of the thesis is to highlight how SC/PE has been constructed and sustained as a site that might, often unintentionally, best serve the interests of science communicators, rather than the 'public'.

Impact Statement

This thesis extends work in STS and science communication concerning contemporary science communication practice by attending to two underexplored features of the contemporary science society landscape, firstly the use and metalanguage of comedy and secondly the role of science communication practitioners within professional practice. I contend that understanding the world of practitioners and producers – in terms of the practices, narratives of science and the 'public' and the collective understanding of the purpose of science communication – is crucial for understanding contemporary science communication, a contention that is not controversial within STS but has yet to be studied in depth. In doing so, the thesis substantiates more theoretical work in STS 'on the ground', showing how concepts such as the 'public', 'transformation' and indeed 'impact' are not self-evident terms that can be employed to assess science communication, but are rather part of a far broader set of increasingly internally referential social practices. In substantiating aspects of science communication and science in society that have been relatively unexamined, the thesis also offers empirical material that can be used and developed in teaching, both in STS and science communication.

While this thesis concerns science communication as a site of practice, it is principally a work of Science and Technology Studies, seeking to understand the world of science communication, rather than enacting an intervention or seeking to 'improve' practice, a goal that might rely upon reproducing many of the professional assumptions that this thesis seeks to explore. I contend that this approach has value in its own right but acknowledge that the 'impact' for practitioners may be less readily discernible. This thesis does not offer a clear product that can be extracted and sold, in part through my own misgivings about conceptualising research in terms of such a knowledge economy. Nevertheless, I hope that this work will speak to practitioners in the field, offering an account of science communication that might be endorsed, contested or indeed dismissed, allowing the space to reflect upon practice and to consider whether – and why – the empirical findings of this thesis speak to their own experience.

In this vein, I hope that this thesis might contribute to fostering a more productive relationship between researchers and practitioners within science communication. Conversations with practitioners conducted throughout the thesis often highlighted a negative view of science communication research, as either overly detached and and unfairly critical, or incomprehensible, offering answers to questions practitioners did not

see to be in need of asking. As a ethnographic study that is born out of the experiences and concerns of practitioners, this thesis might at once speak for and to practitioners (thought not ‘at’), allowing participants a space to discuss the field outside of professional restrictions, while also allowing broader sociological questions to be examined. Rather than aiming to deliver an empirical panacea that can simultaneously characterise and respond to the concerns of multiple communities, the thesis offers a starting point for future dialogue, in negotiating the purpose of science communication, and indeed the purpose of research.

Acknowledgements

While writing a PhD requires an enormous time spent on your own (or at least in your own head), imagining, conducting and writing up this research would not have been possible without the support of many people and institutions, all of whom are deserving of thanks and appreciation (though I hope they are already aware of this).

Firstly, I cannot thank enough the participants in the project; the members of the cohort and the organisers of the scheme. Without their generous help and willingness to give their time for interviews (and allow me to lurk in the darkness while they were on stage), this research could never have happened. As a naïve researcher, reading up to my eyeballs in ethnographic methods and the ways to build relationships within the field, this preparation was wonderfully undercut by their willingness to help me and contribute to the project. I cannot overstate how grateful I am and apologise if I have ever inadvertently referred to you as a 'data point'.

For a thesis seeking to trace the figured world of science communication, it is perhaps unsurprising to say that, despite my best efforts at a truly original and monoglossic yet centripetal tome, it has emerged through the many people who have contributed to the project and provided their support. I would like to thank my supervisors, Brian Balmer and Emily Dawson. Experts in the sociology of biological warfare and secrecy on the one hand, and inequity in science education on the other, might not have appeared the most natural supervisors for a project that started out as a media analysis of science in popular comedy, and so I am incredibly grateful that they were willing to take a chance on an over-enthusiastic masters' student. Their support throughout the PhD has been invaluable, for their criticism, their advice, their ability to see links that would never occur to me, and always pushing me to go further. I am also very grateful that they also ensured that I had the ownership of my project but left enough subtle hints so that I could transform my project from something quite pedestrian to (hopefully) a far more interesting, exploratory and substantive project.

The STS department at UCL has provided the best experience I could hope for in completing a PhD, offering a space to learn, experiment and continually come into contact with new ideas. The mixture of expertise and personalities have meant that there has never been a dull day, and that I've never been able to be certain of an idea for more than a week, as there's always been someone to make me think in a new way or challenge what I've hoped was definite enough to write down. Joining STS has truly felt like joining a (bizarre, dysfunctional) family, and when making a list of the staff I

wished to thank, I quickly wrote out the entire department. To the staff and my fellow PhD students – past and present – thank you for the chats, coffees, ‘quick’ drinks in the Housman room, longer drinks at the IOE, reading suggestions, chats on the stairs and generally being very lovely people. Given my research topic, I am eternally grateful that I was never subject to anyone’s favourite science jokes.

Seemingly easy to forget in acknowledgements, I cannot understate my gratitude to the professional services team at STS. Lori Coletti Campbell, Susan Walsh, Malcolm Chalmers, Randalle Roberts and Christina Ogunwumiju: without you my PhD would not have happened. Thank you for making the department such a great place to work, and humouring and dealing with my inane questions and inabilities to deal with money, technology, teaching and the general planning of my life[1]. My PhD would have been a lot harder, and certainly less enjoyable, without the opportunity for random chats, gossip and an easily accessible source of instant coffee.

Outside of UCL, particular thanks must go to Nicola Sugden and Jenny Bulstrode. As friends, colleagues and critics, their support has been invaluable, providing biting feedback when I needed it, and knowing how to build me up when my confidence (or mental health) was lacking. I would also like to thank Katrin Ettenhuber, my first ever academic supervisor. Not many people would respond to a first year undergrad telling them they hated the course they were doing and wanted to quit by urging them to untangle the weird mixture of interests they had and find a suitable outlet, and supporting them as they did. Finally, I would like to thank Simon Schaffer, for being the first to make me realise I might have something interesting to say about science (even if clearly not as a historian of science) and pushing me to UCL, where I found my home.

Finally, thank you to my family. To my sister Liz, thank you for introducing me to ‘good’ comedy. A PhD about comedy would never have happened without the sense of humour and interest in comedy that you helped instil in me. To my parents, Stephen and Juliet, for their constant support, allowing me to make mistakes, and stressing the importance of finding out and pursuing the things that interested me and I found important. I am also very grateful that they never insisted I pay rent. To all the other Bankeses and Thomases, thank you for your time, your distractions and keeping my feet on the ground.

[1] See chapter seven for discussion of the incompetent PhD student as a staple of science comedy

As the inspiration and material for my own history in person (see Chapter 3), this continual support has given me the confidence to develop as a researcher (see Chapter 7), shaped my thinking and made completing a PhD a highly enjoyable experience. Given just how generative and constitutive this support has been to my own research, it seems only fair that responsibility for the errors, misconceptions and flights of fancy held within this thesis be shared collectively.[2][3]

Finally finally, from reading multiple theses and acknowledgement pages, I understand that it is convention to thank your long term partner that has supported you through the long and winding road of completing a PhD, while also showing to the reader one's ability to maintain committed relationships, despite the pressures of academia.

Please turn over for the contents page.

[2] This is an example of academic humour
[3] But if you read Bakhtin, you will see that you are all to blame.

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Chapter One: Introduction

1.1: The Emergence of Science Comedy

Within the diverse and heterogenous fields of science communication and public engagement research and practice, there has been growing, though still tentative, interest in comedy as a new form of science communication practice. In part, this move has been motivated by the success of mainstream comedy shows that suggest a market for science content within mainstream media that could serve as a basis for more focused science communication work. The American sitcom *The Big Bang Theory,* following the lives of a group of research scientists, has gained worldwide success, while comedy has also been used in traditional science broadcasting, such as the pairing of the physicist Brian Cox and comedian Robin Ince in Radio 4's *The Infinite Monkey Cage.* Furthermore, mainstream comedians would appear to have embraced science, with figures in the UK such as Dara O'Briain, Ricky Gervais and Tim Minchin writing full shows around topics of science, mathematics and rationality. In accounting for this enthusiasm, preliminary work on science comedy has suggested two potential trajectories for research. The first is to consider the possible uses for science comedy as a form of science communication and public engagement work. The second, taking a more reflexive turn, takes the emergence of science comedy as an opportunity to examine the world of science communication, seeking to illuminate – and potentially challenge – the circumstances in which this enthusiasm has emerged and to understand the dynamics of a professional field seeking to enrol new communication formats and practices (see Riesch 2015).

In the United Kingdom, science comedy has been positioned as a new way to reach the public and build academic-societal relationships. *Bright Club,* launched at University College London [UCL] in 2009 and subsequently franchised at numerous British and Irish universities, placed academics on stage and challenged them to share the content of their research in the form of a nine minute stand-up set. Advertised as 'the thinking person's variety night' that 'transfor[ms] researchers into stand-up comedians'[4] science comedy would at once offer an edifying experience for the public and a transformative experience for academics as communicators. However, while the proliferation of events such as Bright Club suggest increasing interest in and use of comedy and humour within public discourses of science, there has been little concurrent academic research on the topic (Reisch 2015). This paucity of research offers both a challenge and an opportunity, to examine the specific practices of science

[4] http://www.brightclub.org/, 'About Bright Club'

comedy as it is embedded within science communication practice, and to examine the modes of research and the prerogatives, assumptions and conventions of both practical and academic science communication cultures in which this enthusiasm has become manifest, to explore why science comedy appears to offer a good fit.

By framing science comedy as an opportunity to ask broader questions about the practice and discourse of science communication, there is the opportunity to slow down the impulse to quickly subsume science comedy within extant evaluative and normative frameworks of critique, and engage more reflexively with the world of science communication (see Gehrke 2014). Indeed, the particularities and ambiguities of comedy might not be readily incorporated into existing analytical frames. For example, the power dynamics of comedy seem particularly difficult to define; comedy might at once imply a movement away from conventional models of scientific authority, with the audience invited to laugh at scientific knowledge, yet relies upon the scientists' literal elevation above their audience, who are silenced other than in moments of laughter (Marsh 2013). To ask why science comedy might simultaneously engender enthusiasm and concern and give rise to potentially contradictory accounts of its place in the field is to explore what science communication values, the relationship between the narratives of science communication and its practice – in this case, that of science comedy – and notions of purpose and quality as empirical concerns, rather than seek short cuts to reach a normative consensus.

The purpose of this thesis, therefore, is primarily exploratory, developing an account of science communication as a form of practice and work, using science comedy as a case study of what it means to do science communication and be a science communicator. The empirical content of the thesis draws from an ethnographic case study of a science communication training scheme that used comedy as a means for training participants in performance and prepare them in becoming professional science communicators and public engagement workers. The thesis thus examines what science comedy looks like, particularly when used a form of training, and how it is experienced and understood by participants and performances, as a means for doing science communication.

1.2: Is Science Comedy new?

Initial discussion of science communication has often foregrounded its apparent novelty, suggesting that only now have scientists begun to joke with one another or about their work and share these jokes publicly, or that comedies such as *The Big Bang Theory* are unique in making use of scientific imagery and knowledge within

comedy texts (see e.g. Pinto et al. 2013). Media reporting of Bright Club, for example, referred to the event being the first time that public audiences could see the funny side of research, or indeed that researchers were (or could be) funny[5]. While 'science comedy' as a discrete form of science communication and public engagement might well demonstrate the first concerted effort to incorporate comedy within a raft of professional practices, a longer history of science, comedy and humour can be discerned, both in terms of humour within scientific practice and the use of scientific imagery in mainstream comedy.

Though hardly an expansive domain of investigation, work in the history and sociology of science has attended to forms of joking and humour within scientific practice, often focused upon joking amongst scientists and within scientific cultures, rather than as a form of public communication. Findlen (1990) explores the use of joking within Early Modern scientific discourses, noting the frequency with which nature and knowledge were seen to offer a source for jokes, suggesting that humour and play were intrinsic forms of Early Modern scientific practice. Both Lewis (1983) and Cain (2019) trace the circulation of particular in-jokes in scientific literature, with Cain suggesting that the reproduction of particular jokes provide a powerful way for delineating the insider from the outsider within specific scientific 'tribes'. The most extensive treatment of scientists joking is found in Gilbert and Mulkay's work on the repertoires of science humour, which documents joking within the laboratory, the circulation of in-jokes, fake journals and deliberate hoaxes, and the ritual forms of humour encoded in events such as the Nobel Prize banquet (Gilbert and Mulkay 1982; Mulkay 1988). Though humour has rarely been employed as a specific topic or analytical lens for science studies, this work suggests not only that scientists joke, but that particular cultures of humour might exist in science, being used in specific and analytically interesting ways.

Outside these more restricted institutional spaces, science - taking a broad definition including natural sciences, engineering, technology, medicine and mathematics - has frequently found its way into 'non-scientific' comedy domains. Alongside comedians such as Dara O'Briain and Tim Minchin who explicitly frame their shows as being about science and rationality (and their oppositions), scientific imagery and ideas have frequently been incorporated into comedy, through diverse means and to a multitude of

[5] For instance, the British newspaper *The Guardian,* which regularly reported on Bright Club, frequently suggested that stand-up shows with science content were noteworthy, either for showing that science (and scientists) could be funny, or noting science comedy as a break from previously 'dry' forms of engagement. The following are indicative of the style of reporting: Lipsett (2010), Jahme (2010), Nichol and Butterworth (2011), Gomez (2011) and Lawrence (2018).

ends. *The Simpsons* (20th Century Fox, 1989-) frequently employs scientific, and particularly mathematical, imagery into its visual style, often in the form of 'freeze-frame gags' where mathematical equations and puns relying upon mathematical knowledge are displayed in the backgrounds of scenes (see Singh 2013). With the town dominated by a Nuclear Power Plant, Homer Simpson's scientific ineptitude and ignorance as a Nuclear Safety Officer frequently imperils the town. *Futurama* (20th Century Fox; Comedy Central, 1999-2013) similarly draws frequently from popular depictions of scientists, science and technology and science fiction in creating the future New New York in which the show is set. As a narrative tool, contemporary public debates about science and technology recur in *South Park* (Comedy Central 1997-), with issues such as stem cell research, debates about evolution and alternative medicine being used as narrative tools for the show's exploration of small town American life (see Bankes 2016).

Within British comedy, several shows have taken science as their central theme. Both *Green Wing* (Channel 4, 2004-2007) and *Getting On* (BBC Four, 2009-2012) are set in hospitals, and feature medical staff as their central characters. More widely, science and technology have frequently been used as a means for developing shows' comic worlds. In *The Day Today* (BBC 1994) and *Brasseye* (Channel 4 1997-2001), both created by Chris Morris as satires of news reporting and investigative journalism, science reporting offers a motif for highlighting the meaningless of news discourse and the self-interestedness of journalists. The programme had real-world ramifications: a segment about the dangers of the fictional synthetic drug 'Cake' lead to the safety of the drug being discussed in Parliament. The show's most controversial episode, 'Paedogeddon!', which sought to expose the moral panic surrounding paedophilia, again drew on scientific repertories, inviting media personalities in the UK to state on camera that the internet was being used to turn children 2D, and that DNA analysis has demonstrated paedophiles resembled crabs more than they did humans.

Where these shows might seem to be 'about' science, so too has science been used in shows that engage with very different themes. In *Nighty Night* (BBC 2004-05), written by Julia Davis, the show follows the seemingly sociopathic Jill Tyrell's attempts to seduce her neighbour's husband, hindered by her own husband recovering from the cancer she has told everyone has killed him. Jill's ability to manipulate scientific and medical language, and the credulity of the medical professionals she encounters, drives her ability to get what she wants. In *Absolutely Fabulous* (BBC, 1992-2012), focused on the lives on Edina Monsoon and Patsy Stone and their obsession with fashion and fads as a way of trying to stay young, science emerges as a form of

fashion, for instance in Patsy's use of the chemical weapon 'Parallox', developed at Porton Down, as an anti-wrinkle treatment.

What differentiates 'science comedy' is less the use of scientific imagery within humour, but rather the explicit attempt to instrumentalise comedy within the world of science communication, through projects initiated and run within discrete science communication spaces or academic trajectories (e.g. Pinto et al. 2015, Bore and Reid 2015). To do science comedy is to do science communication, as a means to inform and engage the public regarding science, manage public attitudes to science and to furnish scientists and science communicators with a new way of interacting with the 'public'. As an actor's category, Science comedy thus refers to the contexts in which scientists, science communicators and public engagement professionals use comedy as a means for engaging the public, or as the content of communication and engagement events, stressing its location within a professional landscape of science communication and public engagement with science.

1.3: Science Comedy within the history of comedy

Where science comedy has largely developed within the specific confines of discrete science communication and public engagement infrastructure, it occupies a peculiar space. While many science comedy events take place in venues shared with other forms of comedy – pub event rooms, festivals, performance spaces and theatres – science comedy would nevertheless seem to stand apart from the mainstream comedy circuit. Science communicators adept at performing comedy, or able to tailor their work through comic and improvisational forms might hope for success and opportunities within discrete science comedy spaces and in the broader world of science communication without necessarily needing to prove their worth or develop their skills before 'mainstream' audiences. Where aspirant 'mainstream' comedians might expect to develop their career through an iterative process of bringer nights, unpaid five and ten minutes gigs, the calculated financial losses of performing at the Edinburgh Fringe and hopefully the promise of eventual paid work, science comedy has emerged as a distinct form of performance and expertise within the field of science communication.

Emerging concurrently to other forms of performance based science content, such as science storytelling in the United States (see e.g. Dahlstrom 2014), the use of comedy as a tool of science communication and public engagement would seem to align to attempts to make use of formats and performance styles from the arts to engage non-scientific publics, potentially owing far more to the history of a field concerned with finding new forms of collaboration then necessarily desiring to intervene within the field

of comedy. Nevertheless, the suitability of comedy as a tool in this sphere would appear to rest on comedy being understood as both accessible and legitimate. Indeed, the characterisation of Bright Club as 'the thinking person's variety night', elides these characteristics, at once harking to the once popular (and low-status) cultural form of variety and the cultural legitimacy of such an event in being tailored for the 'thinking person'. This characterisation of comedy echoes a shift in the history of comedy production and consumption that has seen comedy only recently emerge as a refined and politically transformative form of popular entertainment. Tracing the history of comedy highlights the increasing legitimatisation of comedy as an elite form of culture that, crucially for science communication, has the power to 'do' something, by challenging its audience and serving as a form of political education (Friedman 2014).

Historical work on comedy, as a distinct form of artistic performance (in apposition, for instance, to humour) have often pointed to the form's humble origins within a cultural field that at least until the early twentieth century was tightly delineated between 'high' and 'low' forms of cultural activity (Bennett et al. 2009; Friedman 2014). Emerging particularly from working-class music hall traditions, the 'vulgarity' of comedy and its inability, unlike more legitimate forms of culture, to provide any other than entertainment marked comedy's low status and, concurrently, its suitability for an audience unsuited to more legitimate forms of culture (Mills 2010; Mills 2004; Dacre 2009; Paulus and King 2010). Occupying working class spaces such as working men's clubs and provincial comedy circuits, as well as the low-status fields of television and popular film, stand-up comedians were noted (and derided) for their aesthetic deficiency (Charney 1989; Friedman 2014). Lacking originality in the jokes they told – often packaged and sold as commodities that any comedian could use – dwelling on inappropriate and unbecoming themes and concerns and seeking simply to entertain its audience, comedy could not aspire to the loftier transformative potential encoded within true 'art'.

The field of comedy was not entirely derided however, as certain forms of comedy, particularly those which claimed a heritage of literary comedy, were viewed as legitimate. Wit and Satire, in contrast to (vulgar) humour, were celebrated where they offered elite urban audiences the promise of challenging and exposing orthodoxy, fostered linguistic inventiveness and demonstrated the ingenuity and originality of the speaker (Duguid 2008; Mintz 2005; see Stott 2014 for discussion). In the Television market, the 'University wits' of *Monty Python* offered a legitimate form of comedy performance, even where literary traditions of comedy were emmeshed in otherwise denigrated forms of comedy such as farce and slapstick (Friedman 2014). Comedy

could be high culture, so long as it was performed by the right people, and to the right audience.

Denigrated and provincialised within cultural criticism, despite huge viewing figures for shows such as *The Comedians* (1971-1992) which gave working-class circuit comedians a televised national platform, comedy was due for a rebirth, which occurred through a new vanguard of performers and a clear articulation of the purpose, aesthetics and value of comedy. The founding of the Comedy Store in London saw the rise of a new form of comedy largely in opposition to the work-class circuit, with performers seemingly eschewing any desire for the degree of success to which such comedians might aspire (Cook 2001; Wilmut and Rosengard 1989). Rejecting the perceived racism, sexism, provincialism and banality of mainstream comedy (Wilmut and Rosengard 1989), Alternative Comedy advocated a new, staunchly political role for comedy. Comedy would not take aim at the marginalised groups seen to the staple of mainstream comedy and would instead provide a space for political action, speaking truth to the power and injustice of Thatcher's Britain (Sayle 2016; Stott 2014). Performing to a new, largely urban, middle-class and university educated audience, 'alternative' comedy was framed as offering something distinctly new, eschewing the content and indeed even the form of the 'joke' inherited from stand-up comedy and insisting that stand-up comedy primarily serve as a space for experimentation, originality and political expression (Duguid 2018; Stott 2014). Profoundly 'difficult', Alternative Comedy would demand that its audience seek more than entertainment, understanding comedy has offering a unique opportunity for subversion and reflection on their own lives (Cook 2001; Wilmut and Rosengard 1989).

This narrative of the history of comedy, which has largely been written by its practitioners, has been challenged, particularly by Friedman (2015). Contesting the heroic narrative whereby Alternative Comedy effected an aesthetic and political revolution, Friedman claims that the achievement of alternative comedy owes more to the articulation of a clear sense of a culturally legitimate way (following Bourdieu) that comedy could be produced and consumed. Indeed, 'mainstream' comedy has not gone away, and where its continued popularity might garner distain, it simultaneously provides a resource for more 'alternative' comedians to mark their alterity and advocate the continuing need for alternative, more aesthetically proficient comedic voices and audiences (see Lee 2010; Lee 2011). With 'alternative' forms of comedy dominating critical attention and benefitting most acutely from the mechanisms for symbolic recognition, such as comedy awards, while not necessarily proving dominant in the amount of comedy that is produced, alternative comedy has arguably succeeded in

articulating the ‘right’ way to understand and appreciate an otherwise derisible cultural form.

Science comedy would appear, at least implicitly, to invoke the tradition of Alternative Comedy. Where comedy best achieves its aesthetic and political potential through public education and consciousness raising, science communication often shares similar goals, positioning audience learning and attitudinal change as key metrics of success. Friedman’s characterisation of Alternative Comedy as a new way of appreciating and articulating the purpose of comedy would similarly seem to align to the limited work so far conducted on science comedy. Where science comedy seeks not only to entertain, but also to inform and celebrate scientific knowledge and positive attitudes towards science, there would appear to be a nascent sense of a political aspiration for science comedy and concurrent stricture on audience engagement. However, quite what politics underwrite this aspiration is far from clear, nor has extant research reached a consensus of what successful science comedy would look like, precisely because this is to as a broader question of the purpose of science communication.

The development of science comedy within a substantively different environment – that of science communication – might problematise attempts to claim a direct lineage between science comedy and the broader history of British comedy. As a thesis about science communication, the reader may well note how the research findings do not appear to hinge on the fact that it was comedy, rather than another form of shared practice, that underpinned the scheme’s work. However, as will be shown in the empirical chapters, the sense of the political power of comedy and its legitimation as a tool of social action and transformative proved generative in how participants discussed their experiences of performance and their sense of what science comedy could be used to do. While this thesis is not ‘about’ science comedy in the sense of seeking to provide a substantive account of science comedy as a form of cultural production, the particularities of British comedy, and the legacy of its politicisation left traces in the ways that participants came to understand science communication. While science comedy may be far from novel, its novelty as a form of science communication never seemed in doubt.

1.4: Science communication and public engagement with science

While delineating ‘science comedy’ as comedy which is understood as constituting a form of science communication might allow some clarity, what then counts as ‘science communication’ is far from clear. Indeed, asking what it means to do science

communication must anticipate a multiplicity of responses, as both science communication and public engagement have proven to be particularly slippery terms. Though at its most generic substantiation, science communication might refer to any act of communication related to science, both science communication and public engagement also invite a more restricted definition, one that indicates a growing professional world of actors – including scientists, researchers and experts in science communication and public engagement – who understand their work to 'be' science communication. The relatively bounded definition, which privileges professional roles, indicates a discrete set of professional practices and concerns, performed by people who might call themselves 'science communicators' and define their work as 'science communication' or 'public engagement' (Horst and Davies 2016). In this thesis, while acknowledging that stories of science communication, and indeed the relationship between science and comedy, may well differ outside of this restricted domain, this professional definition is used to locate the study, so that the study of science communication is primarily that of practitioners who understand their work to fall within this professionalised remit.

However, while it is possible to delineate science communication and public engagement in terms of its professionalisation, this does not necessarily provide clarity in determining the nature of either practice, which remain highly contested and often underexplored. For instance, the concurrent usage of terms such as 'public understanding of science' and 'public engagement with (/of) science, have been noted for their opacity. As Bauer argues, while the two terms ostensibly mark a clear shift in the role of the public, from a group in need of education to one that will participate in decision making, both nevertheless allow divergent interpretations of the key concerns of practice, allowing an interest in both how the public construct, understand and use science on their own terms, or the ability of the public to negotiate the understanding of science amongst scientists, attuned to the consequences of the public engaging with these understandings (Bauer 2014).

As will be argued in the next chapter, the latter focus would seem to dominate attention, with academic work often trying to gauge how well the public copes with science. Yet even where the literature has received a degree of continuity in claiming that public engagement involves the coming together of publics and experts within scientific spaces through an activity that does more than simply 'communicate' science, what is permissible as public engagement seems far from clear. In a survey on science engagement conducted by the National Co-ordinating Centre for Public Engagement (NCCPE), the expert professional body established in the UK as a consultancy for

public engagement with academic research, respondents were asked to choose their primary motivations for working in the field, from the following options:

- To promote specific work
- The embed STEM as part of life/"culture"
- To create a more fair and equitable society
- To promote particular STEM projects or issues
- To help people feel more confident in engaging with STEM
- To help people enjoy STEM
- To create conversations between STEM professionals and the public
- To help people seek out STEM events and information
- To encourage evidence-based behavioural change
- To help people talk to friends and family about STEM
- To encourage people to support research in STEM
- To develop a scientifically literate society
- Other

Presuming that each of these motivations were understood as a reason for doing 'public engagement', public engagement would seem to simultaneously incorporate the embedding of science within culture, the promotion of science, changing public attitudes and knowledge, outreach work and fostering relationships between expert scientists and other audiences. Public engagement and science communication would appear to involve a number of divergent, contested and seemingly contradictory goals and rationales, the implications of which may not be easily resolved.

What of course binds these seemingly divergent understandings and rationales is the existence of professional practitioners, a group of actors who would describe themselves as *doing* science communication or public engagement work, however the two might be defined and understood. For the thesis, therefore, science communication and public engagement will be used predominantly as actors' categories, as a reflection of the valency of the terms within the field. This means that at times the terms may appear broadly synonymous, may be defined in opposition to one another or in a hierarchy, depending on the context. Speaking of science communication *and* public engagement is not to suggest that there is a substantive difference between the two, but rather that together, they offer a short hand for examining the role of comedy within a professional sphere that to a greater or lesser extent coalesces around the terms. Thus references to 'science communication', 'public engagement' and the two together within this thesis serve to refer to this professional world, rather than indicating distinctions between them.

1.5: Research Questions

The central question for this thesis asks what it means to do science communication, using science comedy as a case study and entry point for studying the practices, imaginaries and identity work involved in 'doing' science communication. Thus science comedy is explored as an extant practice within the modern ecology of science communication, and as a lens for investigating broader concerns of the structure, narratives and understandings of science and science communication that mediate science comedy practice. In answering this overall question, the thesis is guided by three research questions that seek to focus on examining science comedy as a practice in its own right and as a case-study of contemporary science communication:

- **RQ1**: What are the stories told about science, science communication, science comedy and the role of science communicators within science comedy?
- **RQ2**: What forms of practice underpin these stories? How is science comedy employed, experienced and understood by practitioners as a form of science communication?
- **RQ3**: How does science comedy relate – and how is it imagined to relate – to the broader fields of Science Communication, Public Engagement and Comedy?

1.6: Summary of Thesis

The thesis consists of eight chapters (of which this introduction is first). In Chapter two, I provide a literature and theoretical review of current work in the study of science communication and public engagement. This review primarily seeks to locate the thesis between two traditions within the study of science in public, one more practically focused on the mechanics of science communication, and the other more theoretical and critical, illuminating science communication as a site for the negotiation and governance of science. The latter often serves as the basis for critique of the perceived failures of practice-orientated science communication research to enact desirable versions of science communication and science-society relationships, particularly when assessed against the understanding of science communication found within STS. Arguing that neither approach has so far attended to the specific work of doing science communication and being a science communicator, particularly in relation to the role of practitioners, this review serves to advocate for an account of science communication as practice, attending to the specific ways in which meanings about science and science communication are constructed.

The theoretical and methodological challenges in developing a practice-based account of science communication are discussed in Chapters three and four. Where the theoretical and conceptual tools within science communication research and STS highlight questions that motivate the study, I draw more broadly from practice-based theories in sociology and anthropology, presenting Dorothy Holland's conceptualisation of Figured Worlds, Lave and Wenger's work on Communities of Practice, and Pierre Bourdieu's account of Field, Habitus and Capital. I argue that these theoretical tools offer productive ways to explore the everyday features and effects of practice, the imaginative architectures that structure social activity, and the relationship between different practice within the broad notion of science communication as a 'field'. More fine-grained methodological concerns, including an overview of the research design, are provided in Chapter four. Alongside discussion of the research methods used, I discuss my understanding of the purpose of science communication research. Informed by Isobel Stengers' methodology of humour, I suggest ways in which science comedy might be studied not to simply to furnish its celebration or derision, but as a way to enable the collective negotiation of what science communication ought to do, and how it might be done.

I then turn to the empirical findings in chapters five through seven. Rather than seek to answer each research question in turn, the empirical chapters are instead arranged thematically, with each anchored by a focus on a specific narrative told within the scheme. Chapter five explores the notion of the 'good science communicator' as a good member of the community, chapter six explores stories told about the 'public' and the 'audience' attending events, while chapter seven explores the narratives of purpose and transformation through which participants positioned their work and imagined their future. This structure acknowledges that questions of practice, narrative and imagination, identity and the location of particular practices are highly interrelated and preclude easy forms of separation. The thematic focus provides one way of bringing the research questions together, for instance in chapter six, where discussion of the public is simultaneously a story of the ways participants reacted with the audience in the room, imagined alternative audiences, framed the identity and role of the audience in terms of broader stories told about science communication, and anticipated how these experiences might be used in their future careers. As will be discussed more extensively in chapter three, the three research questions reflect the theoretical underpinning of the project, which seeks to identify the 'figured world' of community (corresponding most explicitly to RQ1), supported by discussion of the practices underpinning this world (RQ2) and the broader constellation of language, practices and

ideas in which the scheme was located (RQ3). Explored together in the empirical chapter, a discrete ‘answer’ to each of the research questions is provided in chapter eight (8.2.2-8.2.5).

Chapter five examines the practices and experiences of training to be a science communicator through comedy. Attending to the specific ways in which comedy was understood and instrumentalised as a pedagogical tool within the confines of the scheme, I argue that learning to be a science communicator was imagined as a process of learning to belong in the discrete community of the scheme, so that a good science communication was primarily a good community member. Increased involvement in the scheme led to participants’ labour coalescing on recognising and responding to the local concerns within the space, so that their principal activity was the maintenance of the community. A good science communicator was thus one who worked for the good of the community, and thus principally other science communicators, a trait considered lacking in the broader field. The chapter ends by highlighting the tensions that were engendered by such a definition, with participants’ commitment to the scheme potentially inhibiting their ability to work and within other communities located in the field.

Chapter six turns to discussion of the role of the audience and the ‘public’ within science comedy. Eschewing an a normative reading, the chapter focuses on the discursive use of the ‘public’ as a means for characterising science comedy and more broadly as a register that participants could employ to navigate the field as professionals. In this chapter, I argue that a key facet of training was the acquisition of ‘public talk’, enabling participants to narrate practice and the science communicator’s position in the field in relation to the public. Yet this ‘public talk’ was rarely about the public, serving instead as a means through which participants could make sense of and regulate their practice and comment on their position in the field and relationship to other communicators. The chapter concludes by considering the possible irony that, as a means for narrating the internal dynamics of the field, the discourse of the public worked best the further the public could be kept away.

The final empirical chapter explores how the imagined (and desired) purposes of science comedy and science communication became manifest in the practices of the scheme, and whom participants considered science comedy to be ‘for’. I pay particular attention to notions of ‘transformation’, as the discussion and practice of science comedy was frequently underwritten by an implicit sense that it was both new and capable of effecting change for both the public and practitioners. I argue that this sense

of transformation was coupled with a concomitant urge for continuity, particularly where calls for new forms and understandings of science communication rested on a commitment to the continuation of science communication as a professional enterprise. From this analysis, I suggest a broader notion of purpose in the field, that science communication exists above all for science communicators, as a new space to be a scientist and as a restricted space for negotiating the public face of science.

To conclude the thesis, Chapter 8 provides a summary and discussion of the empirical findings, as well as consideration of the limitations and implications of the study, and directions for future research. Rather than attempt to 'answer' the problems of the field, discussion in this chapter instead focuses on the trade-offs and tensions suggested by the multiple and divergent meanings of science communication as a site, for instance, that is at once ostensibly for the public yet also a space of opportunity for scientists and communicators which might preclude 'public' involvement. Returning to Stenger's methodological principle of humour, the chapter considers how the findings from the thesis might permit further discussion of the purpose of science communication for practitioners and academics. The study's methodological and theoretical limitations are outlined in terms of participant recruitment through the use of a single case-study, and the relationship between the case and the broader field. Based on the limitations and findings of the study, several directions for future research that might help develop elements of the study are outlined.

Chapter Two: the world of science communication and public engagement

2.1: Introduction

Science communication and public engagement in the United Kingdom would appear to be in rude health. More than 30 years after the publication of the Bodmer Report by the Royal Society, which pointed to a need for concerted efforts to communicate science to a public thought to be failing in their civic duty to properly understand and appreciate scientific knowledge, science communication and public engagement have become established cultural industries. Science communication and public engagement practice is already highly heterogenous, described as a 'hybrid' field (Trench and Bucchi 2010; Hornig Priest 2010), encompassing various forms of performance practice, formal education, institutional coordination and administrative enabling. Science communication personnel including academic social scientists, including specialists in science communication, scientists, policy makers, performers, administrators and volunteers (Chilvers 2012). Numerous specialist journals, conferences and professional networks are devoted to the subject, alongside an ever-growing number of books providing how-to guides for scientists, stressing the importance of scientists communicating their work (e.g. Brake and Weitkamp 2009; Brake 2009; Bennett and Jennings 2011). Alongside practising scientists communicating their work and participating in public engagement events, Science Communication and Public Engagement also offer a wealth of careers in their own right, alongside numerous masters' courses training neophytes to communicate, promote and facilitate public encounters with science.

As increasing academic attention has been paid to the place of science in society, there have been sustained attempts to delineate science communication as a distinct academic field (e.g. Gascoigne et al. 2010; van der Sanden et al. 2017). Noting processes of professionalisation, increasing publishing output, institutional affiliation and internationalisation, numerous scholars have claimed that science communication bears the hallmarks of a discrete field (see Trench 2017; Trench and Bucchi 2010 for discussion). As the field begins to write its own history, the lineages of science communication across the world have been highlighted, celebrating the embedding of science in public spaces and lamenting lost opportunities to establish discrete science communication practices or have their worth recognised (see Massarani et al. 2017; Froes de Fonseca 2017; Lopez Perez and Olvera-Lobo 2017; Sanchez-Mora et al. 2015; Fleming and Star 2017; Watanabe 2017).

This chapter surveys current scholarship on science communication and public engagement, examining work that has emerged from and responds to the professional world of science communication, and more general work on the role of science in the public sphere. In doing so, this chapter has two goals. Firstly, I seek to critically analyse prior work in science communication, particularly in highlighting the different images of 'science', 'scientific knowledge' and the 'public' that emerge in professionally oriented literature and broader work within STS on the relationship between science and society. The differences between these literatures invites critical commentary, particularly given work on science communication often neglects the highly contingent ways in which public meanings of science are constructed, either in adopting a constructivist approach to understanding scientific knowledge, or in offering fine grained analysis of science communication practice with which to substantiate this constructivist lens. One result is that this literature rarely considers the implications of science communication producing particular versions of science, instead reproducing a notion of science communication 'translating' immutable scientific knowledge and notions of science and society into the public sphere.

The second goal is more ethnographic. This thesis is a study of science communication, and consequently much of the literature discussed in this chapter has emerged within this world. There is thus the opportunity to explore the narratives and understandings of science and science communication practice that might mediate practice as they emerge within the literature. Thus while I present a critical view of science communication research and attend the elisions and absences within the field, the goal is not solely to lever criticism but rather to begin to illuminate the understandings, assumptions and prerogatives of science communication as a discipline and in doing so, locate the starting points for my own research. Much of the chapter attends to the views of science communication found throughout the literature where science communication practice is often reduced to specific technical concerns with an unspoken assumption that nothing needs to be said about the purpose of the field, or its own role in the production of scientific knowledge. As will be discussed throughout the chapter, this formulation suggests an avenue for my own research, examining science communication as a generative form of social practice.

2.2: The how and why of Science Communication

While the growth of science communication has often provided cause for celebration, numerous scholars within STS have expressed concerns that science communication and public engagement practice and research had lost sight of what really matters. In a special issue of the journal *Public Understanding of Science* in 2014 that looked back

over 20 years of practice and research, the editors expressed concern that the field had shifted from ends-based debates to an over-focus on the means and processes of doing communication and engagement (Stilgoe et al. 2014). Where the field prioritised the 'how' rather than the 'why', the editors of the issue suggest that research in the field was focused on refining the ways in which science communication and public engagement were carried out and evaluated, at the expense than asking how science communication and public engagement could and should contribute to society, particularly in the democratic governance of science and technology. Doing science communication and public engagement, the authors suggested, had become understood as an entirely technical problem, assuming the value of public engagement without questioning its purpose. Authors throughout the volume noted with alarm that scholars in the field were increasingly adept at doing science communication and public engagement, without a clear sense of what they were seeking to do.

For the authors of the volume, a research trajectory dominated by case-study research seeking to improve the 'hardware' of science communication was not sufficient for understanding the meaning of 'science' and 'science communication' within practice (Stilgoe et al. 2014; Irwin 2014). Yet this specific critique underwrote a much broader concern: science communication practice and research seemed insincere. While science communication and public engagement might claim to be concerned with expanding who can know about and participate in science, the field appeared to be actively preventing such transformation. Consequently, the authors questioned how far public facing communication and engagement could be said to be 'public', as scientists' and science communicators' understandings of science were rarely interrogated. While the field had effected radical changes in understandings of the public amongst science communication and STS researchers, particularly in acknowledging 'non-science' publics as legitimate knowers, far less attention had been paid to what 'science' itself might be said to mean (Wynne 2014; Jasanoff 2014). Without the space to acknowledge and challenge the normative commitments encoded in scientific practice, science communication might reproduce tendencies to read public concern as an act of refusal or failure to understand. Presuming – or rather blackboxing – answers to questions of the role of science in the public sphere or the public's role within science, the 'public' appeared little more than beneficiaries of practices they were awarded little role in constructing (Nowotny 2014). While the discourse of science communication and public might stress the need to 'engage' the public with science, the reality seemed starker: science communication sought to transform the public enough so that they could be enrolled within a particular (unexamined) version of science (Jasanoff 2014).

Subsequent research has sought to develop these critiques by substantiating the role (or lack of the role) for the 'public' in events ostensibly for them, particularly in policy contexts. Smallman (2017) shows how seemingly little impact public engagement and science communication events have had on the imaginaries of science used in policy and governance. Where public engagement events gave voice to multiple, and often conflicting, imaginaries of and aspirations for science, only the imaginaries of science offered by expert scientific voices were taken up in forming policy decisions. The 'public' were listened to within science communication events, yet their voices did not carry into policy: participation in dialogue events offered no guarantee that 'dialogue', as a tool of governance, would occur. Invariably presuming that the purpose of science communication and public engagement should be to effect the democratisation of science evidenced through policy change, contemporary practice is thus accused of failing in this mission, viewing dialogue as essential to public engagement practice but not to governance. However, rather than read this literature as a straightforward critique of science communication done wrong, these critiques suggest numerous tensions and contestations as to the purpose of science communication. Terms such as 'dialogue' prove highly mutable in different forms of practice, at once describing a mode of governance and as a set of technical criteria for goal communication and a goal in itself. Where this critical work has noted largescale neglect of the question of 'what is science', this research has proceeded on an unspoken assumption related to the nature of science communication. Where the development of critiques of science communication and public engagement have often focus on the (lack of) discrete changes in policy and government, science communication is framed as being – or at least should be – about the governance of science.

2.2.1: From Deficit to Dialogue: Dialogue as Governance

While science communication serves as a holdall term to characterise a range of different professional and academic cultures, prerogatives and understandings of science, different communities within the field nevertheless share a multitude of discourses, though as will be made clear throughout the chapter, often for very different purposes. In developing critical accounts of the development of science communication, the conceptual shift from 'deficit to dialogue' is frequently evoked to characterises changes in the understanding of the public's role in science. Following the Bodmer report, the perceived scientific illiteracy of the public, and their consequent failure to properly enact their role as citizens, provided impetus for large scale attempts to change the public and restore public trust in and enthusiasm for science, under the banner of 'Public Understanding of Science' (Lock 2011). Within this logic, disparities

between elite and public understandings of and attitudes towards science were primarily the result of disparities of knowledge. Once the public were sufficiently educated, they would see scientific issues and social problems in which science and technology were enmeshed in the same way that scientists did, and by extension, do so correctly. The 1988 Public Understanding of Science Survey proceeded in this vein, attempting to measure public literacy and establish a benchmark for future action. However, this conception of the public as deficient was quickly contested by scholars who sought to challenge the assumption that public controversy was the result of unequal access to knowledge.

Subsequent work in science communication and STS has frequently proffered a different explanation: public controversy surrounding science reveals far deeper conflict concerning the ability to define social problems. Rather than being unable to understand scientists' framings of problems, public controversy lies in the contestation of the – often unspoken – normative commitments encoded within scientists' own understandings of science. As Wynne notes in his study of scientists' encounters with Cumbrian sheep farmers after Chernobyl, the breakdown in the relationship between the two groups lay in the scientists' assumption that they could extend the logics of the laboratory into the everyday world without contestation (Wynne 1993). Public dissent was a rejection of the discourses and means of decision making in science that education could do little to resolve (Wynne 2001). The controversy was not simply a breakdown in communication, caused by the scientists failing to listen to the farmers' specific local knowledge at the right time, which might have been solved through communicating and engaging better, but the inability of the scientists to allow definitions of the problem that were not their own. The farmers' own knowledge – for instance the particular elevations at which the sheep grazed, or their movement patterns - could not be 'added in' to furnish scientific work, as there was no way for it to be seen as knowledge. The conflict was not epistemic, in the sense of being mediated by unequal access to a singular knowledge base, but cultural, as the specific, local and embodied culture of science was given exclusive dominion over defining social issues (Wynne 1996a; Wynne 1996b).

In this vein, the 'deficit model' of science communication has served to critique the presumed universality of local and particular scientific worldviews and forms of practice predicated on the need to educate the public into accepting this worldview. To frame problems of public trust and engagement with science as issues of knowledge was to presume that science could be understood in a single way, with varying attitudes and enthusiasm towards science delineated by knowledge of the domain. Instead, the

critique sought to highlight the diverse ways in which science might be understood and located in the world and to appreciate that the understanding of science governing the laboratory was only one way (and probably a poor one) for understanding science in the world. The framing of issues, the relationship of science to social, public and personal identities, trust in institutions and the concurrent lack of institutional reflexivity amongst scientists were argued to be crucial facets of science-society relationships (Irwin and Wynne 1996; Wynne 2006; Irwin 2009). For Wynne, this critique was not a call for relativism or a denigration of scientific expertise but rather a challenge to the assumption that the solutions to social issues of trust, governance and risk could be defined solely 'scientifically'.

Emerging within STS critiques of the governance of science, the notion of the 'deficit model' served primarily as a critique of the unquestioned hegemony of the narrowness of 'scientific' framings of social issues. The object of critique was 'scientism', the presumption that human experience could be defined in terms of and reduced to components about which science had something to say and could claim dominion (Gregory and Miller 1998, Introduction). Less a specific critique of how science was communicated, the deficit model was envisaged as a way to reflexively examine the beliefs and assumptions that framed scientific knowledge and to render these assumptions open to change (Wynne 1993). As an issue of governance, the 'deficit model' critique arguably aspired to political transformation far beyond the scope of science communication and public engagement activities, seeking to democratise science and foster a willingness to reimagine what science might mean. Where the 'deficit model' seems more familiar with science communication practice as a set of strictures upon communication, this suggests that the term has gained multiple meanings in various domains.

Notions of 'deficit' and 'dialogue' were not, however, entirely divorced from science communication and public engagement practice. Indeed, the shift towards 'dialogue' entailed conscious attempts to experiment in the public governance of science and technology (Stilgoe et al. 2014). Public consultation events regarding Biotechnology, GM Food and Nanotechnology were hoped to offer a new type of politics, as a form of extended peer review that would permit democratic oversight, enabling the public to make substantive and effectual decisions (Stilgoe and Wilsdon 2009). As 'experiments' in governance, the authors of the published work on these projects were keen to stress that the rationales underpinning public consultation mattered far more than the mechanics of events that incorporated engagement and dialogue as concrete forms of action (Wilsdon et al. 2005). In developing new concepts that could inform the

governance of science and technology, there were concerns from the outset that analytical focus would narrow (and already had) on the ‘hardware’ of public engagement events themselves, rather than the codes, values and norms underpinning the practice (see Stilgoe and Wilsdon 2009)

One facet of this hardware that flourished in the United Kingdom was a new language of public engagement, replacing ‘public understanding’ with terms that stressed the public as stakeholders and decision makers in the governance of science and technology (Lock 2011). Within academic discourse, the shift from ‘deficit to dialogue’ engendered numerous new terms that would characterise and frame science-society relationships: engagement would be dialogic, two-way and mutually beneficial (see Smallman 2016). Through the formalisation of public engagement through the establishment of national bodies such as the National Coordinating Centre for Public Engagement, a discourse of inclusion became increasingly prevalent. The public would be the beneficiaries of, and at times knowledge partners in, research. A language of mutuality and shared ownership emerged that was quickly embedded into academic and professional practice.

In foregrounding this conceptualisation of science communication and public engagement as a form of governance, the reader may well note that this specific literature has little valence in the development of the thesis. The case study that forms the basis of this research had little interest in and made no claim to directly affecting the governance of science in the United Kingdom, though as will be discussed in chapter seven, notions of purpose and transformation frequently recurred in discussion of what science comedy could be used to do. However, without disputing the legitimacy of this work in relation to governance, it is noteworthy how these critiques may presume that all science communication and public engagement might be understood as more or less successful experiments in governance. A contention of this thesis, that will be developed in chapters six and eight, is that this narrow framing inhibits the opportunity for close examination of science communication practice, particularly where they diverge from explicit programmes of governance. The utility of these critiques, in presuming a clear externalised model for science communication, ought to be examined and will motivate the thesis’ discussion, particularly in chapter six in relation to the ‘public’. Here I will argue that the tendency to assess science work according to a normative notion of governance provides a poor form of analysis for making sense of what science communicators might be seeking to do.

2.2.2: From Deficit to Dialogue: Dialogue as Aesthetic

As science communication and public engagement have been increasingly institutionalised, the shift from 'deficit to dialogue' has taken on a different meaning and trajectory to that found in STS. Rather than a heuristic to describe governance and reflexivity, 'public engagement' and 'dialogue' have been increasingly employed as an invocation for particular forms of dialogic communication. The predominant concern in public engagement practice is to ensure that mutual benefit might emerge from participation in discrete event formats, so that public engagement must themselves offer benefit through participation. Contemporary definitions of public engagement would seem to be constructed primarily in terms of strictures regarding how public engagement should look, be experienced by the 'public' and be run. The National Co-ordinating Centre for Public Engagement, created in 2009 to offer expert consultancy work for public engagement in universities, positions public engagement as a specific form of communication and interaction:

> "Public engagement describes the myriad of ways in which the activity and benefits of higher education and research can be shared with the public. Engagement is by definition a two-way process, involving interaction and listening, with the goal of generating mutual benefit." (NCCPE n.d.)[6]

In this definition, public engagement occurs through processes of interaction and listening, as characteristics of the public engagement event in which research is shared between universities and the public. Academics and facilitators are urged to ensure that the public are respected during events, listened to, and have the opportunity to speak. Thus, the movement from 'deficit' to 'dialogue' has taken on a life of its own within professional practice, as a means for imagining how science communication and public engagement practice ought to be operationalised (see Davies 2008; Davies and Horst 2016). Notions of 'deficit' and 'dialogue' have been institutionalised in practice and academia as quasi-communication models, positioning good public engagement as that which guarantees dialogue and two-way communication. Rather than needing to ensure particular outcomes, a predominant concern of professional practice lies in ensuring that public engagement events are themselves dialogic, predicated on forms of communication that enable 'openness'.

In this reading, talking about 'deficit' functions as a means for describing and critiquing the mechanics of engagement, as an interdiction against 'one-way' forms of communication where scientists share their expertise with the public without necessarily inviting conversation. Indeed, the critique of the 'deficit model' in more

[6] http://www.publicengagement.ac.uk/about-engagement/what-public-engagement

professional oriented literature looks very different to that found in STS. The ‘deficit model’ has often been critiqued for its sheer inefficacy in properly engaging the public to learn about science (Dickson 2005; Wright and Nerlich 2006). As models of communication style rather than governance, ‘deficit’ and ‘dialogue’ emerge predominantly within this literature as ways to characterise practice based on the forms of communication available to the public, with an implicit valorisation of events which go ‘beyond’ science communication in allowing for real dialogue. The tension between the language of public engagement being read both as a heuristic for democratisation and as a stricture on form has been noted in Riesch and Potter’s (2014) study on the language of citizen science, which has been simultaneously used to describe attempts to make scientific decision making ‘public’ and to denote specific patterns of public involvement in data collection. Within an increasingly professionalised world focused upon the production of the events and ‘hardware’ of science communication, this discourse would seem to have taken on a very different meaning.

Where ‘dialogue’ has experienced a shift from a description of desired outcomes to a desired model of process and communication, a similar shift can be sensed in the meaning of ‘public engagement’, which has been increasingly defined and understood as a form of event. A coming together of scientists and the public, public engagement is to be described and critiqued through the nature of the exchange, rather than its outcome: regardless of its broader outcomes, public engagement activities must themselves offer the public ‘value’. Public engagement is often described in the literature as a moment where scientists and public learn from one another, on the condition that the discussion or interaction itself be a forum for intentional and meaningful interaction (Storksdieck et al. 2016; Dijkstra 2017; Horst and Michael 2011). Indeed Bultitude (2011) explicitly distinguishes public engagement from science communication by the mutual learning that occurs within public engagement events. With the value of public engagement depending upon the interactions enabled within events, ‘good’ public engagement rests on the value of the conversation itself facilitating learning, without necessarily needing to consider the broader outcomes of the conversation (Peterman et al. 2017). Where this work has looked to STS for inspiration, we can see that a degree of unintelligibility has already emerged in the use of discourse. For instance, Selin et al. (2017) critique the Stilgoe et al (2014) paper for being overly restrictive in where good public engagement can occur. Taking Stilgoe’s discussion of governance as a claim that public engagement must only occur in policy discussion, Selin’s paper highlights ‘informal’ spaces where public engagement might occur, such as science cafes and festivals. Such a critique suggests an increasing

alignment between public engagement and particular event formats. Where the 'deficit to dialogue' critique is read as such, academic attention has largely moved towards demonstrating, ensuring, and to a degree celebrating, the value of dialogic communication.

Where good public engagement results from – and potentially can be equated with – good communication, expertise in dialogic forms of communication and event management have been positioned as essential to good practice. Distinct to the scientist or the expert in what the public think, the expert *in* public engagement, specialising in brokering different publics and creating opportunities for them to meet with academic research, has frequently been cited as essential (and at times the only way) to ensure that science communication and public engagement offer meaningful interactions (Sykes 2007; Katz-Kimchi and Atkinson 2014; Fischoff 2013; Scheitle and Howard Ecklund 2017; Berditchevskaia et al. 2017). The cultivation of specific forms of public engagement expertise would seem to have become a goal in itself. Indeed, the shift has been met a concern that equating good public engagement to the presence of public engagement experts might lead to disproportionate focus upon public engagement events, rather than broader processes of change (Gehrke 2014[7])

In this vein, numerous scholars have questioned the extent to which understandings of good public engagement have become overly determined by the aesthetic of the event. For example, Horst (2014) expresses surprise at the disbelief amongst science communication practitioners and academics following the closure of the Danish Board of Technology, which facilitated consensus conferences on emerging technologies. For Horst, the board closed because it lost its purpose: succeeding in institutionalising the role of the public within Danish governance, there was no need for such worek. Yet where international commentators presumed that projects that bore the hallmarks of good engagement must themselves have value – and potentially conversely a suspicion of governance lacking explicit public engagement formats or expertise – very different sets of understandings and concerns within public engagement were clearly on show.

In a similar vein, both Burns (2016) and Sturgis (2014) have expressed concern at the apparent elision of public engagement outcomes and aesthetics. For Burns, debating the relative merits of dialogue and dissemination/deficit as forms of communication rests on a fallacy of inferring outcome from format. Such a critique of course presumes

[7] See also McKinnon and Bryant (2017) for the opposite view, who celebrate the institutionalisation of science communication training programmes as a way of showing the need for science communication as a discrete form of practice

that professional science communicators are engaged in the same project envisaged by STS, seeking to transform the governance of science through public engagement, for which an over-focus upon method would seem a clear mis-step. For Medvecky and Leach (2017), who ask what an ethics of science communication would look like, ascertaining what public engagement should aspire to achieve is a necessary prerequisite to any critique. Noting that science communication practice invariably presumes that its work constitutes a social good, there is a strong imperative to ask why. The very need for an explicit ethics of science communication suggests that questions of purpose and intention are often viewed in the literature as having been subsumed within forms of discourse of practice focused upon critique and the evaluation of the aesthetic suitability of different formats.

The contested notions that become evident in the literature highlight the need to attend the specific meanings of terms such as ‘deficit’, ‘dialogue’ and ‘public engagement’ within practice. The contestation found with the literature highlights the terms’ malleability in substantiating very different accounts of desirable forms of science communication, for in the extent to which reflexivity is figured as a core part of practice. The malleability of the discourse of science communication is a core concern of chapter six, which examines the language of public engagement within the scheme and its localisation. Discussion of science comedy as a form of event is found in chapter five, in outlining the predominantly logistical focus adopted in managing and producing content, alongside a discussion of how far the scheme precluded the opportunity for the deeper reflexive work highlighted above

2.2.3: Return to the Deficit?

In these diverse contexts, it is difficult to discern a clear sense of the purpose of science communication, yet its necessity would seem not to be in doubt. While science communication practice may not share the vision found in STS of the need for the transformation of governance, the importance of science communication is affirmed through the ongoing work of creating, evaluating and critiquing science communication and public engagement events. Where science communication research has increasingly oriented towards developing, evaluating and calibrating forms of communication, broader questions of purpose and value potentially do not need to be asked, where more technical concerns provide a clear rationale for improving practice in the field. Science communication might well be seen as a goal in its own right, with the practices of science communication serving as a means to ensure their continuation.

Yet the unquestioned need for science communication reveals a curious irony: presuming the need to tell the public about science, and the social good that will emerge from public participation, the complex forms of practice that have emerged in response to 'dialogue' arguably rely upon a very 'deficit' assumption. Where the public need to engage with science, but not necessarily be part of broader systems of governance, public ignorance recurs as a social problem, to be remedied through education. For instance, public non-participation in science communication events is a problem to be overcome. The 'disengaged' are seen to demonstrate a lack of interest or awareness, rather than signalling the failure of science communication to offer them value (Burns and Medvecky 2016; Dawson 2014; Dawson 2018). The perceived dangers of public ignorance still feature prominently in professional writing (e.g. Chang et al. 2017; Montgomery 2009), often stressing the need to defend science and make the public aware of its importance (e.g. Gascoigne and Metcalfe 2017; Ross et al. 2018; Roche and Davis 2017). For Illingworth and Allen (2016), the social responsibility of scientists necessitates that the products of science are shared with the public, to educate and inspire them. Acknowledging the power of scientists to decide who benefits from science, 'inspiration' through communication is positioned as a mode of recruitment, encouraging a new generation of scientists who will assume the powerful role, rather than seeking to emancipate this power.

Where science communication and public engagement are presented as being 'for' the public, a very particular image of the public and their role within science emerges within the professional ecology. Academic understanding of public attitudes and understanding of science is often presented not as a task of understanding *how* the public understand science, but instead asking *how well* they understand science. a potential moment of reflexivity shifting (back) to an attempt to establish control over public meanings of science. Knowing the public's own views serves to guide how best to communicate with them. Indeed, making science accessible is often cited as crucial for ensuring maximum impact. As an issue of form, the problem of science communication lies at once in identifying cultural forms that will appeal to the public and make science more understandable, while simultaneously ensuring that the scientific message is not lost, with differing views as to how far the public should be allowed to shape these meanings (see Colliver and Weitkamp 2018, Hook and Brake 2009, Szu et al. 2017 and Long and Steinke 1996 for discussion of science communication adopting pre-existing popular cultural forms). Bennett's (2009) discussion of science on TV examines *Walking with Dinosaurs* with a distinct note of alarm, criticising the programme's 'over-focus' on spectacle at the expense of

accuracy, and warning practitioners to consider the dangers of inserting science content into established cultural domains. Such a reading assumes that science in the public sphere must serve an educational purpose, and that the public are served poorly by a programme that fails to meet specific standards of accuracy. Constructing the public as still being in need of science, science communication practice is oriented to fulfilling such a need.

In effect, attempts to tailor communication might appear to be motivated not by an awareness of differences in understanding, but by a desire to overcome them. Indeed, such an argument is made explicitly by Bowater and Yeoman (2013), who position science communication as a powerful resource for encouraging the public to become more reflexive in their understanding of science, without any indication that similar reflexivity is needed on the part of scientists. Understanding audience interest and motivation has been cited as an intrinsic part of science communication practice, to ensure that events are appealing (Crall et al. 2017; Hornig Priest 2014; Martin et al. 2016). As a form of 'recruitmentology' (Wright et al. 2015), knowing the biases and motivations that inhibit public engagement with and uptake of science provides a means to present engaging with science as being in the public's interest, particularly where positive assessments of science are imagined to be inhibited by religious and political views (see e.g. Kahan 2015; Kahan et al. 2012; Pechar at al. 2018; Pasek 2017). Knowing the audience entails knowing how best to correct them, overcoming the public's biases that inhibit an understanding of the world predicated on science. Infused with the language of public engagement and dialogue, science communication practice would appear to have retained an explicit focus upon education and the recruitment of the public into science, while simultaneously seeking to maintain control over the public meanings of science.

The relation between implicit notions of deficit and broader discussion of the purpose of science communication form part of chapter seven, where participants were asked in interviews what they understood – or hoped – the role of science comedy and science communication to be. Here, the apparent obviousness of the need for science communication was broadly unchallenged by participants, yet not in a way that would appear to align to more coercive intentions that have been feared to characterise the work above. Whether believing in the need for science communication without qualification can be explained by an appeal to attitudes relating to the broader governance form a core concern, particularly in absence of the more reflexive account of science communication presumed to exist and be ignored in work that had been criticised.

2.3: Science Communication and Exclusion

The shift from deficit to dialogue as a form of scientific governance was explicitly normative, presuming that the democratisation of science – both in terms of participation in policy making and, more conceptually, in acknowledging a plurality of scientific worldviews – would be a good thing. In adopting the language of public engagement, and perhaps emboldened by policy that stressed the necessity of public engagement with science (such as the Bodmer Report and 2000 House of Lords of Report (Bodmer 1985; House of Lords 2000)), the belief that science communication and public engagement provides a social good has rarely wavered. Yet where the value of public engagement in STS would rely upon fostering reflexivity amongst scientists, science communication practice has proliferated with little imperative to examine whose versions of science become manifest in practice, and by extensions, whose are excluded (Horst and Michael 2011; Burns and Medvecky 2016).

This apparently lost opportunity for reflexivity has in part been attributed to an over-focus on form. Where science communication and public engagement practice has prioritised and celebrated discursive forms of engagement as a means to open science up to the public, the insistence on discursive forms of engagement might marginalise those unable or unwilling to engage discursively, or to be seen as doing so. As Davies notes, the insistence that public engagement events be discursive constricts the ways in which publics act and speak, ironically disallowing the public from defining the event they are taking part in (Davies et al. 2009). Insisting that public engagement and science communication be run as dialogic events precludes non-discursive forms of participation; responding to science affectively or emotionally, or indeed with silence or non-engagement, will likely be read as an unwillingness or inability to participate (Davies 2014; Mellor 2017; see also Morris et al. 2017). The valorisation of particular forms and aesthetics of public engagement might ironically risk forgoing the stated purpose of public engagement as a way of emancipating meanings of science and expanding who is allowed to enter conversations (Davies and Horst 2016).

While Davies and Horst provide a substantive and nuanced account of the trade-offs and problems of engagement, it is instructive to consider how rarely such discussion recurs in the literature. Where science communication research has focused on the discrete activities of developing and improving tools of communication and evaluation, there has been less space for other reflexive forms of practice. Where science communication research may have achieved a degree of certainty in defining what constitutes good science communication or an ‘engaged’ public, defined for the most part through ensuring equal (if not equitable) communication through strictures on form,

scholars have questioned how robustly science communication can account for its own role in perpetuating inequality and exclusion (Hine and Medvecky 2015; Gregory 2015; Gregory 2016). For instance, Dawson (2014) notes that where non-participation is discussed, the focus on 'barriers' effects a discursive shift that locates issues of inequity beyond science communication's own practice. Presuming that participation in science events is equitable, non-participation is externalised and embodied within the disengaged, stemming from their own lack of interest or understanding, as a passive inability to acknowledge the intrinsic goodness of science communication. In doing so, the effect of embedded inequality can be ignored, and the role of science communication and public engagement in constructing particular versions of science once more neglected (see also Dawson 2018).

By highlighting the people, ideas and understandings that can be left out of science communication, this work urges attention to the specific forms of world-building that occur within science communication, constructing science communication a space for certain people and not others. Though the work cited above has mostly concerned the role of the 'public' in science communication, these insights can be extended to considering whether certain practitioners are privileged others. In chapter seven, the notion of 'science communication as a space for scientists' is introduced as a shorthand for participants' understanding of the field being specially designed to accommodate their own experiences of science and experimentation with communication. In considering who is excluded within this imaginary, the thesis explores in chapter five the characteristics that precluded entry to the scheme, in chapter six to the 'public' as a group seemingly written out of practice, and in chapter seven, the implications for non-scientists and alternative performances of science when science communication appeared to presume that a science communicator was above all a scientist.

2.4: The absence of the practitioner as producer of knowledge

In examining the world of science communication, it would seem natural to begin with practitioners, as the group that populate the practices and discourses that have been examined so far within this chapter. Academic work on science communication and public engagement is dominated, perhaps unsurprisingly, by practitioners. It is practitioners' work, forms and means of evaluation, understandings of science and science communication that predominate, as they report on practice and write about the public. The voice of the public is far more diffuse; the public's own understandings of science receives far less attention, and the presence of the public is often restricted to their participation in events run by practitioners. Practitioners are ever present in the

literature, as they conduct, evaluate and report on science communication practice. Yet this presence is rarely explicitly acknowledged: the practices that constitute science communication are invariably excluded as discrete objects of inquiry. Thus little research asks what practitioners understand themselves to be doing when they do science communication, or to interrogate the world of science that is produced through science communication. As both Elsdon-Baker (2015) and Burns and Medvecky (2016) have noted, this omission is curious, as practitioner understandings of science, and particular their assumptions about 'the public', will frame science communication and public engagement events and set the terms for engagement. Anticipating that practitioners' local understandings of science, the public, science communication and their role within the field will inflect on what comes to be 'science communication', examining the role of practitioners is a key motivation for this thesis, one that has yet to be fully interrogated in academic literature. To substantiate this conviction, I now turn to extant work on the production of scientific knowledge that highlights why such an omission might be curious.

Attempts to characterise practitioners' understanding of their work has largely occurred through examination of their professional talk. Motivating this work is an acknowledgement that, despite the language of science communication and public engagement stressing dialogue and mutual benefit, it is science communicators who have to (and are allowed to) define the public through the ways they are engaged in communication events (Davies 2008). As public engagement with research, and particularly STEM research, emerged as a discrete form of practice in the 2000s, numerous empirical studies pointed to science communication and public engagement professionals continuing to view the public as deficient, even when working within public engagement frameworks that have largely rejected such a view (Felt and Fochler 2008; Kurath and Gisler 2009; Burchell et al. 2009; Wilkinson et al. 2011). Though this work attends to the ways in which public engagement and science communication are talked about by practitioners, as a way into understanding the larger worlds of communication and engagement, Davies (2008) acknowledges that analysing talk may not fully elucidate how this talk is enacted, raising the question of how discourses of public engagement and science coalesce in practice.

Traces of the relationship between discourse and practice, and the role of communicators (whether scientists or science communication and public engagement professionals) can be found in discussion of training. The need for professional training has been frequently acknowledged (e.g. Besley et al. 2013; Hassol 2008), particularly where science communication and public engagement roles are thought to require

discrete forms of academic and practical expertise (e.g. McKinnon and Bryant 2017; Carletti and Massarani 2015; Leshner 2007). In this work, the role of the communicator is defined predominantly through their outputs, so that a good science communicator is one who can steward the goals of science communication, such as fostering public trust in science, the ability to promote research and frame issues in ways pertinent to the audience and prompt public action (Rodgers et al. 2018; Baram-Tsabari and Lewenstein 2013; Baram-Tsabari and Lewenstein 2017). Science communicators are thus predominantly characterised in terms of their professional competencies, as workers who can ensure clarity and accuracy in communication, have the ability to tailor messages to different audiences, and can negotiate with the media (e.g. Landrum and Hallman 2017; Agre and Leshner 2010; Sommerville and Hassol 2011; Weitkamp 2009; Murcott 2009).

Attempts to delineate the technical competencies required of science communicators suggest an implicit politics of professionalisation and purpose: discussions of training often serve as a venue for articulating what it should mean to be a professional in the field. While some authors have claimed the professionalisation of science communication has already occurred and that the legitimacy and maturity of science communication is already evident (e.g. Sanchez-Mora et al. 2015, McKinnon and Bryant 2017, Gascoigne and Metcalfe 2017; critiqued in Trench 2017), other authors have employed discussion of training as a means to examine the role of science communicators, and what such a role might become (Lewenstein and Baram-Tsabari 2017; Mellor 2013; Trench 2017). Indeed, Mellor (2013) expresses the hope that the experience of training and learning the skills science communication and public engagement might provide an opportunity for reflexivity, with new science communicators gaining an awareness of the ‘big picture’ of science communication and an opportunity to interrogate their assumptions about the nature of science and the purpose of communication. Training might serve as a site for the transformation of understandings of science and science-society relationships, if only for practitioners.

However, within the broader the literature, the rules of the game, and consequently the purpose of training, appears far more set, despite rarely being formally articulated. This is particularly noteworthy in the incorporation of reflexivity as a technical competence. The ability to acknowledge and respect audience values, attitudes and worldviews has frequently been positioned as a key skill for science communicators, but not as a tool for engendering transformation. Instead, an adeptness in ascertaining what the public think about science and acknowledge that they know differently is positioned as an indication of high communicative competence without any co-requisite that these

alternative understandings of science might bring about substantive changes in practitioners' own practice (e.g. Carr et al. 2017; Kamolpattana et al. 2015). Indeed in Baram-Tsabari and Lewenstein's typology of the necessary skills for writing about science, awareness of competing scientific worldviews is seen as a feature of advanced competence, desirable only where scientists are already able to avoid jargon or adapt their writing style to their intended audience (Baram-Tsabari and Lewenstein 2013). Awareness of multiple, and potentially disruptive, worldviews is not seen as a basic premise or motivation for public work, but rather a metric of scientists' own skill and ability to anticipate and manage audience responses. Indeed, in Mogendorff et al. (2016), reflexivity is positioned as a communicative tool; by fostering reflexivity in scientists' understanding of their communication work, they will be more aware of unintended negative outcomes that might emerge from being unable to appreciate the worldview of their audience and hinder communication. Failing to respond to the public's own views within the event is the death-nail of good communication. This version of reflexivity would not appear to anticipate disruption beyond the event: reflexive scientists and science communicators will be better at communicating scientific messages, without needing to question the assumptions, content or implications of their message.

These incarnations of reflexivity would suggest that science communication does have a clear purpose, seeking to ensure the spread of science. Such an observation seems facile, but only where engagement with science is presumed to be a simple – though difficult – affair. Although some recent work has sought to explore scientists and science communicators' understanding of public communication and engagement, or their motivations for participation (e.g. Johnson et al. 2014; Ranger and Bultitude 2016; Samuel and Farsides 2018; Dudo and Besley 2016; Dijkstra et al. 2015), the goal is often largely instrumental, assessing how far scientists appreciate and value science communication and public engagement work. There is little suggestion that these attitudes towards public communication might themselves be transformative, but rather seek to identify professional values and motivations that will help in recruiting scientists to take part. Training and recruitment are positioned as entirely non-controversial activities, as technical facets of ensuring the continuation of a practice presumed to be both self-evident in its goals and, beyond its technical constraints, readily understandable.

2.4.1: Constructing the world of science through communication

Where the practice of science communication is figured predominantly in terms of the technical competencies of the field, and specific concerns regarding recruitment and

training, far less is said about ‘science’ or indeed what is communicated, beyond the specific content of various interventions. The omission of discussion of the ‘science’ within science communication might be read critically, particularly by STS scholars, as indicating an unwillingness or inability to acknowledge that science communication and public engagement have the potential to transform understandings of science beyond an increase in public approval. However, a more constructive sentiment is to suggest that this omission suggests that science is rarely a concern for science communication, in the sense of requiring problematisation. Within the field, it is possible that nothing need be said about science, where the meanings appear manifest and obvious, and thus not needing any particular comment. At least within the literature, the site for contestation, contingency and local adaptation occurs in negotiating the public, and ensuring their engagement with science be managed or fixed (see Gregory 2016 for critique).

Given that academic interest in public understanding emerged as an attempt to understand the different ideologies and imaginaries of science underpinning conflict in science-society relationships, it is perhaps unsurprising that the most vocal critics of science communication and public engagement have been simultaneously engaged in challenging the assumption that meanings of science are fixed or embedded within a single, stable worldview. Jasanoff’s concepts of co-production and social technical imaginaries both stress the contingency and embeddedness of science within local systems of knowledge production and governance (Jasanoff 2004). Jasanoff and Kim’s development of socio-technical imaginaries stresses the local norms, discourses, metaphors and cultural preferences on which science and its governance are built; across nation states, very different notions of science emerge and are sustained through policy, social landscapes and material practices (Jasanoff and Kim 2009; Jasanoff 2015). While Jasanoff and Kim stress that the imaginaries do not lie solely in the architecture of nation states, their focus nevertheless resides predominantly in explicit contexts of policy and state governance, rather than the more quotidian contexts of science communication practice. Nevertheless, we might find a similar, though more localised story within science communication and seek to evidence the production of specific understandings of science.

Research on science media has similarly demonstrated that the communication serves as a site of transformation, rather than transmission. Noting the plethora of images, discourses, ideas and languages made available through science, the work has sought to explore the different meanings that science affords (Hansen 2009; Stern 2004; Nelkin and Lindee 1995; Nelkin 1987; Mellor 2009). Scholars have traced the

representation of science in literature, often seeing literature as a way to evince public attitudes towards science through the ways scientific discourses are appropriated and repurposed (Haynes 1994; 1995; 2016) or trace the uses of scientific metaphors and imagery in wider culture (Turney 1998; 2009; Hecht 2015; Locke 2005; Schwarz-Plaschg 2018; Wald 2008). Similarly, through textual analysis, different ideologies and discourses of science have been evoked, for instance science as a Baconian hero story (Curtis 1994), and science as 'horrible', but ultimately epistemically sacrosanct (Bell 2011).

Alongside work tracing particular narratives within popular science texts, scholars have considered the impact of these narratives in framing public discussion of science, popularisation and communication events. Stephen Hilgartner's work on popularisation, while refuting the 'dominant view' that popularisation of science invariably constitutes an act of pollution, notes that the notion of pollution serves as a powerful resource for scientists seeking to reify the idea of pure scientific knowledge, and ensure that scientists alone can define legitimate knowledge, in part through decrying its misuse (Hilgartner 1990, see also Johnston 2017). Similarly, in discussion of Richard Dawkins as a celebrity scientist, Johnson et al. (2016) note that science communication offers a space for scientists to construct a desirable image of scientists in public. In reference to the two cultures debate popular within science writing, Lock (2016) and Mellor (2003) note how public discussion of science by scientists construct boundaries around the epistemic domain and professional identities of scientists through their opposition to the humanities and 'popular' takes on science. Venues for science communication serve as sites for forms of practice far more extensive than the simple transmission: science communication would appear to serve as a space in which the meanings of science are made.

Through these analyses, questions of intention and the purpose of representation in popular writing have begun to be explored. Often based on single case-studies, narrative analyses have noted how writing for popular audiences has sought to construct, for instance, nuclear power as a social and community good (Yli-Kauhaluoma and Hanninen 2014), or use the gene as a way to bridge species/organism distinctions in constructing a narrative of genetics (Oikkonen 2009). In the popular communication of physics, Mellor shows how issues of risk and ethical and social aspects of physics are written out of popular reporting, a selective gaze that constructs an image of science where the social and ethical are non-concerns for doing science (Mellor 2010; 2015). Examining narratives of encounter in primatology, Rees notes how popular accounts seek to justify anthropomorphism as a legitimate tool for

encounters in the field, particularly given its taboo status within research. As a site for scientists, popular writing and science communication provide a productive space for scientists to fashion understandings of science and position their own expertise within them (Rees 2007). Applying these questions to communication practice offers a starting pointing for considering the purpose and intention of science communication. Where previous work in STS has largely been focused on other sites for science in public, such as popular writing or law, this work highlights valuable heuristics for developing an account of professional science communicators.

One attempt to analyse professional science communication specifically as a form of practice is found in Davies and Horsts' 'holistic' account of science communication (Davies and Horst 2016). Arguing that science communication is best understood as an 'ecosystem', with a multiplicity of niches that are 'teeming with different life forms, all relating to each other in different ways' (p.6), science communication is figured as a specific cultural phenomenon and a productive space for the emergence of shared meaning. Drawing upon Hall and du Gay's notion of the Circuit of Culture (du Gay et al. 1997), they suggest that the artefacts of science communication be understood as constitutive of the social world, rather than either automatic reflections and reifications of science knowledge on the one hand, or the ephemera of deterministic political or economic systems on the other, as argued in some Marxist sociologies (see du Gay et al. 1997). To ask what the products of science communication 'mean' is to locate science communication with the constitutive processes of production, consumption, regulation, representation and identity.

Where Davies and Horst's focus lies predominantly on the events, texts and public activities which are produced by science communication rather than the world of the producers, their work nevertheless highlights the potential to examine the role of producers as actively shaping the world of science communication. This literature provides a starting point for this thesis, in highlighting the diversity of narratives of science and science communication that might emerge in practice, and as an impetus for studying the relationship between narrative and practice. The stories that emerged in the scheme about science communication provide a thematic anchor for each chapter, through which the practice of science communication is analysed. Rather than seeking to map the stories told about science communication to those already existing in the literature, however, this summary serves to highlight the contingencies of representation and production that risk being neglected where this generative view of science communication is not endorsed.

2.5: Dialogic Ignorance

Where the literature furnishing science communication at once presumes the need for the public to engage in science and to engage in science in a way that will not affect or transform scientists' and science communicators' own understandings of science, science communication would appear to be justified by the problem of ignorance. Science Communication and Public Engagement rest on the need for the 'non-scientific' public to participate in science, echoing a 'deficit' assumption in which they come to know a science that they are not allowed to change, and indeed is presumed to be unchangeable. Despite public engagement and science communication adopting and appropriating the languages of shared governance and communal knowledges that motivated their emergence, ignorance recurs as a core motivation for work. The public simply doesn't know enough, or worse, think they know more than they really do (Scharrer et al. 2017; Cole 2015), or are too biased to ever be able to appreciate science properly (Kahan at el. 2012). They do not place enough trust in science (Yankelovich 2003; Bennett 2011; Goodwin and Dahlstrom 2014) and need to be convinced of its importance (Dahlstrom 2014; Nisbet and Mooney 2007). They fail to appreciate the expectations placed on them living in a highly technoscientific society, and without professional science communicators, risk failing in their civic duty (Goldfarb and Kriner 2017; Geiger et al. 2017; Lee and Kim 2018; Hennink-Kaminski et al, 2014). Where the public are deficient, there is a clear rationale for science communication (e,g, Luchenco 2017).

Whether the 'public' really is ignorant of science is a moot point here. However, as a discourse frequently employed to justify particular forms of science communication intervention, ignorance clearly has significant generative weight, permitting and enabling forms of action and framings of science-society relationships that might be ameliorated by remedying such ignorance. While ignorance may be presented in the literature cited above as a societal and moral evil, it nevertheless provides a rhetorical impetus for practice, particularly where the root of ignorance is imagined to lie in poor communication (see Gross and McGoey 2015 for discussion of the uses of ignorance). Several accounts of scientific ignorance have suggested that the public is deliberately misled in issues relating to science and technology, the truth masked through miscommunication and concealment (Ogien 2015; Stocking and Holstein 2015; Firestein 2015). The most prominent of these accounts is Oreskes and Conway's work on Climate Change, which notes the conscious attempts to conceal information from the public and generate ignorance in order to protect industrial interests (Oreskes and Conway 2008; 2010; see also Proctor 2008). While the public might not be to blame for

their ignorance, their inability to accept the manifest truth encoded in (good) scientific knowledge nevertheless remains a danger (Friedman 2015; Pinto 2015).

While these accounts might figure ignorance as a problem to be overcome, this construction of ignorance might offer clear reward to science communication: the ignorant public does not need to be listened to. Analysing surveys purporting to measure the public understanding of science, Bauer et al. (2007) note that surveys succeed in framing the ignorant public as a problem, reifying a public knowledge and attitudinal deficit that can evidence the need for science communication and caution against such an ignorant public being allowed to engage in substantive questions of governance. Similarly, Erikson (2005) argues that 'popular science' necessitates a narrative of threat, to delineate between public forms of science and more legitimate and sanctioned imaginaries of science, access to which remain tightly bounded. Ignorance carries an implicit normative force, disallowing the public from participating in the definition of problems, or locating science in the world (Welsh and Wynne 2013). While public engagement might ostensibly advocate for the democratisation of science, it cannot do so – and need not do so – when faced with an ignorant public.

Secondly, identifying the public's ignorance potentially enables the submersion of broader discussion of the ignorances produced through science. In critiquing accounts of scientific ignorance, Gross and McGoey (2015) note a 'conspiratorial logic' where ignorance is the product of deviant science, either science done wrong or deliberately misconstrued. Reliant upon a bifurcation between manifestly good and deviant forms of scientific knowledge, ignorance emerges as a recognisable and concrete absence of true knowledge. For STS, such a view would seem troubling, given the inherent selectivity (and thus ignorance making) of scientific practice, which relies upon specificity and separation to foster internally referential and coherent knowledge systems (Knorr-Cetina 1999). Rather than science encompassing all valid knowledge, its absence marked as ignorance, ignorance is a corollary of knowledge making practices that by necessity privilege only certain forms of investigation (Balmer 2012, discussed in Rappert and Balmer 2015). Ignorances do not then exist in and of themselves, as objective absences of knowledge, but emerge within particular cultures that determine what is and is not worth knowing, and what cannot be known (Gross and McGoey, 2015; Frickel and Vincent 2007; Bauchspies 2014 for discussion).

Where science communication is able to construct the 'ignorant' public in opposition to a seemingly discrete and readily identifiable body of true knowledge, this suggests a power of science that remains underexplored in the science communication literature.

The authority of science might lie less in bringing forward truth, but rather in effacing and rendering invisible the selectivity and partiality through which it operates (Machlup 1980; de Sousa Santos 2008; Hess 2015). This draws attention to the question of what science and science communication leave out and consider not worth knowing (Elliott 2015; Frickel et al. 2010). Work investigating the ignorances of science have attended to the historical erasure of knowledge, particularly in the context of colonialism (e.g. Tuana 2008; Schiebinger 2008; Mayor 2008), as well as questions and routes of enquiry that struggle to gain recognition that struggle to gain legitimacy as valid scientific concerns and remain 'undone' (Frickel 2004; Hess 2009; Frickel et al. 2010). Where the status of scientific knowledge as the sole form of legitimate knowledge is taken for granted, the politics underlying knowledge production might remain unexplored (Kleinman and Suryanarayanan 2013). in the context of science communication, so long as it is the public that is ignorant, without recourse to challenge these accounts of knowledge, quite what they are ignorant of can remain unexplored (Michael 1996; Entradas 2015).

Studying the co-emergence of knowledge and ignorance provides another means for attending to the specific conditions of practice, in asking what matters for the community, the knowledge that is valued, and conversely what is seen as not worth knowing. Where ignorances and forms non-knowledge are an inevitable and intrinsic feature of any knowledge production or knowledge production, tracing the knowledges and ignorances can bolster attention to the specificities with which science communication work is orchestrated. The group's own ignorances are considered in chapter five and chapter six, firstly in exploring the work that was not done within the group, and then in considering the 'public' as a construction of ignorance, with participants both seeking to navigate a group they did not know, and a group that proved most generative in its absence.

2.6: Comedy and Science Communication

While the literature discussed above has for the most part been concerned with science communication and the public understanding of science as broad phenomena, there has been specific interest in the place that comedy has, or might have, within this world. Within this much smaller literature, it is worth noting how many of the issues previously discussed in the chapter recur, as discussion of comedy has quickly focused on determining the accuracy of scientific knowledge within comedy and means to avoid its contamination. Presuming the need for formats that are attractive to the public, there have been tentative attempts to evaluate comedy's suitability. Very quickly, the value of

science comedy has been understood to depend predominantly on its suitability as a vehicle for knowledge transmission.

While some work had already documented the use of humour within science and medicine (e.g. Nelson 1992; Lewin 1983; Kilbourne 1996), often to argue that scientists and doctors were funny despite the serious nature of science, there has been a concerted effort in the last decade to explore the effectiveness of humour and comedy as forms of science communication, often with a note of alarm. In 2013, the hashtag #overlyhonestmethods trended on Twitter, with laboratory scientists appearing to offer 'honest' descriptions of their work, reported by the Guardian as reflecting 'less than scientific methods'[8]. Though the episode was generally reported positively in the press, and there was some sense the hashtag could counteract negative stereotypes around scientists (Lorch 2013), academics expressed concern that the tweets could undermine public trust in science by challenging the public image of science gaining its credibility by adherence to scientific method (Simis-Wilkinson et al. 2018; Bezuidenhout 2015). Discussing the role of humour in public discussions of science, and presuming that the Twitter trend had reached the 'public', the apparent violation of a pre-existing public image of science based upon scientific method suggested that humour could subvert and threaten the authority of science in the public sphere.

Despite the concerns that humour might threaten the seriousness of science, and presuming that such an outcome would be negative, there have been attempts to ascertain how far humour might prove tractable as a means for communicating (correct) images of science (see Bultitude 2011). Studies of science comedy projects has for the most part rested on attempts to measure audience knowledge and attitudinal changes. Bore and Reid (2014) report on a satirical play that sought to educate the public about climate change. In trying the gauge how the public understood the message of the play and were inspired to act against climate change (as metrics of the play's success), the malleability and indeterminacy of satire proved concerning. Where satire allowed audience members to interpret the play in different ways, they could do so 'incorrectly', failing to understand the real (scientific message) of the play, particularly if they were side-tracked by the humour. Rather than examine how audience members understood the play or drew the boundaries between the comic and the serious, the authors' concern lay instead with determining the correct

[8] Examples collated within the press included "This dye was selected because the bottle was within reach", "Sample size was smaller than planned because I had been in grad school for 10 years & my advisor wanted me to graduate" and "We don't know how the results were obtained. The postdoc who did all the work has since left to start a bakery." (Mallikarjuna 2013).

proportion of science and satire for the right understanding to get across. Cientistas de Pe, a Portuguese scheme that trained researchers to perform stand up comedy, is evaluated in a similar way, asking whether comedy could effectively package science to the public, with the authors expressing concern that comedy would oversimplify science and thus inhibit communication (Pinto et al. 2015).

The mainstream success of *The Big Bang Theory,* a sitcom about the lives of nerdy research scientists, has garnered significant attention. The very existence of a show about science has been celebrated, even if the humour in *The Big Bang Theory* might prove inaccessible or alienating to audiences without particular scientific backgrounds (Mooney 2014; Heyman 2008; McGinty 2015; 'StephS' 2010). Alongside media and linguistic analyses of the show (Hu 2012; Saey 2012; MacIntosh 2014; Stratton 2016a; Stratton 2016b; Bednarek 2012), *The Big Bang Theory* has been cited as a potential vehicle for public understanding of science. Li and Orthia (2016) use the show to measure audience understanding and appreciation of the 'Nature of Science'. Crucially, their question is not what understanding of science the show engenders, but rather how accurately audiences grasp the show's representation of science as a reflection of an underlying scientific reality. The focus of the research is particular focused upon how well audiences come to understand and articulate a specific – though undefined – version of science.

The science communicator/researcher's role in constructing an experimental research environment where particular 'scientific' understandings were enforced and legitimated through audience work is largely unexplored in this research. Steinke et al. (2012) measure wishful identification amongst children shown clips from comedies featuring scientists. Where students were asked to state which characters they liked, it is assumed that they were identifying with the characters qua scientists, neglecting other associations that children might make (indeed they were not asked why they liked them). Using research designs that measure how far public attitudes cohere to science communicators' own understanding of science, there is little space for considering science communication work as its own form of practice, constructing particular configurations of science through which the public are defined.

This literature has sought to answer a question very different to my own, asking primarily whether comedy 'works' as a form of science communication, rather than seeing science comedy as means for exploring the world in which it emerges. In answering this question, the particularity of comedy comes to the fore, with moderated in part by a sense that comedy is a substantively different type of cultural output, at

once more accessible and potentially destabilising, so that research has at sought in part to map these seemingly intrinsic features of comedy onto the landscape of science communication. I will argue in the next chapter for the need to resist such an approach, in presuming that science comedy is intrinsically different other forms of science communication, yet this discussion highlights one feature of comedy that prove important, in the pre-existence of a substantive 'meta-language' with which comedy is described and enacted, particularly in relation to the 'appropriateness' of comedy in different situations. The meta-language of comedy within the scheme across the empirical chapters, as participants frequently described and evaluated their practice in terms of what science comedy could do.

2.6.1: Humour and Education Research

A small amount of work within Education literature has assumed a similar goal to the work in science communication in seeking to ascertain the potential use of humour both within educational practice and as a form of teaching. For the most part, work has been heavily quantitative, seeking to measure changes in understanding or attitude after specific interventions employing humour. Research thus seeks to ascertain whether, for instance, watching late-night comedy increases young Americans' knowledge of current events (Feldman and Young 2008; Feldman 2013), can help them to understand complex political ideas (Baek and Wojcieszak 2009), or can influence political positions and attitudes towards science (Nabi et al. 2007). Several studies have applied this framework to science, attempting to measure specific learning outcomes resulting from science content being presented humorously, for the most part reporting highly ambiguous findings (Gardiner et al. 2018, Moyer-Guise et al. 2011; Fisher 1997; Brewer and McKnight 2015).

However, the ability of often singular humorous interventions to effect substantial change has been challenged (Weinberger and Gulas 1992). Surveying 40 years of educational research, Banas et al. (2011) question whether the ambivalence of humour, as a means for both fostering group cohesion and social isolation, might ever be captured in single-variable experimental settings, resulting in research capable of little more than platitudinal observations that humorous instruction is seemingly beneficial (pp.116-17).[9] Experimental methods require humour to be abstracted and essentialised; how humour is used or experienced can only be hinted at. Observations that emerge from this work, for instance that the use of humour is stratified by gender, seniority and employment security, cannot be substantiated beyond observation within

[9] See Lareau (2009) for discussion of the limitations of using control studies and single intervention research studies in studying education.

the data. Where education is taken to mean knowledge transfer, broader questions of the contexts of humour use – as well as the potential for humour to transform these educational settings and interpersonal relationships – cannot be examined.

In medical education literature, however, these questions have begun to be explored, particularly concerning the value of humour as a form of medical and nursing practice. Often focused on personal experiences in the ward, authors have pointed to the benefits that laughter affords medical practitioners, particularly in coping with stress and acknowledging difficulties they face at work (Goodman 1989; Beck 1997; Bennett 2003; Feagai 2011). These accounts are far more ambivalent when discussing the general suitability of humour as a learning tool, noting at once the potential for humour to foster a positive learning environment, but also to disrupt medical hierarchies or create uncomfortable situations where students feel targeted (Granek-Cataviras et al. 2005; Lopez Nahas 1998; Chauvet and Hofmeyer 2007; Mallett 1995; McCreaddie and Wiggins 2009). Roth et al. (2011) express a concern that attempting to build humour as a pedagogical methodology would risk enacting a dialectical tension between science as serious and science as fun. The ability of humour to invoke multiplicity presents a problem where the process of science and medical education is seemingly to move students from multiple ways of understanding the world to a singular professional one. At stake in these discussions is more than whether humour effectively transmits knowledge, but rather to ask what social and professional worlds become possible through humour.

The methodological move from analysing comedy as a concrete entity towards studying comedy as a form of practice within a broader social world is instructive for this thesis, where science comedy is studied as lens onto the broader world of science communication. Examining humour and comedy as part of broader projects of constructing scientific knowledge, professional roles and the ‘world’ of science communication, there is the opportunity to ask what science comedy is used to do. The experience of comedy within the scheme maps onto some of the findings from this medical literature, particularly in chapter seven where the ability to view science comedically was cited by participants as a tool of resilience and means for confidence building. The relationship between comedy and education is discussed in chapter five, in outlining the pedagogical role imagined for comedy within the scheme.

2.7: Summary: Towards an account of science communication as practice

As the study of comedy within science communication gains traction, numerous concerns already seem to pervade academic attention, underwritten by an assumption

that the value of science comedy lies in the degree to which it can be instrumentalised within existing public engagement practice. Assuming, but not necessarily explicating, the value of science communication and public engagement, science comedy would seem to pose an empirical question of how far comedy enables the further proliferation of particular forms of professional practice that have become manifest in the last thirty years. However, by considering the contingencies of this professional practice, there is an opportunity to ask questions of 'why?' rather than 'how?' (Stilgoe et al. 2014). While the claims made to justify public engagement and science communication might well be (and have been) challenged, they nevertheless must be understood as constructive of the world of science communication, raising the question of the work that these specific imaginaries and understandings allow.

The role of practitioners in building images of science through science communication has been comparatively neglected in research. Where science communication might be taken to be explainable and determined by the content of its science, rather than the socio-cultural contexts of doing science communication, little need be said about these contexts, other than ensuring they can properly allow for the transmission of knowledge and the ennobling of the public, reminiscent almost of the earliest days of Mertonian functionalist sociology of science. Yet as numerous critiques of science communication and public engagement have shown, such a view of science is untenable. While the absence of practitioners' role within science communication might be an indication of how science communicators understand their practice, there is a need to ask what role practitioners play in the construction of science communication. This is to ask what science communicators are *doing* when they communicate science and *do* science communication. While it might eventually be desirable to ask whether science comedy 'works' as science communication, the terms of such a question are not self-evident. Consequently, this thesis aims to explore what it means to say that science comedy works, as a question about science communication, and in doing so, illuminate the practices, concerns and evaluative standards that motivate such statements.

In positioning science communication as a generative form of social practice, the thesis is informed by a rich literature from STS has highlighted the contingencies of scientific knowledge production, and the need to interrogate concepts such 'science', 'the public' and 'understanding' as empirical topics, rather than self-evident categories that might not require analysis. However, applying this theoretical work is not necessarily straightforward, particularly where work in STS has rarely attended directly to the practices of professional science communication, instead focusing on competing versions of science in the laboratory, the law court or government. Similarly, where

numerous textual analyses of science writing and broadcasting point to the selective representations of science within them, less is said about their contexts of their production, which is the space that aligns more closely to this thesis' own focus on the world of communicators. Consequently, questions remain as to how a study of science communication practice ought to be conducted. The following two chapters set out the theoretical and methodological choices made in this study to substantiate science communication as a site for sociological analysis. Chapter three outlines the theoretical commitments of the project. It begins by asking whether, and if so how, it matters sociologically that this thesis is a study of humour and comedy, before looking to broader work on practice in sociology, STS and Science Education to highlight the theoretical tools used in this project. The methodological prerogatives and concerns that emerge from attempting to examine science communication as a form of practice are discussed more fully in Chapter 4, which outlines the methodological, ontological and epistemological commitments of this thesis, as well the methods for data-collection and analysis.

Chapter Three: Science Communication as figured world, communities of practice and field: towards an account of science communication practice

3.1: Introduction and Chapter Overview

This thesis aims to provide an account of science communication as a form of practice. As noted in the previous chapter, this approach is premised on the rich work within STS and Science Communication that argues that the specificities of particular forms of science, science communication and public engagement practice are crucial to understanding the localised and contextualised meanings of science that emerge in academic and public cultures. The empirical basis of this account is drawn from ethnographic research on a cohort-based science communication training scheme that used comedy as the primary vehicle for teaching communication and performance skills, as well as providing opportunities for members of the cohort to perform to the public. The cohort primarily consisted of PhD researchers in the natural sciences and participants within science backgrounds already working in the professional science communication/public engagement sector.[10] The scheme offered sustained training opportunities and mutual support for participants over the course of a year, and for many was understood as a way to develop a career in science communication, while also providing a site for sustained interaction and community building amongst the cohort.

The scheme provides a rich basis for examining science communication as a form of practice. As participants in the cohort came to learn, embody and enact particular forms of activities and shared understandings of 'doing science communication', there is an opportunity to consider what science communication might mean for those who take part in it. However, while work in STS and Science Communication has produced highly complex and nuanced theoretical accounts that demonstrate that science communication, like science, be understood as localised and contingent form of social practice, the theoretical tools developed within STS are tailored for specific sites and scales of enquiry. For instance, Sociotechnical Imaginaries primarily serve as a means for understanding the role of technoscience in relation to nation states (Jasanoff and Kim 2015). Conversely, where science communication literature has attended to the local conditions of the field, there have been fewer attempts to theorise science communication practice, particularly in relation to the role of the practitioner.

[10] A demographic breakdown of the cohort is presented in Appendix one.

Additionally, these accounts, hardly unexpectedly, have had little to say about humour and comedy. Where this thesis is about science communication, it is also about humour, as forms of practice that underwrote the scheme's activities and provided participants with a set of discursive resources with which to make sense of and articulate their work. Without presuming that a study of humour requires a fundamentally different theoretical or methodological approach, it is worth considering whether, and if so how, it matters that comedy and humour were a core part of the scheme. Consequently, this chapter has two principal goals, firstly exploring how comedy and humour might be studied sociologically, and secondly to highlight broader theoretical work that can inform the analysis of comedy within science communication as a form of generative practice. To develop this account, I draw from three broad theoretical traditions that give primacy to practices as having generative and constitutive force in the production of social meanings and repertoires: Lave and Wenger's account of Communities of Practice, Holland's work on Figured Worlds, and Bourdieu's work on Field, Habitus and Capital.

3.2: Is there anything special about comedy and humour?

Appealing to a discrete 'sociology of humour' that might underpin the project's theoretical orientation very quickly proves to be a difficult task. While work on humour has become increasingly prevalent in the last forty years, within a wide range of disciplinary perspectives, sociological work has been far less forthcoming. The lack of interest in humour and comedy within sociology has been invariably attributed either to humour being seen as too ubiquitous and obvious a phenomenon to require sociological explanation (see Billig 2005b), or an affront to sociology's disciplinary commitment to (exclusively) engage in 'serious' topics and concerns (Davis 1995; Watson 2015). Indeed, when surveying early attempts to build a sociology corpus of work on humour, Davis doubted that an extant sociology of humour would ever gain fruition (Davis 1995).

Consequently, the majority of academic work on humour to date has occurred outside sociology, particularly within philosophy, psychology and linguistics. This work has generally taken two directions, firstly attempting to elucidate intrinsic features of humour and joking, either linguistic (e.g. Sacks 1978; Raskin 1985; Davies 2009) or philosophical, attending to the metaphysical and ethical nature of humour, often claiming humour as an intrinsic moral good (Lippitt 1994; Lippitt 1995a; Lippitt 1995b; Critchley 2002; Lippitt 2005). Secondly, in presuming that humour is a self-evidently positive phenomena, the purpose of this research would appear to entail a celebration and attempt to protect humour's status as a public good. Thus work in psychology has

often foregrounded the power of humour to alleviate problems and facilitate social bonding, often urging that humour be employed as a therapeutic intervention (discussed in Billig 2005b). Likewise, philosophers have identified a moral imperative for humour, casting humour as a form of liberation and means for expressing defiance to unjust social order (Critchley 2002; Morreal 2009). For Critchley, the comedian is a 'daring man' capable of exposing the arbitrariness of social order by laughing at it, a role otherwise fulfilled by philosophers (Critchley 2002, 9-10). While this work has made claims about the outcomes of laughing and joking, it has primarily focused on identifying the intrinsic properties of humour that enable its social function. Such work would appear out of step within a broader STS analysis where such appeals to externality and intrinsic accounts of phenomena are largely resisted.

3.2.1: Ambivalent Sociology

Sociological approaches to the study of humour contest the two over-arching stories found in the literature cited above, on the one hand challenging the claim that humour has an intrinsic essence from which its social function can be deduced, and on the other questioning whether humour is unquestionably good. Like work in philosophy and linguistics, sociological analysis has sought to develop generalised accounts of humour, while largely resisting essentialist explanations. Thus while linguistic accounts of humour (e.g. Atardo 1994) characterise humour as a moment of incongruity between two cognitive or linguistic frames, so that whether a joke is 'really' a joke depends on the existence of incongruity, sociological work has sought to ask when, where, and for whom such situations are incongruous. For Mulkay (1988), jokes might be understood as moments of incongruity within social structures of communities, where the organised discourses employed within a community are at once presented as unified and serious and revealed to be incoherent and contingent. Jokes thus emerge through the perception of incongruities within the 'serious' world, where jokers notice apparent problems in the structure of the world. Similarly, Lewis' study of Holocaust gallows humour argues that the meaning of humour depends upon the context, worldview and intention of its tellers (Lewis 1987). Different tellings of a joke – in this case narrating three Jewish men on their way to their execution - will rest on different views of what is incongruous about the situations, employing different discourses, yet resulting in the same text. Attempting to determine the meaning or consequence of joking from philosophical or linguistic features of the text, therefore, would seem to mask the complexities of the worlds in which they are told.

In seeking to contextualise humour, sociological work has simultaneously sought to explicitly counter the view that humour unilaterally constitutes a moral or social good,

particularly where it can be used to silence, exclude and denigrate. The notion that humour may provide a source of harm appears a perennial concern for philosophical and psychological accounts of humour, invariably resolved by bifurcating 'positive' and 'negative' humour – or 'true' humour and its distortion or misuse - as intrinsically different phenomena (e.g. Morreal 2005, 79-78; discussed in Billig 2005). Examining jokes told by the Klu Klux Klan, Billig demonstrates that rather than exhibiting clear traits of pathological or distorted humour, the Klan's joking matches philosophical accounts of 'true' humour, as racist humour enabled socio-positive bonds within their group and a means for expressing solidarity and a positive shared identity (Billig 2001). Where theoretical accounts necessitate the valorisation of humour, then the KKK's use of racist humour must, by the same logic, be similarly celebrated (Billig 2005). Sociological accounts have urged a more ambivalent attitude to humour, acknowledging that humour can be used to include and exclude, uplift and humiliate, so that research be focused on asking not what humour is, but what it can be used to do (Mulkay 1988; Kuipers 2006; Lockyer and Pickering 2005).

3.2.2: The False Prophet of humour research: Bakhtin's carnival

The tensions between these approaches can be witnessed in the highly divergent reception to the work of the Russian literary theorist and semiotician Mikhail Bakhtin's work on carnival. Formulated primarily through his reading of Rabelais' *Gargantua and Pantagruel,* Bakhtin positions the carnivalesque as a literary and discursive mode that exposes and challenges dominant forms of power and order through laughter, disorder and parody (Bakhtin 1984). For Bakhtin, the carnivalesque is most visible within the ritual acts of 'inversion' that occurred in Medieval carnival, where public norms and notions of order was subverted through public celebration of the 'low' and profane. During carnival, usual forms of separation and piety were suspended through free association and the celebration of the bodily, occurring symbolically through the inversion of roles in which members of peasant classes were crowned King and Queen.

While the aesthetics of the carnivalesque drew heavily from the specific rituals of Medieval carnival, Bakhtin positions the carnivalesque as a mode of thought and speech with significance and political power far beyond the specific periods of carnival time. Where the rituals of carnival showed that medieval society could be inverted, through parody and the re-referencing of language, the carnivalesque provided a resource to demonstrate that society was neither the reflection of a natural underlying order nor (as in Marxist readings) arbitrarily imposed (Denith 1995). Carnival demonstrated simultaneously that power relations could be different, but also that

critique was only possible through the use and reproduction of the hegemonic language that outside carnival ensured domination: in carnival it was possible to parody and repurpose the language of power, but not to speak anew. As a critique of formalism and structuralism, Bakhtin sought to show how speech, discourse and power emerged through the contexts of their production, both constraining and constrained by the ways in which they were put to use.

Responses to Bakhtin have grappled with the ambivalence of this account of humour, parody and subversion, often noting that while the carnival might reveal the falsity of the claim that political power reflected a natural order, it could achieve little substantive change. The need for medieval carnivals to be licensed by the authorities that were apparently compromised by the inversion of social order would suggest that, beyond the contained space and time of carnival, the temporary suspension of order within carnival was a licensed form of resistance, legitimated by and ultimately subsumed back within hegemonic power (Stallybrass and White 1986; Jenks 2003). Examining modern incarnations of carnival, Saltzmann (1994) describes the actions of upper-class strike breakers during the 1926 General Strike, who adopted the dress and gait of the workers they replaced, describing their actions as a 'University lark'. Where the strike-breakers' activity evoked carnivalesque notions of inversion and conscious shifts in the use of body, it served a hegemonic goal, silencing the working class by transforming the demands of the strikers into an upper-class game.

Where the historicity of claims regarding the power of carnival might been questioned, Bakhtin's work has received very different readings within psychology, philosophy and sociology. For the philosophy of humour, Bakhtin would appear a false prophet. Where carnival cannot bring about real change, Bakhtin's work has largely been ignored, and when discussed, invariably dismissed as a failed promise, offering an account of the positive power of humour that fails to deliver (see e.g. Morreal 2009, Critchley 2002). By contrast, sociological work, in line with Saltzmann, has sought instead to interrogate the use, meaning and value that carnivalesque imagery might come to have. Bell's work on *Horrible Science* – a series of popular humorous books about science for children replete with carnivalesque imagery – is an instructive example. Like other critics of Bakhtin, Bell argues against the idealism of carnival, noting how the series employs bodily, 'low' and carnivalesque imagery, not to emancipate children's engagement with science, but rather as a performance of science's epistemic authority (Bell 2008; Bell 2011). For Bell, *Horrible Science* requires readers to simultaneously laugh at science and revere its epistemic authority. A form of licensed revelry, the representation of science within the series is predicated on the careful use of

carnivalesque imagery that might enrol children to the wonders of science. Where philosophy and psychology might dismiss Bakhtin's account for failing to offer an account of science that is suitably valorising, Bell's work suggests a more productive reading, asking what the use of carnivalesque imagery reveals about the contexts of its production, in Bell's case, the world of science communication.

Though Bakhtin's account of carnival does not provide for an extensive account of comedy, the notion of 'licensed revelry' proves useful in the context of science comedy, particularly where science comedy is so embedded within broader practices of science communication, and has been framed in the extant literature of bolstering, rather than disrupting, the 'serious' work of science. Indeed, the enthusiasm for comedy has largely depended on its ability to strengthen public engagement with science (e.g. in Bore and Reid 2014; Pinto et al. 2015; Li and Orthia 2016). This duality of comedy and humour, as at once destabilising and easily contained provides a productive tool for examining how comedy was discussed within the scheme, and is drawn upon particularly in chapter seven, where notions of transgression through comedy emerged simultaneously with a broader desire for continuity in determining the purpose of using comedy as a form of science communication.

3.2.3: Humour as a sociological lens

Where the practices of humour can be related to the 'serious' work of identity, conflict and domination, humour might appear more amenable to the serious concerns of sociology. In this vein, a sociology of humour has emerged that focuses less upon what can be said about humour specifically and more upon what humour can illuminate about broader social processes. Humour has thus often been positioned as a lens and orienting tool for building a bigger picture story of serious practice. This approach is most explicit in Gilbert and Mulkay's (1982; 1984) examination of scientific repertories.[11] An account of the ways that scientists make sense of their own practice, particularly in the concurrent use of empiricist and contingent repertories, the study of humour is offered as a test of the use of such repertoires. Examining forms of joking in the laboratory and in scientific publications, Gilbert and Mulkay demonstrate a shift in repertoire consistent with the broader switching between empiricist and contingent forms of explanation, using humour to reproduce non-empiricist accounts of science

[11] Gilbert and Mulkay note that they analyse humour in part because it appears to be the hardest feature of scientific discourse to pin down and subject to systematic analysis, for being so ambiguous and indeterminate. Echoing Bloor's (1976) claim that demonstrating the validity of the strong programme would rely on the ability of sociology to explain science's hardest case, namely mathematics, the decision to study humour would seem in part a clear rhetorical choice: the strength of the repertoires account can be asserted in part because it can even explain humour.

that foreground contingency and error. Just as #overlyhonestmethods relied on a clear shift away from conventional forms of scientific reporting to offer a humorous construction of the 'real ways in which science gets done, and in doing seemingly revealed the conventions and attitudes underpinning scientific reporting, humour provides an empirical focus for examining the serious work of explaining practice and accounting for error.

Work on cultural consumption has similarly studied humour as a case-study in broader patterns of structuration. Employing a Bourdieusian analytical framework, Kuipers examines how participation in comedy and humour is differentiated by educational inequality (Kuipers 2006), attitudes towards gender (Kuipers 2009) and the social status of minority ethnic groups in the Netherlands (Kuipers 2000). In a similar vein, Friedman similarly attends to how patterns of comedy consumption and appreciation are strongly delineated by class (Friedman 2011). In doing so, Friedman argues against the notion of the 'cultural omnivore', developed by Bennett et al. (2009), which claims that cultural consumption in the United Kingdom has become increasingly uncoupled from class, particularly through the increasing consumption of 'low' cultural forms by audiences with high social and cultural capital. By contrast, Friedman shows that even where the consumption of comedy may have expanded, particularly as comedy has become more 'legitimate' since the 1980s, the ways in which it is consumed and discussed is nevertheless highly stratified by social and educational background. In this instance, comedy and humour provide a means for exploring the continuation of class differentiation and inequality in British society.

A similar attitude to humour can be found in anthropology, which largely resists seeking to develop a unified, theoretical understanding of humour (or claim there might be one) but rather to attend to the role of humour within diverse anthropological settings (Carty and Musharbash 2008). Often published as a case-study within a larger ethnographic project, anthropological work has focused on employing humour as a means for understanding more 'serious' issues, such as gender roles and expectations (Seizer 1997), competing epistemologies and 'irrationality' (Hanks 2016), the experience of indigenous identity (Alexeyeff 2008; Beckett 2008), and how humour is used to foster egalitarian social ties in work environments (Lynch 2010; Yoshida 2001). Just as in sociology, humour is treated ambivalently, as both a tool of derision and self-expression, as a way to enforce power and a form of resistance. Thus humour can at once, for example, be used to enforce symbolic control over women's bodies and silence patient concerns in medical interactions (Pizzini 1991; Oliffe 2009) and provide

patients with discursive resources to manage patient-practitioner relationships to their own advantage (McCreaddie and Wiggins 2009; Haakana 2001).

Unique to the anthropology literature, humour is simultaneously suggested to offer another form of critical lens, in enabling methodological reflexivity. Scholars have suggested that anthropologists' reflection upon their interactions with humour in the field allows a site for interrogating their own position within the communities they are studying. The ability of the anthropologist to take part in humour and 'get the joke' offers a gauge of their integration (Rasmussen 1993; Carty and Musharbash 2008; Dwyer Minnegal 2008)[12]. Humour here functions as a test for anthropology, revealing potential conflict or miscomprehension between the anthropologist and community, or conversely the anthropologist's ability to recognise the epistemologies through which humour emerges. Similar to work in sociology and social psychology, rather than attempt an account of humour in and of itself, humour is used as an orientating concept, both as an observable practice and as a way for anthropologists to reflect upon their own work.

3.2.4: The meta-discourse of comedy

The academic work discussed above would suggest that there is little intrinsically special about humour. Where it might serve as a lens to enable broader analysis, other forms of practice might surely be used to a similar end. In part seeking to move against a theoretical tradition that has sought to valorise humour's uniqueness, it might be expected that sociological analysis would be reluctant to attribute special characteristics to humour and comedy. However, while it is important to query whether humour intrinsically requires different forms of sociological analysis, this is not to say that the particular features of humour are unimportant. For one, as is particularly evident within the philosophical and psychological literature, while humour might not appear a special phenomenon, it is often treated as though it is, as a phenomenon that is uniquely good or politically powerful (discussed in Billig 2001; Kuipers 2006; Coupland 1996). Where this has in part contributed to the proliferation of a broader discourse in which the value and potency of humour are frequently stated (and where contested, nevertheless acknowledged), comedy and humour can be seen to have a meta-language that is more developed and explicit than other quotidian forms of practice.

[12] See also Bingham and Green (2016) for discussion of 'getting the joke' as an indication that the listener understands the social norms encoded in the joke, in this instance jokes about disability.

Kuipers suggests that analysis of this meta-language might similarly illuminate broader social practices: the skill of humour, in knowing when to joke, what to joke about and when to laugh, require significant cultural knowledge and awareness of the implicit rules of joking (Kuipers 2006). Exploring humour as a topic of discourse would thus again provide a way for examining the 'serious' world in which it is produced, for instance, as suggested in the previous paragraph, in examining and the implication of the assumption that humour is a good thing. For Kuipers and Friedman, the ability to 'talk' humour, and control the meta-discourses of humour is a powerful of distinction and legitimacy, particularly where the consumption of comedy is no longer itself a status marker, but instead rests on how it is consumed. In this explicit Bourdieusian frame, the meta-language of comedy and humour serves as a form of 'taste-talk', marking a broader shift whereby distinction is no longer tied to particular forms of cultural production, but rather as an embodied form of cultural capital stratifying acceptable forms of eclectic consumption (Friedman and Kuipers 2013).

To access this meta-language, Kuipers notes that explicit discussion of humour becomes most visible at the moment of a 'humour-crisis', where humour is seemingly going too far and facing a threat, as the infrastructure of good joking breaks down (Kuipers 2011). The academic meta-language of humour can be seen in responses to such perceived crises; the journal *Humour* published two 'round-table' discussions between scholars in the field, the first after calls for the censorship of comedy and the second in the aftermath of the publication of the Muhammad cartoons in the *Jyllan Posten* (MacHale et al. 1997; Lewis et al. 2008). Denying any sense that calls to curtail humour might be legitimate, these discussions frequently equated criticism of humour to an attack on free speech, with the philosopher John Morreal labelling any attempt to restrict joking an act of terrorism (Lewis et al. 2008, p.11).[13] The ambiguity and indeterminacy of humour gained curious purchase in the discussion, with multiple respondents claiming that where jokes might offend or do harm, the chance they would not be interpreted in that way necessitated no further discussion of whether humour should ever be curtailed.

While this discussion illuminates a fairly elite version of the meta-language of comedy, examining how humour and comedy are discursively positioned within the world of science communication might illuminate the culture in which science communication emerges. While not a claim that other forms of cultural production lack this developed meta-language, the raft of resources which the value, appropriateness and impact of

[13] For discussion of 'political correctness' as a discourse for negotiating values and denigrating undesired social concerns, see Fairclough (2003) and Johnson et al. (2003).

comedy might be parsed were of course forms of discourse participants had already encountered and used prior to entering the scheme. The ubiquity of humour, joking and comedy within British society can prime the assumption that participants had already engaged with these broader forms of work associated with comedy, even if obliquely: participants might struggle to articulate why they liked particular forms of comedy over others, but each had a clear sense of what they found funny, and what they considered inappropriate. The notion of this 'meta-language' recurs in the thesis in exploring how participants and organisers understood and described the nature of comedy and its place within science communication, alongside specific consideration of the form of the discussion of legitimate forms of consumption and appreciation documented by Kuipers and Friedman. In chapters six and seven, concerns surrounding the audiences of science comedy provided a space to privilege particular forms of consumption as a means for describing what science comedy could be said to 'do'.

3.3: Science Communication as a Figured World

In answering the first question posed by this chapter, what makes humour and comedy 'special' would be the stories that can be told through and about them. Such an observation might seem obvious, particularly as the attraction of comedy as a vehicle for science communication resides predominantly in the new and attractive stories comedy might be used to tell, creating an image seemingly more attractive to the nebulous publics targeted within professional practice. Attending to the power of stories implies a deeper analytical implication, however, as an invocation to examine the use and meaning of the stories told about science within science comedy and science communication more broadly. These narratives are surely crucial in understanding the nuances of practice.

This observation is by no means new in science communication. For example, Mellor's work has frequently examined and stressed the importance of collective imagination, shared narratives and discourses that become manifest in popular science, constraining the ways that science can be understood and discussed in public, as well as providing the cultural resources for this discussion to occur (Mellor 2010). Jasanoff and Kim's work on sociotechnical imaginaries similarly foregrounds the imaginative and figured relationship between science and the social world, attending to the ways that the practices and materiality of science are constructed in relation to specific narratives concerning the nature of science and its place in the world. As a 'reservoir' of cultural resources (Hansen 2009), science and science communication might be understood as highly imaginative forms of practice. In applying these concerns to the study of science

communication practice, a theoretical lens to make sense of these narratives and stories is provided in the concept of ‘Figured Worlds’.

Figured Worlds offers a detailed exposition of the resources and interpretive frames that structure activity. Holland et al. define a figured world as ‘a socially and culturally constructed realm of interpretation in which particular characters and actors are recognized, significance is assigned to certain acts, and particular outcomes are valued over others (1998, p.52). As stories told about the world, Figured Worlds consider the implications of these stories, asking for instance ‘What if gender relations were defined so that women had to worry about whether they were attractive?’ (p.49). Figured worlds serve as a form of imaginative architecture, as a shared story that gives meaning to language, interactions and activity. These worlds are socially and culturally produced, gaining meaning through the frames and shared interpretations that structure them, and provide heuristics of meaning that give shape to particular forms of action, artefact and actor that become possible through them:

> ‘These collective, “as-if” worlds are sociohistoric, contrived interpretations or imaginations that mediate behavior and so, from the perspective of heuristic development, inform participants’ outlooks. The ability to sense (see, hear, touch, taste, feel) the figured world becomes embodied, through continual participation. […] Players become ever more familiar with the happenings of a figured world and learn to author their own and make them available to other participants. By means of such appropriation, objectification, and communication, the world itself is also reproduced, forming and reforming the practices of its participants. (Holland et al. 1998, 52-53).

Rather than simply acknowledging the existence of collective discourses and frames, the concepts stress that these frames are both embodied and generative, shaping both the meanings of social practices, and for the individual, constructing an understanding of ‘who one is’, as a form of inner self. A key contention of Figured Worlds is that discourses are not simply performative, carrying valence only through their use in specific interactions, but carry a greater valence, as the resources through which individuals live their lives. A key claim in this work is thus that the stories we tell about ourselves become who we are (ibid, 3).

The concept of Figured Worlds aims to develop a cultural understanding of personhood and identity as a continual and unfinished form of action. Emerging from work in anthropology on culture and the self, Figured Worlds moves away from a binary distinction between cultural and social constructivist approaches that has previously

dominated analysis of personhood. At their most extreme, these accounts position personhood as being the direct and fixed product of a social system - as an iteration of a broader 'culture' - or as simply reflecting a continuous process of interaction and renegotiation, without any sense of durability (ibid, 27-28). By contrast, the concept of personhood found in Figured Worlds emphasises the contingency and durability of narratives that furnish individual's accounts of who they are, and by extension, the people they become. Drawing particularly on Soviet psychologist Vygotsky's work on the 'fossilisation' of identity through semiotic mediation, Figured Worlds suggests that the discourses and figures used in social interaction are intrinsic to the identities and understandings of the world that are produced through such interaction (ibid 36-37). Locating the construction of individual identities within broader processes of cultural production, personhood emerges through the repertoires, cultural forms and images around them, and individuals' own improvisation in using and repurposing these figures to negotiate the world around them. Foregrounding personhood as a form of practice, the account contends that individual personhood gains a degree of stability without ever simply reflecting a predetermined cultural 'essence' (ibid, 31).

3.3.1: Discourse and heteroglossia: the linguistic philosophy of Mikhail Bakhtin

Figured Worlds urges an understanding of cultural frames, discourses and narratives as inherently generative, providing the resources for interactions, the development of shared understandings of the world and the creation and stabilisation of individual and collective identities. This account, which like in discourse analysis positions discourse and narrative as the building blocks of reality (see Potter 1996; Edwards 1997), draws heavily from Bakhtin's work on the philosophy of language. While interest in Bakhtin's work in the Anglophone world has mainly been focused on his depiction of carnival, discussed earlier, Bakhtin's broader work on language and discourse has been seen to anticipate post-structuralist and constructivist linguistics (Bostad et al. 2004; Jenks 2003). Rejecting Saussurian formalism, Bakhtin sought to position language as an emergent ideological system, rather than an entity with intrinsic meaning (Denith 1995). For Bakhtin, language is a 'succession of utterances', with the meaning of individual utterances depending on the meaning and use of the utterances that preceded it, and itself acting as a site for the negotiation and potential transformation of future meaning. Thus the use of language offers a 'never ending story' of ongoing transformation, through specific, local and socio-historically mediated instances of interaction (Bostad et al. 2004, 2; see also Jenks 2003).

For Bakhtin, language should be understood as a singular or unified entity, but rather as an assemblage of the historical contestations of meaning that had occurred,

meaning that utterances will always carry a ‘taste’ of the multiple contexts in which they have been used (Bakhtin 1981, p.293). This assemblage of multiple languages (for Bakhtin, the ‘heteroglossia’) coalesce into a singular voice in the moment of an utterance, a voice that by necessity will echo the multiple voices through which it is constructed (ibid, p.272). Consequently, Bakhtin contends that an utterance or text can never ‘speak for itself’, as utterances are necessarily polyphonic, possible only through the voices of others who had come before. Individuals instead ‘orchestrate’ language, bringing together different voices in the pursuit of specific communicative goals (ibid. 262-263). Characterised by Holqiust as ‘dialogism’, existence is understood as an event, with individuals in a continual state of being addressed and responding, encountering and then repurposing and appropriating discourses, cultural artifacts and shared interpretations as a means for positioning themselves in the world (Holland and Lave 2001, p.10; Holquist 1990).

3.3.2: History in Person

A Figured Worlds analysis focuses predominantly on the stories and shared imaginaries that shape interaction, identifying the arch narratives constructed within and made available to individuals in social interactions. As a meso-level account of personhood, there is less attention to individuals’ experience of living in such a world, a level of granularity explored more explicitly in Holland and Lave’s notion of ‘History in Person’ (Holland and Lave 2001; Holland and Lave 2009). Within a figured world, individuals are the product of their history, as these histories constrain local practices while also providing the resources for the negotiation and potential disruption of the structures they engender. Following Bakhtin, individuals exist in a constant state of being addressed. The creation of the ‘I’ is thus inherently dialogic, makes use of the resources available to them, but never being able to do so entirely freely, as their participation in cultural activities relies on their identity being comprehensible within the dominant categories and understandings circulating around them.

The ability of individuals to participate in shared practice and the development of collective imaginaries thus relies on a continual interplay between, on the micro-level, the interactions that constitute social practice and on the macro-level, the institutions, discourses and frames that constrain how individuals speak and understand themselves. While individuals have agency in the ways that they use discourse and tell stories about themselves, so that figured worlds are themselves born out of the improvisation and agency of its members, such activity can never be fully autonomous. Individuals will always to some extent ‘wear’ the identifications of others upon themselves, which Holland and Lave characterise as a form of ‘tranvestism’, mediated

in part by the power of these identifications to mediate social meaning (Holland and Lave 2001, p.13; see also Warren 2001 and Linger 2001). Consequently, to examine a Figured World, as a meso-level unit in which the pulls of the indeterminacy of interaction on the one hand and the constraints of systems of power and stratification on the other become largely stabilised, is to ask how figured worlds are constructed through forms of social action that occur on different scales.

For this thesis, the notion of Figured Worlds provides a theoretical impetus to explore the narratives structuring the worlds of science comedy and science communication. Indeed, each chapter is anchored thematically by a set of stories that were told about science communication within the scheme, relating to the identity and characteristics of science communicators, the composition and role of the audience, and the stories relating the purpose of science communication. In each instance, the composition of this story is framed as an issue of narrative, but also one of practice and the broader constellations of activity in which the scheme was located. Consequently, as will be discussed below, each chapter considers how these figures were constituted through the ongoing practices of the field, and these worlds' own location between systems of power, moving between different levels of scale and granularity to bolster understanding of the specific composition of the figured world.

3.4: Communities of practice

The figured world of science communication can be understood to emerge through an assemblage of quotidian practices, interactions and forms of mean-making that continually reproduce and transform shared meanings. It is imperative to account for these forms of practice. A concept that can illuminate the study of practice is Lave and Wenger's concept of the 'community of practice' (Laver and Wenger 1991; Wenger 1998). Developed initially through ethnographic work on apprenticeship, Communities of Practice consists primarily as a social account of learning in which neophytes acquire competencies considered valuable within a specific community and become increasingly involved in the group's discursive practices. Foregrounding learning as a practice, rather than the acquisition of discrete knowledge items, the concept attends to the ways that communities conceptualise and understand problems, the ways they respond to these problems, and the artifacts that are produced through these work, whether they be heuristics, knowledges, practices, or shared histories. For the individual, the process of learning is thus understood as the process of gaining access to a community, identifying and gaining competencies responding to the shared concerns of the community, and potentially being able to participate in the ongoing negotiation of these problems.

As a unit of analysis, the Community of Practice is imagined as a meso-level category much like a Figured World, situated between the level of everyday activity and interaction and societal level social configurations of practice and order. Shared meanings emerge from quotidian interactions, through a continuous simultaneous process of participation and reification. Continual interaction and negotiation (participation) leads to the creation of objects, discourses and resources that stabilise meanings and allow these meanings to travel beyond the specific moment and context of their emergence (reification). These reified artifacts permit further participation and the potential negotiation of their meaning, so that reification never indicates finality or fixity. These reifications, such as regulations, codified heuristics of practice and working, tools, at once encode the shared histories of the community and provide the resources for its future. Like a figured world, the relative stability of a community of practice indicates that a community is more than the aggregation of interaction, but is simultaneously shaped by the broader histories and shared meanings that allow continuity in interaction, both within the community and between the community and a broader constellation of practices and cultural activities.

This shift to a practice-based account, which foregrounds the everyday activities of communities as being generative and constitutive of shared meanings and knowledges, correlates to concurrent work in STS that sought to shift sociological work from accounts of ‘Science as knowledge’ to ‘Science as practice’ (Pickering 1992). Responding specifically to the tradition of Sociology of Scientific Knowledge (SSK) within STS, Pickering argued that SSK approaches had for the most part sought to replace explanatory accounts of scientific knowledge that were based on ‘truth’ to a similarly deterministic account predicated on ‘interests’. Focused primarily on negating the importance of truth, little attention was paid in SSK to the practices of science, which were presumed merely to enact the interests determining the production of knowledge. A move to ‘science as practice’ proposed that the practices might themselves be constitutive of the knowledge concerns of science, a notion developed particularly of Fujimura’s notion of ‘the social worlds of science’, which identified scientific practice being as engaged in the maintenance and transformation of specific social worlds as they were the production of knowledge (Fujimura 1988; Fujimura 1992).

Communities of Practice are imagined as relatively bounded and coherent spaces delineated by a ‘shared history of learning’, enabling the continual negotiation and transformation of meaning tailored to the community’s concerns (Wenger 1998, p.87). Within the community, Wenger suggests three broad, and interrelated, conditions

necessary for learning: mutual engagement, joint enterprise, and shared repertoires. Through sustained engagement, communities articulate and enact a local view of the meaning of their engagement, recognising and constructing problems around which their practice will coalesce. In doing so, they will simultaneously develop a 'regime of accountability' that allows participants to interpret their practice in terms of the community's shared sense of purpose, articulating the practices and solutions that are required to respond to and develop the concerns that the group considers meaningful. Through this mutual engagement and shared development of problems, a specific set of routines, images, discourses and ways of working will provide the tools for engagement, as a reflection of the community's history and as resources for further practice and negotiation. Rather than suggesting that these facets offer a deterministic account of learning – mandating for instance particular dynamics of engagement or specific ways in which shared repertoires will be employed - they instead serve as heuristics for making sense of learning as an ongoing social practice, attending particularly to the specificity of practice within different communities.

Learning as an individual activity is thus imagined in terms of an individual's relationship to and practice within the community. Developing previous work on 'legitimate peripheral participation', which examined learning as a form of social and cognitive apprenticeship (Laver and Wenger 1991), learning is positioned in terms of a trajectory towards full participation within a community. As the learner enters the community, they come to understand the norms and concerns of the community, gain competencies in the communities' practices, attitudes and languages, and potentially gain increasing access to the domain of problem definition and shared meaning. Understanding an individual's experience of learning is thus to examine the forms of membership to the community permitted through their participation, and their ability to contribute to the ongoing processes of negotiation through participation and reification, acknowledging that the ability to contribute to the negotiation of meaning is likely to reflect broader inequalities (Kirkup 2002; Shanahan 2009). Furthermore, Wenger suggests that this participation serves as a productive site for identity work, as individuals' sustained engagement with the practices and discourses of the community is likely to change their sense of who they are (Wenger 1998, pp.145-151).

As a meso-category interested in the ongoing processes of participation, negotiation and reification that occur through a community working together in a shared enterprise with increasingly complex set of discursive and practical resources, Communities of Practice shares much with Figured Worlds. Both attend to the shared meanings within a community, the relationship between individual and communal practice, and the

forms of interaction through which shared understandings of the purpose and meaning of work within the community become established.[14] While the two theories foreground different aspects of community building, for instance in Figured World's focus on shared narratives and the role of agency in self-narration and Communities of Practice's primary interest in the mechanics of participation, this reflects more a feature of their particular goals, in developing accounts of personhood and social learning respectively, rather than any theoretical distaste or dismissal of the other. In this thesis, the two are employed simultaneously, as both provide a critical lens for understanding the dynamics of a community, and the relationship between the community, the individual and broader systems of power, and in turn offered highly useful sensitizing concepts on the ground for making sense of observations and interviews. References to both theories recur throughout the thesis, as questions of narrative are simultaneously questions of practice and community building.

3.4.1: The Uses of Communities of Practice

While Communities of Practice was initially introduced by Wenger as an analytical framework for understanding the social dynamics of learning, its proliferation has led to a more applied aim, as Communities of Practice has increasingly been employed as a normative account of good pedagogy and educational management. Communities of Practice have thus been understood as a means for producing desirable outcomes. In Science Education, Communities of Practice are argued to offer an optimal way of fostering desirable professional competencies and identities (e.g. Forbes and Davis 2008; Hunter et al. 2006), while in organisational and management literature more broadly, Communities of Practice have been implemented as a means for fostering particular types of knowledge considered useful for innovation and organisational productivity (e.g Iverson and McPhee 2002; Iverson and McPhee 2008; Pyrko et al. 2017; Green 2005). In part, this shift reflects Wenger's own research, which has increasingly focused on developing business tools that can maximise innovation and profit (Wenger et al. 2002). Presuming that Communities of Practice enable learning and knowledge production, Wenger's own work has sought to find ways to incorporate

[14] One distinction that can be noted, but it is not of particular relevance is the question of scale. Where Lave and Wenger's account stress the importance of interaction and mutual engagement, Communities of Practice and Legitimate Peripheral Participation evoke a relatively bounded and discrete definition of community, as it is unlikely to observe concretised forms of participation and shared repertoires on a macro-scale, for example. By contrast, Figured Worlds could be imagined to work on any scale, where they are bound by the collective realisation of an 'as-if' formulation, which in Holland et al's work includes restricted communities, such as those who participate in Alcoholics Anonymous, but also on a societal level, where there is, for example, a shared belief in meaningfulness of gender. However, where both theories share a definition of community broadly centred on shared purpose and understanding, they permit a very useful degree of coherence.

Communities of Practice into institutional structures, where profitable learning can proliferate.

Numerous scholars have expressed concerns over this trajectory. Jean Lave, Wenger's initial collaborator on cognitive apprenticeships and legitimate peripheral participating, has criticised the shift of Communities of Practice from a bottom-up analytical lens to a top-down form of knowledge management, transforming the importance of identity, participation and negotiated meaning as forms of agency to processes that must be controlled within specific knowledge economies (Lea and Nicoll 2002; see also Farmer et al. 1992 and Amin and Roberts 2008). Where Communities of Practice rely upon the autonomy of communities to define problems and develop responses through shared learning, the agency of learners becomes a threat in these accounts, as potentially inhibiting productivity. Similarly, where Communities of Practice offer a site for the construction of identity, attempts to cultivate communities can achieve preferred outcomes might rely upon coercion. Exploring attempts by institutions and businesses to create 'affinity groups' amongst their staff, Gee (2000-01) argues that individuals become expected to behave and understand themselves in ways useful to the institution, acting a sort of 'fan club' for a business (p.105). Participation in the community will rely upon workers viewing their labour and their own professional identity in terms of an affinity to the enterprise, rather than as a sign of their exploitation, with little recourse to change the group's focus.

Through this critique, concerns regarding the dynamics of knowledge capitalism and the role of research have highted two readings of Wenger's work, and two forms of community of practice, that which is organic and emerges uncoerced through the processes of mutual engagement, reification and development of shared repertoires, and those which are cultivated, being specifically designed and maintained to produce desirable outcomes. Such a strict distinction does not prove helpful in analysing the specific development of a group, however, where a degree of hybridity might be expected. Indeed, in this thesis, the community studied was both cultivated and organic. The scheme was deliberately engineered and brought about to foster a new cadre of science communication performers and professionals, designed in part to cultivate specific forms of working relationships and professionals. Yet the scheme was nevertheless a site of agency for participants, who could identify and respond to their own problems, and prioritise specific shared goals. In this sense, the scheme perhaps reflected Wenger's own sense of a cultivated community of practice working well, with a direction, opportunities and input from the organisers to motivate its continuation

while providing a space for participants to engage with science communication on their own terms (Wenger et al. 2002).

3.4.2: Identity in Communities of Practice and Figured Worlds

Both Figured Worlds and Communities of Practice, as meso-level units of analysis, attend primarily to the local structures, practices and narratives that emerge amongst particular communities. In both accounts, where the structure of the community is characterised as being mediated above and below from the simultaneous influence of agency and structural constraint, identity is configured as mediating concept between the individual and the social. Identities are at once built from the resources available to individuals, as well as characterisations and designation attributed to individuals they may be unable to control, and provide the means through which individual can navigate the world and act as agents. In Figured Worlds, identity is conceptualised as a form of self-understanding that guides participation:

> 'People tell others who they are, but even more important, they tell themselves and then try to act as though they are who they say they are. These self-understandings, especially those with a strong emotional resonance for the teller, are what we refer to as identities…They were producing, from the cultural resources available to them, understandings of themselves that seemed to be not only "of" (about) themselves, representing the dilemmas of their respective social situations, but also "for" themselves. These productions figured in their communication with themselves about their past and present actions' (Holland et al. 1998, pp.3-4).

Similar to Holland and Lave's concurrent work on history in person, identity is configured as a form of embodied history, a record of their experiences of the world and the resource for making sense of themselves, their practice and their past, present and potential future role in the world. Identities are thus almost micro-cosmic of the broader community practices contained within the account, with individual identities illuminating the social conditions that constrain and permit particular self-understandings, offering a lens for examining broader patterns of interaction and meaning-making that coalesce in ways that individuals understand themselves.

In Communities of Practice, identities are similarly conceptualised as a facet of broader patterns of participation. Participation in communities allows access to perspectives, outlooks and interpretative heuristics that allow individuals to make sense of themselves, and provide the resources that will mediate further interactions, in an ongoing, iterative form of practice. This schematic account of identity highlights three

modes of belonging within a community: engagement, imagination and alignment, mediated by individual's participation (and non-participation) within communities, and their ability to identify and be recognised in terms of the discursive resources that are accessed through participation (Wenger 1998, 190 – Figure 9.1). Examining forms of practice and meaning-making on a group level requires consideration of the relationship between the individual and the social, born out both from the agency of individuals and broader patterns of structuration, looking both 'up' and 'down' to explore participants' own involvement within a community, and the constraints upon participants' engagement with a community by their broader history and place within a larger social ecology.

This concern with identity is explored throughout the thesis, though particularly in chapters five and seven. Following Wenger's notion of alignment, engagement and imagination, the ability and desire of participants to align their own sense of self to that of the community is explored primarily through the divergent cases of the participants who felt they did not belong, either through being marginalised for being seen not to belong within the scheme (Chapter 5.4.3) or the field (Chapter 7.2.3), and being unwilling to align their identity to that of the scheme, where they felt their own contribution was not recognised as a way of either doing science communication or belonging to the community (Chapter 7.3.3). Chapter seven also examines the notion of identity in explicit reference to Holland and Lave's and Bakhtin's notion of self-authoring to consider science communication as a space which participants might reconstruct as a new and more desirable space in which to be a scientist (Chapter 7.3). Where these questions of identity rest on the simultaneous location of a community within patterns of participation and broader notions of structure, accounting for this 'bigger picture' is paramount, and thus I now turn to highlight one theorist whose field theory can be applied in this case: Pierre Bourdieu's work on field, habitus and capital.

3.5: Field, Capital and Habitus: Bourdieu

Bourdieu's work, focused mostly on patterns of production and consumption within the Arts, emerges as an attempt to develop a historical, practice-based account of cultural activity and meaning (McGuigan 1996). Positioned between a 'social physics' and 'social phenomenology', Bourdieu sought to avoid explanation that rested, on the one hand, on the reduction of cultural production (particularly Bourgeois culture) to market forces, and on the other, on a ''charismatic' ideology' of the artist as creator, working entirely autonomously and bound only by seemingly externalised aesthetic systems of value and recognition (Bourdieu 1993, p.76; Hesmondhalgh 2006). Seeking to show how systems of value and recognition were themselves constructed and sustained as a

function of differentiation and power, Bourdieu sought to account for the ‘objectivity of the subjective’ (Bourdieu 1990), so that the symbolic and material conditions of cultural production were understood as being mutually constitutive, without seeking to reduce one into the other (Bourdieu 1993).

For Bourdieu, the social world might best be understood spatially, constructed on the basis of the differentiation and distribution of power and capital (Bourdieu 1985). Though Bourdieu often invokes economic metaphors for describing this space, his characterisation of the social world far exceeds the distribution and exchange of economic and material goods. Bourdieu positions the primary activity of the social world to be symbolic, engaging in struggles to differentiate and legitimise particular understandings of the world, and to make these understandings appear self-evident and natural (Bourdieu 1985; Moi 1991). For Bourdieu, at the basis of social interactions lies the ‘symbolic struggle over the production of common sense’, a continual attempt to gain control over social meanings and impose a legitimate(d) vision of the social world (Bourdieu 1985, 734). The status of individuals within this social world might then be ascertained by examining their relation to these activities, in the dispositions and identities they foster, their ability to acquire and mobilise different forms of capital and contribute to the production of common sense through the ways they participate in this social ‘game’.

Bourdieu’s vision of the social world is largely mediated through three inter-related concepts: Field, Capital and Habitus. The notion of the field acknowledges that while the social world as a whole might be understood as the site for the game of negotiating common sense, the meaning and constitution of this activity, and the practices that result from it, will be highly divergent. Consequently, the notion of field refers to ‘an independent social universe, with its own laws of functioning’, defined in part though the values and rules that distinguish the field from others (Bourdieu 1996, 163). Comprised of the social positions of individuals, institutions, forms of capital, as well as the opportunities that are available within it, the field is always fluid, offering specific positions and (continuing the economic metaphor) opportunities for gain to individuals. The relational position of the field within the broader social world might also mean that individuals who gain success within the field (for instance in the acquisition of capital) might well have success in related fields, where there is a degree of similarity between systems of value and the logics governing participation.

Within this economic metaphor, relationships within and between fields are managed through participants’ use, accrual and potential loss of capital. Conversely, the

individual's position within the field is largely determined by the capital that they possess and are able to use within the field, including economic and material resources, networks of people that they know, their understanding of the rules of the field, or the resources that bestow legitimacy or recognition. Where individuals acquire capital throughout their lives and the various practices they take part in, fields offer particular opportunities for gain (and loss), depending on the specific logics by which they operate. Indeed, capital, as a form of value, can only exist and function within a space in which its value can be determined, and there is the possibility to gain, exchange or lose it (Bourdieu 1977; Bourdieu 1992).

Bourdieu positions social activity as a sort of game that needs players. The concept of 'habitus' provides an orientating tool for examining how individuals manage their positions in different fields, negotiate between different forms of capital, and draw on the resources available to them to negotiate their choices within the field. Bourdieu defines the habitus as:

> 'durable, transposable dispositions, structured structures predisposed to function as structuring structures, that is, as principles which generate and organize practices and representations that can be objectively adapted to their presupposing a conscious aiming at ends or an express mastery of the operations necessary in order to attain them.' (Bourdieu 1990, 53).

Rather than mechanically reproducing predetermined forms of social action, or consciously attempting to learn and adhere to (or disrupt) the rules of the field, Bourdieu suggests that individuals have a 'feel for the game' that inclines them to act in specific ways. The habitus can thus be understood as a set of dispositions that is learnt and internalized, that is at once structured, as individuals' experience of the world must be mediated through the same processes of distinction that they are engaged in, and structuring, as the habitus provide the resources for subsequent practice. Consequently, individual's histories – both their personal experience within different fields and their experiences of broader structural inequalities – will become constitutive of the decisions that they make, the positions they can take within fields, and the capital they will both have and be able to acquire.

3.5.1: Applying Bourdieu to the meso-level: Subcultural capital and Science capital

Together, the notions of field, capital and habitus offer theoretical tools for understanding the 'rules of the game', while also enabling consideration of the relational position of the field, both between different forms of practice, and the location

of practices within broader patterns of structuration. Yet where Bourdieu provides a set of tools for examining broader macro-level concerns of power, structuration and the conditions in which 'games' are played, applying Bourdieu's ideas to close analysis of local contexts is not simply to explain meso-level practices using a macro-level story. As an account of power, Bourdieu's work does not so much provide an account of the ways that power influences specific decisions or the production of cultural goods, but rather seeks to identify the processes through which certain preferences and practices are made to seem natural, and only certain forms of cultural participation and consumption are recognised as legitimate (Lamont and Laureau 1988). Bourdieu denied that his work was intended to provide an absolute macro-theory, qualifying his work both as making specific empirical claims about France, and more generally, in offering 'a particular case of the possible', that might provide the basis for further comparative work through the emergence of 'universal propositions' that could be tested (Bourdieu 1984; 2010 xiii).[15]

While Bourdieu acknowledges the importance of fine-grained analysis of specific social phenomena, his theoretical concern was primarily one of structure. This raises the question of whether all analysis should seek to tell a story on the same level of scale. In Figured Worlds, the value of Bourdieu's work comes from the theoretical tools that can be used to examine the location of specific worlds within broader social landscapes, exploring how broader patterns of legitimacy and exclusion are enacted in local contexts. Bourdieu's concepts and terminology might thus be used as orientating concepts for understanding the local 'rules of the game', examining the relational positions that are available to participants within the field. Yet the focus upon the figured world as an autonomous social space has been criticised precisely for its inability to offer an account that is able to demonstrate how specific cultural practices reproduce social order, or how participants in Figured Worlds come to misrecognise their relational position within the field and fail to appreciate how their own agency is constrained (Choudry and Williams 2017). While this critique may be valid in the sense that Holland et al.'s work rarely seeks to explicitly relate specific practices to the broader constellations in which they are located, it is unclear whether their analysis is necessarily weaker for taking a different focus.

While considering the macro-level picture of science communication and public engagement is certainly a pertinent concern in its own right, it is not the specific scope of this thesis, which seeks primarily to substantiate the practices and meanings of a

[15] For discussion of the application of Bourdieu's work to the US and the UK, see Lamont and Laureau (1988) and Benett et al. (2009).

single community. Consequently, the analysis within this thesis in concerned more acutely with the ways that the issues of field, capital and habitus inflected in the scheme that forms the ethnographic site for empirical work, and how participants imagined and anticipated the relationship between the scheme, science comedy and science communication. Without access to a field wide view of science communication that might substantiate a sense of science communication with an appropriate level of scale, I seek to avoid relying on generalised notions of power and differentiation to explain the specific practices that emerged in fieldwork.

The difficulties of applying Bourdieusian concepts to fine-grained analysis has been noted in the literature. Lamont and Lareau (1988) argue that the Bourdieusian fields of power and cultural production are deliberately idealised and consequently struggle to account for a highly differentiated and complex society, where not all cultural practices stand in relation to one another, and multiple systems of legitimacy and norms emerge. For the study of science comedy, while we presume that concerns of distinction, differentiation and the distribution of capital will matter, science comedy might nevertheless illuminate particular forms of stratification and value. A concept that aid this more localised study is provided by Thornton's (1995) work on subcultural capital, as a form of capital that gains value within a discrete community. Based on work on raver and club-cultures, Thornton shows that while rave falls outside dominant modes of cultural production and distinction, it nevertheless entails its own specific hierarchies and offers potential benefits that consume rave in ways the community view as legitimate, permitting the acquisition and embodiment of a form of capital that cannot be reduced to broader economies of economic and cultural capital (p.11-13).

Without denying the importance of Bourdieusian notions of capital, field and habitus as tools for making sense of social stratification and participation, Thornton's work suggests that a movement between a macro- and meso- level of inquiry might well lead to different stories emerging. Distinct forms of capital within communities, even if not contributing to broader economies, nevertheless can structure the opportunities available to participants within this community and enact localised systems of legitimation and exclusion. Indeed, Thornton notes that an understanding of the cultural field as a whole, which dismisses rave as inauthentic and low-brow, does little to explain the opportunities that participants find in rave. Though Thornton evokes Bourdieu in the conceptualisation of 'subcultural capital' precisely to demonstrate a continuity in distinction as a structuring force, this story of distinction in raving is not simply a substantiation of a broader story, reducible to a macro-, arch-narrative.

A second useful application of Bourdieu's work can be seen in the concept of 'science capital' (Archer et al. 2014; Archer et al. 2015). Though Bourdieu's attention was primarily focused on the arts, he acknowledged that science could be conceived as a field like any other, while noting that the field was differentiated by a specific logic in its ability to be at once historical and produce seemingly trans-historical truths (Bourdieu 2004). Where Bourdieu identified scientific capital as the symbolic capital associated with scientific authority, the project of science capital is far broader, attempting to map participation in science, with a specific goal of understanding (and ameliorating) exclusion and inequity within the field. Science is here conceived as a field that offers potential benefits to those entering, acts as a form of moral regulation and social stratification, systematically recognising and rewarding certain forms of social, cultural and symbolic capital, while excluding others (Archer et al. 2015; Dawson 2018). In doing so, this work has sought to move away from accounts of engagement with science that explain participation and non-participation in relation to the content of scientific knowledge, and instead show that engagement with science, like any other field, is mediated by broader patterns of exclusion, differentiation and structural inequality (see Dawson 2014; Dawson 2018).

In mapping divergent patterns of aspiration and participation in science education, science capital have sought to move away from explanations of non-participation predicated on personal deficit, such as lack of intrinsic motivation or 'science literacy', instead viewing non-participation as symptomatic of broader inequalities (Archer et al. 2014; Archer et al. 2015). Consequently, rather than indicating a specific form of capital unique to science, the term instead refers more broadly to the diverse forms of capital that can serve as legitimate, valuable and exchangeable resources when engaging with science (Archer et al. 2015, pp.923-28). 'Science capital' thus foregrounds the economic, social, cultural and symbolic resources already available to individuals that can generate social advantage when engaging with science, producing relations of privilege and subordination within the field. Aligning to work in Science Education that has examined the characteristics and performances that are recognised as indicators that learners are good scientists (e.g. Shanahan 2009; Carlone and Johnson 2007; Calabrese Barton et al. 2013), science capital aims for an account of engagement that does rely upon naturalistic accounts of the traits of scientific competence but rather positions science, like any other field, as tightly differentiated by broader inequalities of class, gender, race and ethnicity.

As a macro-level programme, science capital may have less to say about specific iterations of practice. Indeed, Dawson (2018) notes that while the term illuminates the

acquisition and mobilisation of capital within the field, it becomes more difficult to use the concept to ask more specific questions, such as the ways that participation is experienced (p.10). Similarly, where the concept would seem to resist accounts of engagement dependent on the exceptionalism of science, there is less explicit examination of the capital that might be acquired within science, such as Bourdieu's sense of scientific authority serving as a powerful form of symbolic capital. Nevertheless, as a heuristic, the concept allows examination of the types of capital that matter for science, the constraints placed on participants as well as their response. Together, the notion of science capital and subcultural capital point to tools that make examination of macro-level concerns within a specific case-study more tractable and enable fine-grained analysis of a communication located within a constellation of practices they will not always be able to control.

Bourdieu's concepts, refracted by Thornton's work on a more local scale, provide tools for examining the structure of the specific community, and, more discursively, as means for framing participants' discussion and imagination regarding the relationship between the scheme and the wider field. Consequently, Bourdieu's is used in two respects, firstly, in chapter five, by examining the scheme as a form of subculture, and secondly, throughout the thesis, as a means for tracing participants' expectations of the value of their training elsewhere and their relationship to other sites in science communication. Science capital is employed primarily for the metaphor it offers in seeking to change the field, rather than the habitus, and recurs in both chapters five and seven in discussion of both the scheme and science communication more generally as a world built for people like the cohort.

3.6: Summary and Research Questions

This chapter has outlined the ways that science communication, and science comedy specifically, might be explored. I have argued that studying science comedy and science communication as systems of practice requires a holistic view that goes beyond focusing on the discrete interventions and cultural products that are produced within it. Imagining science communication as a 'world' allows an exploration of the diverse practices, narratives and experiences that contribute to what it means to participate in it. Furthermore, as numerous scholars have documented, for instance in Fujimura's notion of the social worlds of science (Fujimura 1988), Pickering conception of Science as practice (Pickering 1992), Jasanoff and Kim's (2009; 2015) work on socio-technical imaginaries and Felicity Mellor's (2003; 2010) work on the narratives of science, science communication could be understood as a highly imaginative world,

mediated by the stories and specific understandings of science, scientists and the public that are produced and reproduced within different forms of practice.

The theoretical tools highlighted in this chapter are intended in combination to offer a local account of the community that stresses its own shared particularities, while contextualising the community's work in terms of the quotidian practices through which it was constituted and its place in the broader world of science communication (see Figure 1). Figured Worlds and Communities of Practices are employed as complementary accounts of community formation and sustenance, with both exploring the relative permanence and coherence of communities in terms of what communities share, what they do and where they are located. Where both accounts position communities between forces above and below, being situated between the push and pull of agency and power, the work of Bourdieu and History in Person serve to bolster this account of the community as a mediated space, exploring respectively the broader 'rules 'of science communication, the opportunities to be found in the field and hegemonic forms of practice through which the community could define themselves, and the experience of community membership from the perspective of the individual.

Where Bourdieu's work may be less tractable when applied to a more finely grained level of analysis, the notion of the Subculture is employed as a mediating concept, to explore the specific forms of differentiation that occurred within a local community. Finally, in offering a parallel account of the relationship between interaction, moments of cohesion and negotiation, and broader patterns of structure and power in specific relation to language and discourse, the work of Bakhtin is used as a complementary frame for exploring the scheme in terms of the specific opportunities for participants to narrate their practices and their lives, to draw from pre-existing forms of discourse and approach the scheme as a site for new forms of self-authorship and orchestration (see Figure 2). As Bakhtin's theoretical work already traverses macro-meso-micro distinctions, and theorises the relationship between power, agency and interaction, Bakhtin stands parallel to these more local theories, as an arch account of language that motivates the study in all spaces.

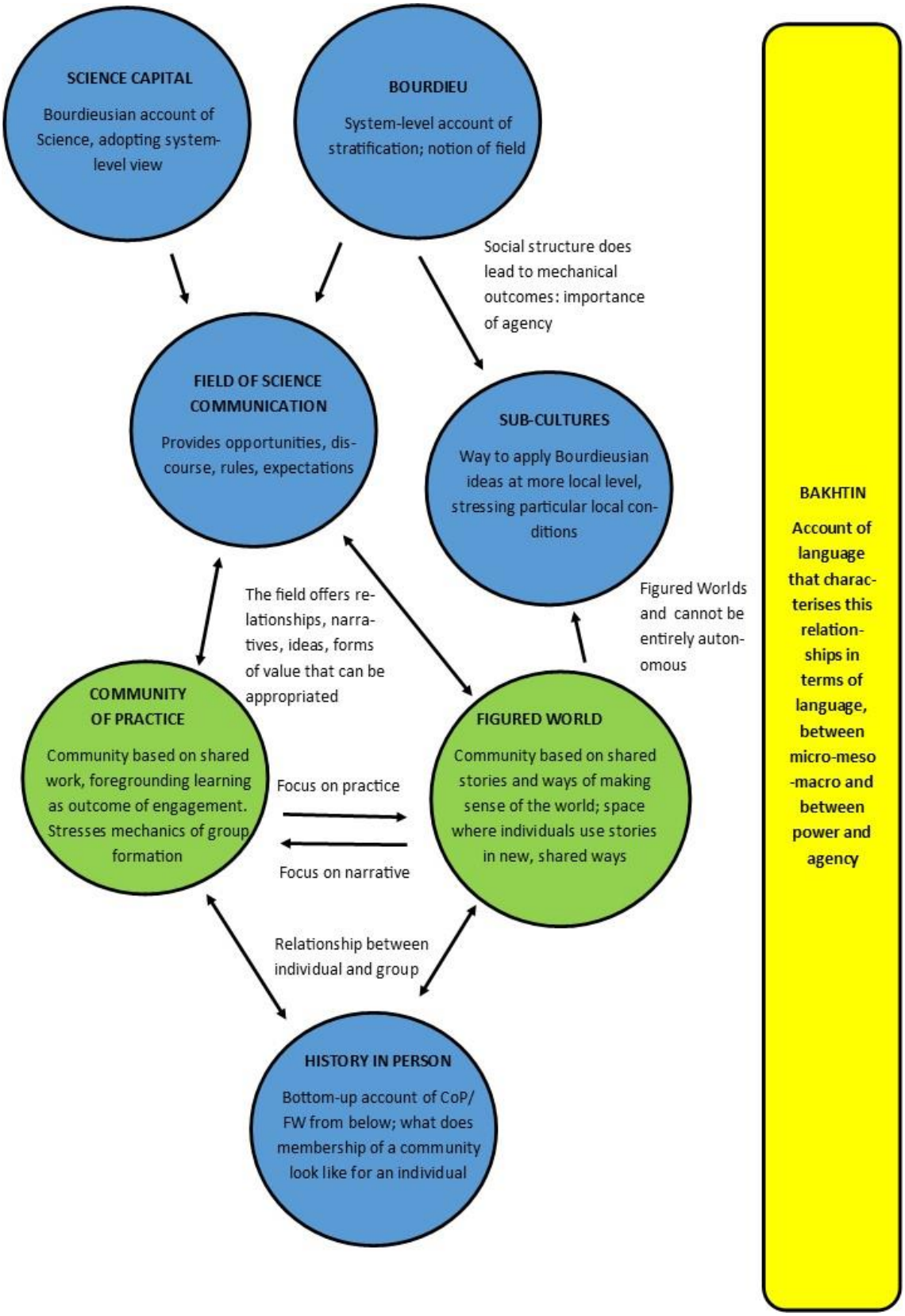

Figure 1: The relationship between the theories discussed in this chapter

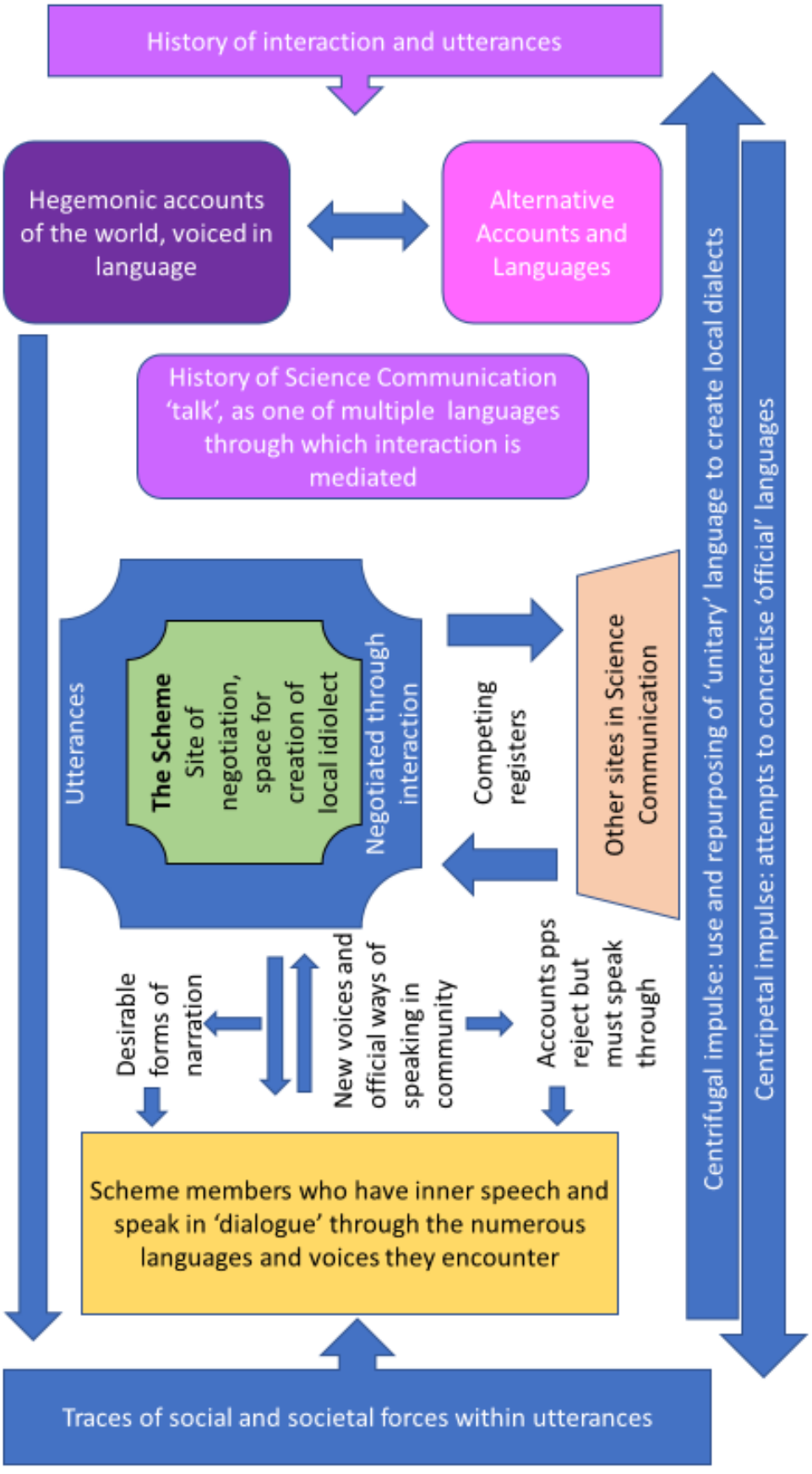

Figure 3: Bakhtin's philosophy of language in relation to the scheme

Within this framework, the study is emphatically one of the local conditions, rules and experiences of science communication, rather than offering an attempt to explain comedy. As was argued in section 3.2, sociological work on comedy has cautioned against presuming that the use of comedy in social activities necessitates a different type of account. Nevertheless, the specificities of comedy do leave traces, particularly in the ways that comedy is imagined to have political power and through the complex discourse and practice through which comedy is consumed and discussed. For participants, comedy offered a venue in which they could craft new narratives of their experiences of science, with the experience of performing comedy at once ephemeral and deeply transformative, not needing to have a life beyond their specific utterance while also providing the resources through which participants could articulate a more desirable version of who they were. While the historicity of the 'carnival' might be questioned, it continues to provide a potent frame for imagining what comedy might do, and thus while the thesis does not contend that the features of the scheme can be explained for the fact that it was comedy performance around which the group coalesced, nor was comedy irrelevant.

Naturally, adapting these theoretical alignments from an abstract sense of relation onto a specific case study produces a far more complicated picture, yet gains coherence through close attention to specific world of the scheme, and attempting to capture the conditions that allowed such practice to become manifest. The research questions were designed to map onto the theoretical framework, as a means for investigating the composition of the scheme, the local practices and narratives that furnished the scheme's architecture, and the relationship of the scheme to broader field of science communication:

- **RQ1**: What are the stories told about science, science communication, science comedy and the role of science communicators within science comedy?
- **RQ2**: What forms of practice underpin these stories? How is science comedy employed, experienced and understood by practitioners as a form of science communication?
- **RQ3**: How does science comedy relate – and how is it imagined to relate – to the broader fields of Science Communication, Public Engagement and Comedy?

The research questions are not intended to imply discrete areas of investigation, but rather to acknowledge the need to explore science communication with simultaneous attention to multiple levels of scale and granularity. RQ1 thus treats the scheme as a

bounded and distinct space, in which the scheme engendered local stories and practices that were the scheme's own, employing Figured Worlds and Communities of Practices as a relatively concretised and coherent unit. RQ2 explores the composition of this community by exploring the quotidian practices through which it was composed, as both a question of mutual engagement and shared practice and repertoire, and participants' own agency in crafting the narratives of the community, and using these narratives as a form of self-authoring. Finally, RQ3 explores the relationship between the scheme and the 'bigger picture', exploring the field as a source of rules, narratives and practices that would both constrain participants' activity and provide the resources for the community to foster a sense of their shared identity and difference, and how they imagined their future work in the field.

The research questions inform each of the empirical chapters, which are organised thematically. Chapter five explores the notion of the 'good science communicator' as the desired outcome of training, exploring the specific practices of science comedy as a form of training, the discursive construction of 'good' communicators, particularly where goodness was defined in terms of other practitioners in the field, and exploring the perceived tractability of these definitions within the scheme and further afield. Chapter six focuses on the role of the 'public' for science comedy, examining the discursive constructions of the public's identity and role in science communication, and exploring how divergent notions of the public became manifest in practice. Finally, Chapter seven documents the notions of purpose underpinning science comedy practice, and the aspiration amongst participants that science comedy might transform science communication, with specific attention to the group's attitudes towards the transferability of their local practice into other terrains. In the next chapter, I set out the methodological principles that have guided research design, data collection and analysis.

Chapter Four: Methods and Methodology

4.1: Introduction

This study aims to develop a better understanding of science communication as a form of practice, through exploratory research on a science communication training scheme that provided participants with training in stand-up comedy and improvisation, and through which participants took part in public science comedy events. This chapter discusses the methodological and practical concerns involved in carrying out the project. Positioning the study within current discussion of humour as a methodology for research, I outline the ontological, epistemological and axiological assumptions of the research, and present an overview of the research design, the research tools used and the process for data analysis.

4.2: Ontology and Epistemology

Within social research, there is some consensus around the values of making ontological and epistemological positions clear (Bourdieu and Wacquant 1992; Guba and Lincoln 2005). Assumptions about both the nature and properties of reality (ontology) and knowledge (epistemology) will permeate research design, the ways that research problems are identified, the forms of data analysis used and the conclusions that are reached. Debates about ontology and epistemology are broadly configured between positions of realism and constructivism. While realist ontological positions stress both the existence and independence of objects and properties so that, to at least some degree, reality is separate from the mind, constructivist ontological positions challenge at least one of these commitments (Miller 2016). In relation to epistemology, however, work in qualitative research particularly has often sought to promote an understanding of knowledge as a social construct, and consequently, that the ability to know the world is similarly constructed, as we can only understand the world through the practices of knowledge making that we ourselves produce. While this view aligns with both realist and constructivist forms of ontology, we might presume that any form of research entails some commitment to epistemological constructivism, even if only as an acknowledgement of the contingencies of research.

Where claims may themselves be constructed, differing ontological positions inflect sharply on the type of claim that is made. Though approaches to research that claim it is possible to reproduce reality through scientific enquiry, such as strongly positivist approaches to research, have largely been superseded in the social sciences, ‘critical realism’ maintains that while individuals might differ in their interpretation of reality, (a

single) reality nevertheless exists independently of our ability to know it (Maxwell 2018; Bhaskar 1989; Archer et al. 1998). By committing to the existence of an independent reality, knowledge might always be said to be ‘about’ this reality, even if the knowledge that is created is necessarily constructed. Furthermore, the independence and existence of reality is understood to offer a means for evaluating knowledge claims, as claims can be understood as being more or less successful in capturing its nature.

By contrast, ontological constructivist positions deny the existence of such a reality. Though some constructivist positions might simply deny the utility of ontology (as it refers to a domain that can never be known), an ontological constructivist position instead maintains that reality it itself constructed and comes into being through the same processes through which it becomes known (Maxwell 2018; Kennedy 2018; Potter 1996). Where, as in this project, the focus of study lies in attitude, experience and understanding, it is difficult to determine exactly to what ‘reality’ these phenomena could be said to correspond, and where it could be claimed to exist. Within this framework, different understandings of the world are understood as indicative of multiple realities, each of which is true, relative to its context, rather than offering versions of reality that are correct to a greater or less degree. Such a view is familiar to STS, particularly after the ‘ontological turn’ (Mol 2003), where the constructed nature of science has served as a key assumption for analysis, positioning scientific facts as assemblages of people, objects, materials and relationships that emerge within specific cultural contexts (e.g. Knorr Cetina 1999; Knorr Cetina and Mulkay 1983; Latour 1987). Where science itself appears to be ‘constructed’, the role of the analyst would seem more fruitfully applied to examining the content and implications of these constructions, rather than evaluating them in terms of an image of ‘reality they cannot hope to access.

However, adopting a constructivist position is not to take the view that because I understand scientific practice to be a contingent enterprise (rather than a mirror onto a singular reality) that the specificities of these constructions do not matter, or that ‘anything goes’. At its most extreme, constructivist ontological positions hold that multiple, constructed realities must be accepted as equally real. Such a view has been criticised, both for its intractability as well as its self-contradiction in claiming the absence of any real or true epistemological position as a truth claim in itself, and indeed the only ‘true’ claim (Maxwell 2018; Hollis 1994). Such an extreme position, in denying the importance of truth even as a relative concept, would also seem to limit the scope of analysis simply to iconoclasm and destruction, arguing against the concept of

truth, but seemingly do little else.[16] Denying the existence of a manifest, external idea of truth as a form of validation need not necessitate nihilism. Instead, analysis can aim to employ different criteria be employed for assessing the usefulness of knowledge.

Work in the philosophy of science has argued that knowledge might be *justified* even when it cannot be aligned to an external criterion of 'truth' (Steup 2018). Indeed, while STS has often been interpreted as advocating constructivism as an attempt to attack and discredit scientific knowledge (Kuntz 2012; discussion in Bloor 2008), such an aspiration is difficult to find within the literature. Instead, work in STS has frequently noted that scientific knowledge is useful precisely for its amenability to the concerns of specific collectives, which often involves the ability to make reliable sense and use of the natural world. Indeed, following Latour, acknowledging the reality of the construction of science, as a means to attend to specific ways that science becomes manifest, might serve precisely as a way to make science more 'real' (Latour 1999, 3). Where this thesis seeks to explore a professional space that may often appear to deny that it is located within particular social worlds, my project shares a similar goal, though admittedly with a far less lofty outcome.

Employing a weaker constructivist position, I therefore maintain that while reality and knowledge are constructed, a simultaneous effect of this construction is the creation of clear understandings of the purpose of knowledge. Similar to Knorr Cetina's view of scientific cultures, knowledge practices might be said to emerge through local conditions that simultaneously create a version of the world and a sense of how knowledge furnishes that world. The value of knowledge thus comes not from its external validity, but a more local concern, in its ability to respond to and potentially advance specific concerns that emerge within these communities. By acknowledging the shared realities that are constructed by participants, and positioning my own work as gaining validity through its ability to speak both to that world and the worlds which I inhabit, including that of STS, a question of the research's axiology emerges, which is addressed in the following section.

[16] Within STS, a similar critique can be found in Latour (1999) and Grint and Woolgar (1997), despite both Latour and Woolgar providing accounts of science rooted in ontological constructivism. Latour, partially in response to the question of whether he 'believes in reality', argues against postmodern tendencies to employ radical forms of constructivism solely to illuminate the failures of rationalism, 'rejoicing in virtual reality' (21), rather than acknowledging the specific realities that become possible, particularly through scientific action. Grint and Woolgar meanwhile doubt the possibility of strong ontological constructivist critique, contending that anti-essentialist critiques usually rely upon specific invocations of essentialism to justify the claims that are made.

4.3: Axiology: Humour as methodology

This thesis is about comedy and humour, at least in part. While analytical interest in humour lies predominantly in empirical investigation of the practices of comedy of humour as a form of science communication, the concept of humour also poses methodological and axiological questions, as scholars have considered how far humour offers methodological tools for social analysis. This work has been predicated on the notion that sociological analysis can reveal incongruities and ironies within social practice, particularly where sociologists' and participants' accounts of practice appear widely divergent (Stengers 2000; Watson 2015). Sociological work might thus reveal 'jokes' within various social worlds (Mulkay 1988). Where the 'slipperiness' of laughter and humour might reveal discrepancies, inconsistencies and absurdities within social practice (Watson 2015), this work raises the axiological question of whether sociology should seek to laugh at their empirical subjects, and if they do, what this laughter should seek to achieve.

Academic discussion of the possible role for humour as a mode of enquiry has focused for the most part on the analytical potential of irony. For Steve Woolgar, STS appears to be a particularly ironic discipline. By demonstrating the disconnection between the languages and ideologies of science, and their 'real' works and effects, identifying the incongruities of science provides a way to open and untangle otherwise black-boxed and tacit practices and worldviews or the demonstrate that i 'it could be otherwise' (Woolgar 1983; CSTMS Berkeley 2014). STS might then gain its power through its ability to laugh derisively at scientists' belief that they truly understand their own world. Yet as both Woolgar and his critics have noted, irony risks an infinite regress, as a continual exposure of false realities without moving towards an explanatory or productive account (Woolgar 1983; Savransky 2015). One might well ask how easily irony allows these 'otherwise' to be substantiated and explored when the role of irony lies principally in its ability to laugh at the apparent untruths of science, its quality judged by the skill of the academic as a joke-writer. If the goal of STS is to laugh at science, rather than engage with the problems that motivate both science and STS, one might question the sincerity of such a critique.

This concern became particularly apparent to me when I began presenting earlier work analysing the university public engagement scheme 'Bright Club'. Speaking at an event exploring the relationship between comedy and academia, the order of speakers seemed to me to be particularly ironic, as the preceding speaker seemed to embody much of the story I wanted to tell. Drawing from the screenwriting maxim of 'Save the Cat' - a moment within film narrative structure where the hero gains favour from the

audience (Snyder 2005) - the speaker suggested that humour could provide academics with a means for showing trustworthiness and relatability and provide a way for the public to see their work as accessible and important. Humour was presented to this academic audience as a mean for managing the public through the careful projection of a less authoritative image of academics.

Taking to the stage after this talk, my own presentation on Bright Club took a similar line, with a far more pessimistic conclusion: comedy events for the public rarely seemed to be *for* them where the intention was put them in line. My argument might well have been seen as an ironic dismantling of the previous speaker, providing the punchline that laughed at the assumed good of the funny academic. Indeed, the following speaker, who expressed surprise at my characterisation of academic comedy, having thought that Bright Club did offer a new space for the academy and the public to interact, questioned what could be made of my talk. If Bright Club didn't offer what it claimed to, what then could be done to build such a space? Taking my role as an academic simply to involve dismantling Bright Club would do little to approach the broader concern that motivated the research, namely understanding the position of science and society, and, potentially, seeking to extend the role of the public in the practices of science. Simply seeking to be ironic would appear to be a poor way to provide a productive account of science comedy that might contribute to this work.

4.3.1: The problem of irony

The ontological, epistemological and axiological commitments implied by irony as a form of academic critique have been closely examined by Stengers, who notes that ironic laughter presumes the ability to act as a judge, standing outside the world of investigation to deride the failures of science:

> It may be that denouncing the ideals of objectivity or neutrality associated with the sciences leads us into a trap: that of accepting, in order to criticize it, that there would be a common identity for the many ways to produce science. Learning to laugh, we choose to laugh with and laugh at. But we accept the risk of being interested, that is, of giving up the position of a judge. (Stengers 2000, p.41).

Where irony might bring forward incongruities, its use as a form of critique nevertheless relies on a commitment to a true account of the world, laughing derisively at science for its failure to live up to its own self-description. The authority of the ironist is only possible where the analyst compares science to a form of knowledge and verification that exists beyond both the scientist and the analyst. As Savransky notes, such a stance presumes the possibility of a transcendental form of knowledge that permits

such arbitration, and depends upon an unrestricted understanding of the nature of 'problems' in science:

> The serious and ironist disagree on what it is that problems *are shadows of,* but their corrosive antagonisms disclose a shared operation – an appeal to a transcendental position that, in being applicable everywhere, will transcend not just concrete problems but the very nature of the problematic itself by bringing its phantasmatic existence to light. By revealing, that is, that ghosts don't exist. (Savransky 2018, 35).

For Savransky, such analysis presumes that the 'problem' of science lies in its inability to present a transcendental picture of truth; the issues and concerns of science are merely phantasmic, incomplete and incorrect versions of a true picture. To laugh ironically at science is to do little but deny the reality of science's problems, and instead impose a different reality, a sociological understanding that transcends the errors of science, while claiming to do what science cannot, and provide ontological certainty.

For Stengers, such critique inhibits any ability to engage with the specific practices and concerns of science, or indeed to foster alternatives, which would require a different type of laughter. Analysis ought to begin with an acknowledgement of the specific achievements of science that emerge through collective attempts to respond to specific problems and interests (Stengers 2000; Stengers 2011). Adopting a form of ontological constructivism familiar to STS (e.g. Knorr Cetina 1999) as well as more foundational discursive work in social psychology (e.g. Pollner 1987, Potter 1996 and Edwards 1997), acknowledging the problems and concerns of science as real enables an examination of their specificity. Thus analysis moves to asking what work is done through science, and what work might be done, creating a space to question and counter hegemonic interests proliferated in the name of science:

> A complex entanglement of interests may surround the way a science "defines its objects" and the claims sustaining this definition. So it is vital that we cease to be easily impressed. It is not that we should engage in systematic denunciation. An entanglement may well be an achievement. But we should always scrutinize and feel entitled to complicate the problem. (Stengers 2000, p.50).

By rejecting critique that rests on appeals to externality, Stengers instead advocates examination of the form and implications of the ways problems are enacted, rather than seeking to arbitrate their veracity. This can serve to challenge the universality of science and create a space to develop new and alternative problems and new opportunities for speculation and imagination (Stengers 2005; Stengers 2011). It is here that laughter gains its analytical force, in producing moments of incongruity

between different constructions of reality and the problems underpinning them (Mulkay 1988). Rather than attempting to overcome or resolve such incongruities, humour might instead provide the impetus for their recognition and examination, potentially permitting the emergence of new, shared problems and spaces for activity.

For the purpose of this research, I follow Stengers in employing humour and laughter as analytical tools in a way that seeks to avoid derision. In acknowledging and exploring different constructions of the world, my research asks what is at stake in these different constructions, rather than using these differences to furnish an ironic critique that seeks primarily to convert the concerns of my participants into a punchline or satirical moral lesson. It is thus to acknowledge that the concerns, practices and understandings of my participants may be different to my own, and to seek to explore these differences, rather than attempting to reduce these differences into a singular account of science communication (Willis 2001). Different understandings and concerns are their own 'achievements', and in dialogue, might allow for the emergence of new concerns and understandings. Thus, I seek to furnish ongoing discussion of the value, purpose and forms that science communication might take, highlighting differences where they appear and attempting to make alternatives possible.

4.4: Research overview: Qualitative, ethnographic case-study approach

This research focuses upon a single case study of science comedy as a form of science communication practice. The case study explores a cohort-based training scheme for Early-Career scientists and science communicators that provided mentoring, skills training, networking opportunities and mutual support through stand-up comedy and improvisation training. Working with the scheme's second cohort, the majority of the project's focus lies in following the 15 participants, as they took part in training around performance, science communication and personal and career development. This involved participants taking part in formal and informal forms of mentoring, and working together both to produce their own science communication and comedy events, and the more day-to-day activities of providing support and feedback for one another and maintaining the group as a working collective.

For this project, a qualitative approach has been taken, acknowledging the strength of qualitative research methods as a means for exploring people's experiences, practices and attitudes (Flick 2014). Often used in combination with ontological and epistemological constructivist positions, qualitative methods permit the examination of social phenomena in natural settings, while also appreciating that the ways in which individual experiences are enacted, understood and experienced are constitutive of

their reality. Qualitative methods are also particularly suited to examination of the complexity of social phenomena, allowing for – and indeed anticipating – diversity in the ways that individuals experience the social world and the ways that experiences, practices and attitudes might change over time.

To explore how science communication and science comedy were practised and understood within the scheme, the research adopted an ethnographic approach. The use of ethnographic methods acknowledges firstly a likely diversity in attitudes and experiences, and secondly that as a form of social practice, the meanings of science communication emerge through the practices that constitute them (Gomm 2008; Holstein and Gubrium 2012). Consequently, the research design and research tools used were intended to allow the exploration of science communication as a lived practice, and where possible, to do so through naturally occurring data (Gomm 2008; Potter and Shaw 2018). The aim of the project was not to write an ethnography, however. The research questions point to specific concerns related to science communication and science comedy, rather than providing a starting-off point for a broader investigation of participants' lives. Participants were only participants in my research when they were taking part in the training scheme, with a goal of creating an illustrative case study (Angrosino 2007). Nevertheless, by adopting techniques developed within ethnographic research, such as participant observation, alongside qualitative interviewing methods, it was possible to develop an in-depth understanding of the meanings of science comedy amongst participants within the scheme.

4.4.1: Case Studies

As exploratory research, the project takes a case study approach. Case studies are an established method of social research, aiming to provide detailed examination of specific manifestations of social activity, rather than attempting to construct a generalised and generalisable account (Flick 2014; Yin 2015). Case study research is valuable as detailed examination of a specific set of social relations and practices allows for the production of substantive claims that might inform future work (Bryman 2012). Though case studies are often used as an initial phase in large research projects to generate research questions and trajectories (Swanborn 2010), given the limited time frame and resources for a PhD project and the lack of extant empirical work on science comedy, a case study approach was seen as the most appropriate way to approach the topic.

Beyond their specific role in large scale projects, case studies have two broad functions for research: the logical and the rhetorical. These facets have defined broadly as what

case studies can do epistemologically, and what can be done with the presentation of the argument (Platt 1988). Rhetorically, rich and specific detail can be persuasive, even if reflecting the views of single individual or group, illuminating diverse understandings and experiences that complicate generalised characterisations of social phenomena. As 'exercises in possibility', these rhetorically rich accounts can be used as tools in developing a broader picture from the ground up. As science comedy is a relatively new social phenomena, adopting a case study approach is intended to begin to explore science comedy as a social practice, examining the specific stories of science comedy and science communication within the scheme, and in doing so highlighting empirical and conceptual trajectories that can inform further research.

Defining the limits of the case is particularly important, to ensure that the case is bounded in a way that is able to encompass a naturally occurring social unit while avoiding analysing a group through an overly narrow set of concerns. Questions of space, temporality and populations are therefore crucial. As a study primarily concerned with the practices and understandings of science communicators, the study was largely framed around their participation in the training scheme.[17] Thus the case study is populated by the cohort members, the group leaders and members of the previous cohort they encountered during the scheme. Similarly, the study is bounded temporally by the period of their involvement, taking place over the 15 months between July 2017 and September 2018 in which they were officially part of the scheme. Spatially, the study is concerned with the collective spaces that were formed within the project, both physical and digital. Together, the unit for the case study is understood broadly as the collective practices, understandings and repertoires that emerged during the specific period in which a cohort of participants were part of a discrete social group.

By focusing on the collective spaces of the scheme, other spaces and populations are excluded, most notably the audiences that were created through the public comedy events produced within the scheme. Given that the project emerges from and is framed within the field of science communication and public understanding of science, this might seem to mark a break from conventional practice, which often takes the audience as its object of study. Instead, the discursive constructions of the 'audience' and 'public', as features of the group's discourse and practice, provide a key empirical focus for this project, particularly in chapter six where the ways that audiences were imagined

[17] Initially, it was my intention to pursue multiple case studies, including Bright Club at UCL and interviews with Science Comedy performers, which is reflected in the ethics approval and consent forms used in the project (see Appendices two and three). However, the depth of investigation possible within the scheme precluded the need for additional case studies, once the terms of conducting ethnographic research within the scheme became substantiated.

and emerged discursively in discussions of practice and science communication more generally serve as a means for examining how the group positioned their work in relation to the field. Of course, this is not to 'study the audience' in the sense of exploring audiences' own responses to science comedy, nor to deny the importance of work concerning consumption and reception which are crucial facets of cultural production (du Gay et al. 1996). However, where my thesis explores participants' work within the scheme, the audience is excluded other than where audiences emerged within participants' own practice.

4.4.2: Case Study Overview

The scheme broadly sought to provide professional and emotional support, as well as substantial performance opportunities, to a selected group of Early-career scientists and science communicators hoping either to work in professional institutional roles in the sector, to work as freelance performers and programmers, or to incorporate science communication and public engagement work into their scientific careers. The aims and objectives of the scheme were codified in the evaluation conducted at the end of the first year and served as the project goals for the second cohort, when the fieldwork was conducted. The aims and objectives listed in this evaluation report are reproduced here:

Aims

* To build the skills, networks and profile of emerging science performers, both researchers and professionals.
* To create a cohort which collaborates and supports each other.
* To grow the sector and increase the number of performance opportunities.

Objectives

Organiser 1 worked closely with 14 science communicators to help them become a mutually-supportive group of elite science performers.

They were given the opportunity to:

* Perform at network of shows and other events Organiser 1 organises
* Access events and development opportunities
* Take part in masterclasses from top science performers and industry experts
* Appear on new podcasts and videos
* Be promoted via the scheme's website, YouTube channel and social media feeds

* Have photos, video and audio created to share with potential bookers
* Access help in writing, improving science shows, and comedy
* Be recommended to science organisations as a performer
* Be introduced to Organiser 1's contacts
* Join a community of like-minded people to support them and work with them

The overall sentiment of *"No reasonable favour will be refused"* was woven into the support and mentoring offered.

Participants were expected to:

* Help the rest of the group and offer them opportunities
* Take part in more than 10 activities during the year
* Give as much help as they get
* Stay involved for the whole year

Personae

As part of the formal evaluation for the first cohort that took part in the scheme, participants' applications and self-evaluation forms completed three times during the year (after four, eight and twelve months) were analysed in order to elicit common themes in relation to motivations for joining the scheme, participants' prior experiences of science communication, what they hoped to get out of their participation, and how they positioned the scheme as part of their imagined future professional trajectories. Three common narratives were identified that were included in the formal evaluation report as anonymised 'personae'.[18]

Persona 1 – PhD student/Early Career Researcher

They are a PhD student or early career researcher with limited experience of science communication and/or public engagement. So far, any science communication activities they have been involved in have been outside of their "official" role, and have not been linked to their current research or to their current institution. Lacking in confidence, they applied for this scheme because they are seeking moral support from the group, mentoring and development opportunities.

Persona 2 – Experienced Science Performer

[18] The exact demographic information that participants provided when taking part in interviews is listed in Appendix One.

They have already developed science performance style they are comfortable with, and have some experience performing. The science communication and/or public engagement work they have been involved in previously has been as part of an official role, or linked to their research and/or seen them represent their host institution. They applied for this scheme because they are seeking greater exposure, networks and opportunities to perform.

Persona 3 – Professional in an unrelated field, with an interest in science and research

They are an artist/film maker/dancer/performer/professional working for a charity or learned society, with no current formal connection to research or a research institution. They applied for this scheme seeking to build connections to research and researchers, new opportunities to perform, new networks and collaborators, and a route to potential future funding.

The three personae were used to highlight the diverse aspirations, career histories and motivations for participation in the scheme, and provided a blueprint for applications in the second cohort. Though these personae relate specifically to the participants who were successful in applying for the scheme, and other personae might be identified for those who were unsuccessful (see 5.3.1 for organisers' discussion of the types of science communication they specifically sought not to recruit), both organisers noted that most applicants in the second cohort aligned to the three personae and that there were far fewer 'outlier' applications that surprised organisers in terms of what the participants sought from the scheme.

Timeline of Scheme

2017

March to June: Participants interested in applying for the second cohort are encouraged to take part in a comedy night run by the organisers if they have not already done so. The scheme is formally advertised through the organisers' networks and public events and participants are invited to submit applications for the second cohort, which are decided by a panel including the project organisers, members of the first cohort and contacts in the sector.

June: Initial meetings between researcher and Organiser 1 to discuss entry into the field and the conditions for conducting research.

July: Participants are added to the Cohort 2 Slack. They are invited to meet one another face-to-face at the end of the month. Members of Cohort 1 are added to the Slack iteratively to offer advice and mentoring.

September: First formal training session, which continue monthly on the First Friday of the Month. All participants of the second cohort attend training on voice and projection. The first training session was also the first time in which the researcher was formally introduced to the cohort.

September: Participants in Cohort 2 take part in two special comedy nights to 'introduce' them as members of the scheme.

End of October: Participants have continued to take part in bi-monthly shows. In addition, participants are increasingly offered performance opportunities outside of the specific nights associated with the scheme, including comedy nights at bookshops, nights that are not explicitly 'about' science, and special events (e.g. Royal Society Lates).

November: In addition to the 'First Friday' training session, participants are offered training and practice in improvisation skills, in preparation for taking part in a science-themed theatre sports event hosted by the organiser.

End of November: Participants are told they will need to produce their own formats, which will run once a month in January, February and March.

November/December: First round of interviews with Cohort 2 and Organisers

2018

December/January: Participants complete their first interim evaluation and reflection on their time in the project, and are invited for one to one meetings with the Organisers.

End of January: Participants host a 'family night' to get to know one another better.

January to March: Participants in Cohort 2 produce three original shows at a pre-arranged venue. Participants set up channels in Slack for each show, develop comedy formats, arrange rehearsals and produce promotional material for their shows.

February: Participants take part in a 'half-way' stand-up night to show their improvement.

February to April: Second round of interviews with Cohort 2. Interviews with members of the first Cohort begin and take place until September.

April/May: Participants complete 8-month reflection and feedback for the organisers.

April to September: Participation in events run within the scheme decreases: participants either focus on developing their own formats, including live events and podcasts, or report the need to participate less in the scheme and focus on academic or professional work. Attendance at training events declines, and participants are asked to identify specific training they want as and when, rather than have discrete training organised routinely.

August to September: Final round of interviews with members of the second cohort.

September: Formal end of scheme, and end of project funding. The separate Slacks for both cohorts are amalgamated. Participants are encouraged to continue working together and to use the Slack for support but cannot expect the same degree of support and opportunities to perform from the organisers. The principle of 'No reasonable favour will be refused' is no longer tenable. Participants in the second cohort complete their final evaluation.

List of training events

* Body, Posture and Breathing (Sep 17)
* Joke writing (Sep 17)
* Comic voice: developing attitude and asides (Oct 17)
* Movement workshop (Oct 17)
* Evaluation training: introduction to terminology and expectations for running public engagement events (Nov 17)
* Improvisation and Theatresports (Nov 17)
* Panel Shows: performing and getting booked (Dec 17)
* Forward planning: participants tell the group their goals in relation to science communication, public engagement and performance, and work together to develop ideas for future collaborations and projects (Feb 18)
* Podcasting: developing formats, promotion and equipment (Feb 18)
* Branding: identifying how people see you, developing your brand and the realia of branding (Mar 18)
* How to get project funding (Apr 18)
* Working in TV: Developing showreels, building contacts and positioning as a scientist (May 18)
* MCing gigs and chairing round tables and public events (Jun 18)

4.4.3: Entering the Field and participant recruitment

Entry to the field was provided by one of the two organisers of the scheme, who acted as the gatekeeper. Agreeing to my entry into the scheme as a researcher (rather than a participant in the scheme), I was given access to the group communication channels, as well as permission to attend and observe group training events and public comedy events attached to the project, on the condition that I at least initially participate in training events that I attended. As the training scheme was a discretely bounded space, with membership for all participants dependent upon admission by the gate keeper, the recruitment of participants for the project was determined by their pre-existing participation in the scheme. At the time that I entered the field, the scheme was about to enter its second year, and had just recruited the second cohort of participants. These participants (n=15), form the basis of this study. In addition, two other groups of participants were recruited. Members of the first cohort who remained active in the project (n=8), and the two project organisers, who participated in the day to day activities of the group, were also recruited.

The decision of participants to take part in the training scheme of course did not mean that they necessarily consented to taking part in my project, particularly as they had not had any role in my entry into the field. Consequently, participation in interviews, which involved a formal process for gaining consent, was used as a proxy for participant recruitment more generally, so that only those who took part in interviews were recorded in observations and the transcription of group communication, and others were removed. However, it should be said that managing recruitment in fact provided few issues, as members of both cohorts were very willing to take part in interviews and participate in my project. All members of the second cohort participated in at least one interview as part of the project.

4.5: Overview of research design and data collection

I now turn to discussing the research design for the project. In exploring the research questions, research tools were employed that would permit the collection of ‘talk’ about membership of the scheme, science comedy and science communication more generally. Three methods were used for data collection: participant observation, the analysis of group communication, and interviews conducted with individual participants. Methodologically, each allowed the collection of data about the ways that participants experienced, understood and practised science communication, and contextualised science communication within their own lives and experiences, in line with the ethnographic approach discussed previously. The use of multiple methods was intended to enrich the corpus of data, while also permitting a degree of triangulation

and comparison between the different methods (Yin 2015). It should be stressed, however, that the methods chosen also reflect the methodological options that were available to me in the field, and in part were chosen for their applicability on the ground.[19] I now discuss these methods in turn and highlight how they were used within the project.

4.5.1: Participant observation

Participant observation techniques are typical of ethnographic methods and refer to a broad number of techniques that foreground the proximity of the researcher to the practices they explore (Bryman 2012). In critical work on ethnographic methods, broad generic distinctions are often made between the roles the researcher can adopt, often seen as a spectrum between full participant, participant-observer, observer-participant and full observer, suggesting differing levels of closeness and distance when working within the field (discussed in Flick 2014). There are divergent views on the relative value of assuming an 'insider' or 'outsider' position, which at either extremes risk either remaining too distant and lacking access or losing critical distance (Hammersley and Atkinson 1989). The role that the researcher can take is likely to be hybridised, and at least partially a consequence of their interactions in the field, rather than a decision that can be made prior to entry.

For the most part, I adopted an observer role as far as possible, intending to minimise my own intervention in the community, particularly as the group knew that I was a researcher. The gatekeeper's insistence that I take part in training sessions sought to aid this; rather than believing I would gain greater understanding through participation, he instead intended to minimise my visibility as a researcher, they instead expressed the concern that adopting a clear observer/researcher role within the sessions would inhibit other members' ability to participate. This meant that initially fieldnotes could only be written after the event.[20] However, as I developed a working relationship with the participants, and they became comfortable with my presence as a researcher, I was able to adopt a more explicit observer role. However, the peculiarity of this position

[19] As an example, participants regularly completed detailed evaluations and feedback on their time in the project for the gatekeeper, which may have well have offered interesting insights into how they understood the purpose of the project and their role within it. However, as participants had been told that only the gatekeeper would read them, my access to them would have constituted a breach of trust within the field and thus was not requested.

[20] Where it was not possible to make written notes during observations, audio memos were recorded that were used as the basis for subsequently writing fieldnotes. This is in part facilitated by being known by the group as a smoker, enabling me to go outside during breaks and intervals, so that these absences were not obtrusive.

was noted by participants, who noted how ‘quiet’ I was.[21] To ensure transparency, the interviews became a site for communicating my rationale for adopting an observer stance. Participants were always invited to ask me any questions that they had, and many did ask me what I was researching and was hoping to get out of it. This provided an opportunity to describe the methodology and rationale of my research and respond to participants’ concerns.

4.5.2: Communication data

A second form of observation involved recording day to day interactions participants had online on the multi-channel communication platform ‘Slack’, which produced a large amount of naturally occurring data that was transcribed every two weeks and stored as encrypted word documents. Assuming an observer role, I rarely participated in online conversations unless explicitly invited to. Additional fieldnotes were regularly written to record themes and topics discussed by the group, as well as noting patterns of interaction. As a space that was public for the group but otherwise private, participants posting on the platform assumed that no-one beyond the cohort could or would read it, though participants were aware that I had access to the platform. To ensure that this platform remained a private space, any conversation or channel that was marked as ‘confidential’ was not recorded, and where possible, I did not read it, to prevent accidental ‘leakage’, where my analysis was informed by discussion I was not allowed to reference.

Reproducing online data significantly complicates ensuring participants’ privacy and anonymity, as digital infrastructures permit searching for specific conversations and identifying speakers (Pink et al. 2016). Though all the data recorded was already public to the group, and in a sense could offer no surprises, this search functionality could allow for the deanonymisation of participants in the other data sets through their pseudonyms. Consequently, while communication data formed an integral part of analysis both in and after leaving the field, it will not be reproduced in the thesis, though group conversations will be synopsised and summarised without indicating individual speakers.

[21] This was said explicitly in the group during a communal activity where participants had to provide anonymous ‘branding’ for one another by providing characterisations and personality descriptions on a shared google doc. Here, I was described almost exclusively in terms of being quiet and mysterious and that unlike other participants, I had deliberately not given much of myself away.

4.5.3: Interviews

Interviews are an established method for qualitative research, allowing in-depth discussion of participants' attitudes and experiences (Bryman 2012). As an ethnographic method, conducted within the field, interviews permit more detailed exploration of issues that arise from observational data, as well as providing participants with the opportunity to discuss how these issues and concerns extend more broadly in their lives (Flick 2014). The constructed nature of interviews cannot be denied, particularly as they occur only through the specific intervention of the research. However, presuming that respondents speak in a way that is true to them allows interviews to be used as a fruitful way to explore pertinent issues and calibrate other forms of data (Gomm 2008).

Interviews were primarily used to explore at length issues pertinent to the research questions that could not be captured in the naturally occurring data. The small size of the cohort meant that it was possible to interview all participants in the project, without the need for purposive sampling (Bryman 2012; Krippendorff 2013). This had the additional benefit of ensuring that all voices could be heard in the project, particularly where other data sources relied on participants' active involvement in group events or discussion, so that some voices might have been harder to discern. Furthermore, the interviews allowed the participants to discuss their experiences in the scheme away from communication channels that were accessible by the entire group. While certainly this led to discussions that were not had elsewhere, they nevertheless emerged as discussion within the field, allowing a space to explore participants' experiences of and attitudes towards the scheme, and more specific discussion of science comedy and science communication.

Participants in the main cohort took part in up to three interviews over the course of the year, though difficulties in arranging suitable meeting times (particularly for those living outside London) meant some participants took part in fewer interviews, which were generally longer. Each interview was semi-structured, using a guiding set of questions as prompts, to allow a degree of calibration and consistency across the cohort, while also allowing participants to talk about issues that were of interest and importance to them. In addition, two of the project organisers were interviewed twice during the project, and 8 members of the scheme's previous cohort took part in a single interview. In total, 48 interviews were conducted: 36 with the main cohort, 4 with the group organisers and 8 with the first project cohort.

Participants were invited to complete a demographic information form at the end of the interview. The purpose of this form was not to collect data that would form the basis of empirical claims within the project, for instance to claim that the scheme's activities might be explained in terms of the cohort's gender, class or race and ethnicity, however, though it was used alongside data collected by the scheme organisers to give a general sense of the composition of the group (See Appendix One for a copy of this form and aggregated demographic information). Instead, the data was collected primarily to ensure that where participants discussed issues relevant to this information, they could be referenced in the way that they wished. This information was thus only reproduced where this information was relevant to what they said in interviews and was otherwise excluded to protect participants' anonymity. This information was destroyed after completing writing the thesis.

4.6: Research ethics

Approval to conduct the research occurred in two principal stages. The first involved discussion with the gatekeeper as to the level of access and participation that would be permissible, the information that I would have access to and the gatekeeper's expectations for my behaviour within the group. Secondly, formal ethical review occurred, and was granted by the Department of Science and Technology Studies, University College London (STSEth 120). Further ethical clearance was granted to extend the period of data collection to into a second year, to allow the completion of the third round of interviews with participants (Ethics 126 see Appendix two for copies of both forms). As the project was considered 'low-risk', it was not necessary to acquire approval at the University level.

Ethical research is far more than an issue of institutional approval, however, and required continual reflection to ensure that the research respected participants and avoided undue imposition being placed upon them (Yin 2015; Lindhof 1995). Ensuring that the research was conducted ethically was a continual concern both for data collection and analysis. As noted above in relation to the use of communication data, negotiating data collection strategies that could respect the confidentiality of the research space led to the selectivity in the spaces that I entered and in which I recorded data. Primarily, this was an issue of ensuring anonymity as far as was realistically possible (Bryman 2012). In line with qualitative research methods, standard processes of anonymisation were used; participants in interviews were invited to

choose pseudonyms that were used in the transcription of all data.[22] However, as not all participants chose pseudonyms, a general system of labelling has been used in this thesis, with all participants referred to as either Organiser or Participant XX. In addition, participants are marked with either C1 or C2 to indicate whether they were recruited to the scheme in the first or second cohort. These labels are numbered according to where participants first appear in this thesis.

As discussed previously, there is a chance that participants might recognise one another, based either on the issues that they spoke about, and or potentially their style of speech. Furthermore, publicly available information about the project, and participants' own online presence, might well lead to convergences between their own outputs and their contributions to the project, which might again inhibit full anonymisation. Consequently, it was important for the research that participants were aware that full anonymisation could not be guaranteed, and participants were invited to raise questions or concerns before taking part in interviews. The consent form and participation information sheet were sent to participants prior to the interview, and the process for data withdrawal was also made clear to participants before they gave their consent (See Appendix three for blank copy of these documents). While few made use of it, participants who had concerns over what had been recorded, interviewees were given access to the audio recording and transcript and allowed to remove any information they did not wish to be used. Though knowing that full anonymisation might not have been possible may well have changed how participants spoke, it was my concern that transparency was more important here.

4.7: The role of the researcher

> *So scientists generally don't like social scientists, like we're getting on their turf and getting in the way of the things they'd be able to get away with if they had no social accountability. They do all these amazing things, and all we do is ask how their amazing things enforce a sexist, racist and classist society, and somehow we're the bad guys. I mean most of us are dreadful but that's beside the point. So I was thinking, what would make you like me and see you as one of our own? What was it that you – science people – and me…normal person, had in common? And it occurred to me: FACTS! I love facts. I've got loads of them. Most are about the history of the Eurovision Song Contest, which are of limited use amongst statistically homophobic science people, however….*[23]

[22] In some instances, where participants were mentioned in interviews before choosing their own pseudonym, a generic identifier was used ('Participant XX') and were subsequently changed in the data sources.

[23] Extract from a comedy set I performed at one of the performance nights affiliated to the scheme, February 2018.

As perhaps suggested by the quote above, by entering the field as a social scientist, my role was clearly different to that of my participants. Indeed, performing science comedy as a 'non-scientist' and researcher, I potentially had a different 'relationship' to science comedy, and my position as a researcher was announced to the audience when I performed. While I saw science comedy as an opportunity to learn about science communication, I did so with different aims to the participants and potentially had a different sense of I would learn. While the research tools used sought to minimise my intrusion into the field, the role of the researcher cannot be negated, nor can it be assumed that the very presence of a researcher will not change the dynamics of a social space. It is therefore important to reflect upon my own role as a researcher, and the ways that my identity within the group as a researcher shaped my relationships with participants, and the course of the research. Though my role was far less active than that of participants, my interactions with the field were nevertheless constrained and permitted through the specific conditions the scheme, echoing many of the concerns that will be explored in later chapters.

Within the scheme, my role seemed to be positioned somewhere between an insider and outsider. As an insider, I was permitted access to Slack and like members of the cohort, was able to attend training events and public events for free. However, I was not a member of the cohort, and so did not maintain an online presence on the group's website or take part in iterative evaluation exercises, though I was asked to take part in the final evaluation project at the end of the year. When I was first introduced to the group, my insider/outsider status was foregrounded by the gatekeeper, highlighting my position as a researcher and making clear that participation in my own project was not part of being in the scheme. However, as will be discussed in the empirical chapters, participation in interviews elided with the moral economy of the scheme, where there was a strong expectation of working for the community and helping one another out.

Having entered the scheme as a researcher, the likelihood of achieving full insider status was unlikely, particularly as I had entered the field for very different reasons to other participants. In conducting interviews, it was clear that my position was ambiguous: to some participants, I was a member of the cohort, while others saw me as part of the group's leadership infrastructure, asking whether interview transcripts would be shared with the gatekeeper. In later interviews, I could sense that my position had changed for some participants, as someone who understood the scheme, but was not 'in' it and consequently was someone who would understand their experiences of the scheme without being invested in the scheme enough that participants felt constrained in how they could talk about it. In this sense, being an outsider was

productive, as I was seen to be less loyal to the scheme and consequently less likely to feed information back into the group.

Nevertheless, participation in the group's practice proved essential to maintaining my standing within the scheme. Numerous participants expressed the view that only by taking part in activities (particularly performing stand-up) could I truly understand it. It would be difficult to claim that my own occasional participation would allow understanding of their experiences, as I was performing for very different reasons, for the most part to show that I would (and could) do so. Performing stand-up may have facilitated trust-building, but I do not claim this made me an insider. Indeed, performing more would have risked taking too much from participants, as performance opportunities were finite, and would have entailed taking the opportunity from someone else. As will be discussed in Chapter Five, there were strong strictures against any individual 'taking too much' from the group; seeking to perform more would have risked going against the moral economy of the group.

Nevertheless, my ability to enter the field would suggest that I was, I some respect, someone who *could* be an insider in the scheme, as I was the sort of person the scheme was designed to help. As an early-career researcher (albeit not a scientist), educated within elite British universities and interested in science communication – admittedly from an academic rather than practical standpoint – I aligned with the background of most participants. Though my specific trajectory was very different, as only one participant had formal academic training in science communication, and most sought professional roles in the professional science communication sector, I could have been a realistic candidate for the scheme.

Being the 'sort of person' might not have been enough, however. Success in the field relied on being *seen* as the right sort of person and demonstrating that I understood science communication in the right way. The scheme's gatekeeper was broadly supportive of STS as a discipline, particularly my home department at UCL, in its ability to level critique at current science communication practice. Through this affiliation, I was assumed to stand on the right side of the debate. Similarly, one of my supervisors, Emily Dawson, was well respected by the scheme's organisers, and my status as her supervisee was publicly introduced to the cohort as an initial sign of my credibility. Access to the scheme depended on the assumption that I would understand the scheme and not inhibit its progression, even if I was there for a very different reason to other participants.

4.8: Validity and reliability

Claiming to have achieved a relatively 'insider' status might well do little in itself to convince the reader of the validity of the thesis' findings. Though the interrelated concepts of validity and reliability are often considered more applicable to quantitative work, numerous authors have suggested that the two concepts are pertinent to qualitative research as well (Lindhof 2014; Yin 2015). Operationalising the two concepts within case study research can be difficult, however, as case studies often prioritise internal consistency and the production of a detailed examination of the case rather than necessarily aspiring to empirical or theoretical generalisability (Bryman 2012). Instead, case-studies might be better evaluated by the usefulness of the heuristics and conceptual tools they provide for future work. While the specificity of the case study might not be reproducible, the validity of the case study might lie instead in its ability to explicate the case's position within the field and account for its particularity (Flick 2014; Mabry 2008).

Similarly, as ethnographic research, traditional notions of reliability, concerning the reproducibility of findings and analysis, are problematised by the singularity and embeddedness of the researcher within the field (Bryman 2012). While it might be possible to employ multiple coders in the analysis of the textual outcomes of data collection as a means for ensuring the reliability of analysis (though of course, not usually within the particular confines of an individual PhD project), the data collected cannot be uncoupled from the contexts of its production and its producers. It is of course the researcher who collects data and decides what is worth recording. The researcher's proximity to the data must be acknowledged, both in their role in shaping the collection of data, but also in the opportunities for analysis made possible through this proximity, urging continual reflexivity in the processes of research design, data collection and analysis.

While the specific empirical findings of the research may not be generalisable, they ought still to be valid, and while different researchers might well generate different stories and analytical foci, the researcher's interpretation ought at least to be feasible and trustworthy (Bryman 2012). Ensuring the consistency and transparency of analysis is crucial. This relies upon openness both in explicating the methods and methodological rationales underpinning analysis and in reproducing the data that has furnished the interpretive decisions made by the researcher, so that it might be interrogated and possibly contested. Locating the case study within broader critical literatures, while not providing a means for guaranteeing the veracity of the findings themselves, can again make explicit how the case study, as an exploration of the

possible, gained meaning within the conceptual structuring offered by the theories and heuristics available within academic work. In the following section, the processes through which the data was organised and analysed is outlined.

4.9: Data Analysis

Qualitative research produces large amounts of data, the analysis of which must be clear, transparent and consistent, if it is to be seen as valid and credible (Miles and Huberman 1994). Indeed, the project produced a large corpus: 48 interviews, each between 5,000 and 16,000 words once transcribed, 453 transcription files of the group communication from Slack, and digitised versions of fieldnotes. Given that it is far harder to identify clear ways to determine the validity and reliability of qualitative data, in this section, I outline the rationale underpinning data analysis, the strengths and limitations of discursive approaches to analysis, and provide an outline of the process through which the data was analysed.

A necessary part of analysis is the act of transcription, turning observations, conversations and interviews into a form that is amenable to analysis (Poland 2001). Though some research methods make use of video and audio recording both in the processes of data collection and analysis (Loizos 2000), for this project, observations, interviews and records of group communication were converted into a textual form, either as a transcript or a digitised transcription of field notes that were written by hand[24]. The act of transcription is by necessity an act of erasure, as body language, non-verbal actions, the physical arrangement of spaces and indeed the space occupied by the researcher cannot be fully reproduced within a textual record. Nevertheless, it was a necessary step for the research, particularly in ensuring that transcripts were consistent. Interviews were transcribed manually by the researcher, after the period allowed on the consent form for requesting withdrawal (20 days) had passed, recording all speech that occurred within them, including pauses, laughter and repeated verbal affects (for instance ‘like’, ‘you know’). Interviews were anonymised at the point of transcription, including references to other participants, using the pseudonyms chosen at interview.

4.9.1: Data Analysis rationale

Social constructivist approaches position language as a principal way in which meaning is created, enacted and sustained, understanding language as a site for the emergence of meaning, rather than reflecting an external pre-determined social reality (Potter

[24] I had initially considered creating audio-visual recordings of training session and performances. However, in initial discussions with the gatekeepers when negotiating access to the scheme, making video and audio recordings was strongly resisted, and were not pursued.

1996; Pollner 1987). Analysing the ways that social themes, attitudes and concerns are understood and experienced through language thus requires a discursive analytic attitude that acknowledges language use as a generative form of meaning-making (Bryman 2012). Within qualitative methods, three forms of discursive analysis have become particularly prominent: ethnomethodology, discourse analysis and narrative analysis.

Ethnomethodology argues that the meaning of language can only be understood in relation to the specific contexts in which it is used (Atkinson 1998; Lindhof 1995). By placing primary interest in the quotidian practices of the organisation and enactment of meaning, Ethnomethodology rejects any account of meaning that relies on an invocation of criteria external to the specific interaction (Schenkein 1978; Garfinkel 1967). Primarily interested in *how* meaning is constructed through language, so that discursive performances are themselves the object of study, rather than the content of speech, ethnomethodology has been criticised for its extreme localisation, in being unable to account for the relatively stability of language and meaning that enables the interactions that motivate this analytical approach (Flick 2014; Gomm 2008; Atkinson 1988).

Where work in STS has employed ethnomethodology to examine scientific practice as a continual form of negotiation and ‘shop talk’ (e.g. Lynch 1985; Lynch 1992), critics have noted the inability of ethnomethodological accounts to explain the importance and permanence discussions of science come to have (Latour 1986). As an approach that attempts an explanation solely through the examination of quotidian interactions and negotiations, other critics have expressed concern that ethnomethodological approaches nevertheless ‘smuggle in’ social explanations, through the explanatory work afforded to the ‘silent agreements’ mediating negotiation, while not examining how these agreements emerge (Bloor 1992; Pickering 1992). By trying to show that discursively, science is conducted like any other form of work, such a claim might also serve as a means to undermine science, as a form of ironic derision, rather than considering the specific work that becomes possible beyond these more ephemeral moments of interactions. As the Figured Worlds approach suggests, while the discursive frames that structure worlds are to an extent arbitrary, this does not mean that they do not seem real to those who use them. Instead, these discourses serve as productive tools for cultural participation and the creation of shared understandings and meaning (Holland et al. 1998).

Developing an analytical approach to language that acknowledges the importance of its content for its users, while maintaining a commitment to the importance of interaction and the dynamism of language requires moving away from ethnomethodology, firstly by rejecting the extreme localism of the approach and secondly in maintaining that the constructed and iterative nature of language need not necessitate that its content be treated with suspicion. Following Bakhtin's notions of polyglossia and later versions of intertextuality, the novelty of interaction can still lead to a degree of permanence and stability, though one that is continually subject to potential alteration (Bakhtin 1981; Denith 1995). This approach thus aligns to traditions of Discourse Analysis, which conceptualise discourses as meaningful entities and units of analysis, but denies that their meaning is determined external to the conditions of their use (Johnstone 2008; Gill 2000, Grad and Rojo 2008). However, when used as a specific method, Discourse Analysis, like ethnomethodology, often takes discourse itself as the principal subject of inquiry, rather than its content. As forms of action research, Critical Discourse Analysis and Foucauldian Discourse Analysis are both principally interested in identifying and seeking to disrupt the ways that power is manifested and performed through language, and the ways that speakers (but not analysts) fails to recognise the power structures they reproduce in their speech (van Dijk 1993; Johnstone 2008; Dolon and Todoni 2008). Rather than attend to the specific ways that discourses are used, more sustained attention lies in the ways that discourse intrinsically forms part of larger systems of oppression.[25] Furthermore, focusing on discourses as objects in their own right risks neglecting the continual processes of negotiation that construct them, and ask what discourses are being used to do (Stenner 1993; Parker and Burman 1993). Where critical discourse analysis aims to construct a macro- (and potentially generic) account of power, there is still scope to ask what work these power relationships allow with finer levels of granularity.

Where a discourse analysis approach attends to the meaningfulness of speech, maintaining the importance of the specific contexts of language use suggests an account of language more akin to narrative analysis, which provides a means for attending both to the specific achievements of language use (as a form of story-telling), and the ways that discourses are selectively used and orchestrated as a means of making sense of the world (Bryman 2012, Gill 1993, Gill 2000; Lindhof 1995; Bamberg 2012). However, where I employ narrative analysis, I move away from the dominant

[25] This point is made explicitly by Van Dijk (1993), who cautions against the identification of discourses of power as a goal in its own right as a macro-level analysis, rather than focusing on the micro- and meso- levels of interaction and meaning-making that occur within systems of power.

use of the term to refer to the analysis of specific narrative forms (particularly life stories) that cohere to literary versions of narrative (Holstein and Gubrium 2012; Jovchelovtich and Bauer 2000; Shuman 2012). My approach takes a broader definition of narrative, seeing all accounts and forms of interaction as forms of narrative, in that they tell stories about the self and the world, and structure the world through their invocation of meta-narratives of how the world is, and how it ought to be (see Flick 2014).

This approach might be seen to sit between the three methods discussed above, in positioning language both as a source of evidence of participants' worlds, as well as a potential resource for these worlds' (re)construction and transformation. Stressing language as a constructive, socio-historically located and contextual resource for creating meaning, analysis is focused on the specific ways that language is used within the field as a form of action, both on the quotidian level of everyday and mundane interaction, and in more general collective processes of narrativizing and making sense of the world around them. This follows Johnstone (2008), where discourse is understood as both a reaction to and an intervention within a specific social world (p.229), evidencing the genealogies of shared meaning and practice as well as the processes through which meanings are constructed and coalesce through everyday interactions in the field.

Where the research questions ask how science communication is understood, experienced and located, the questions might be analysed in terms of how science comedy and science communication are narrativised, the stories that are told about them, and the work these stories are used to do. Methodologically, the use of narrative analysis thus aligns to the theoretical commitment to the study of the scheme as a form of figured world, explained in the previous chapter. In moving between different levels of analysis, the approach attends on the meso-level to the stories that circulate about science communication, as resources for interaction and self-building, underpinned by a consideration of how these stories are used, contested and transformed, and how they relate to the broader narratives of science communication that constrain the language that can be used and a provide a crucial source for participants imagining what science communication means, and might come to mean.

4.9.2 Summary of data analysis procedures

Data analysis occurred in three main phases. The first phase occurred during fieldwork. I regularly wrote research memos when in the field, alongside fieldnotes made in observations, which noted emergent or recurrent themes in the participants' activities

and conversations, and reflecting on my own interpretations and my role within the field. These memos were intended to guide the ongoing direction of the project, noting key events that could be explored in interviews and as sensitizing concepts to guide subsequent work in the field. Particular attention was paid to seemingly divergent cases, as means for exploring and complicating patterns within the field (Gill 2000, Lindhof 1995). From these fieldnotes, an initial coding frame was developed for the second phase of analysis, in essence a list of recurring narratives and descriptions encountered in the fieldwork, as a well as divergent cases that could be used to examine the consistency of the corpus.

The time constraints of being in field made it difficult to carry out further analysis (for instance formal coding of the interviews and communication transcripts). Consequently, the second phase of analysis began in August 2018 towards the end of completing fieldwork. Though principally a pragmatic measure, this allowed a degree of distance from the data, in the sense of seeking to continually make the familiar strange (Tavory and Timmermans 2010), through a comparison of analysis made within the field and close textual work on the data. Having transcribed fieldnotes and records of group communication into Word files, these were coded using NVivo 11. Similar to thematic coding, each code represented a ‘story’, as a discursive or narrative item used by participants. Beginning with the coding frame developed in the field, the coding was iterative and exploratory, adding new codes, re-describing codes and indicating possible relationships between them.

Though the development of an initial coding frame might have allowed for a degree of purposive sampling, all files were analysed, to ensure that I could be surprised by the data, particularly in discovering narratives and counter-narratives that might have been submerged by the volume of the data collected in the field. In line with critiques of forms of content and thematic analysis that use rigid coding frames that are designed before analysis (Gomm 2008; Bryman 2012), this open coding was intended to ensure that the corpus could be analysed as a whole, and that the subsequent iteration of the coding frame that emerged was driven by the data, rather than a particular theoretical position or a subset of the data that my fieldwork had suggested was more important (and were thus reflected in the initial coding frame). The use of NVivo allowed consistency in how the data was analysed, recorded and in how cross-comparisons between nodes might be made.

In the final phase of analysis, using the adapted coding frame developed in the analysis of field notes, the interview transcripts were analysed, again iteratively, using

open coding to adapt and reformulate the frame where appropriate. The interview transcripts were coded as a separate NVivo project. This was partly pragmatic, to ensure that data with different conditions for representation in the thesis were not accidentally merged, while also to allow a comparison between the interviews and the observational data, particularly in acknowledging that while my attitude towards the interviews was that my participants were speaking truthfully, the artificial nature of interviewing might have changed how they spoke. Similarly, as noted above, having noted that some participants used the interviews to voice concerns they did not feel could be raised elsewhere, keeping the two data sets separate facilitated mapping where different stories emerged. Continual cross-comparison between the interviews, and between the interview and observation data sets ensured that the locations of the stories would be clear. The coding frames and descriptors employed during the project, can be found in Appendix four.

4.10: Summary

This chapter discussed the working concepts and research tools that informed the development of this study. Informed by nascent discussion of humour as a methodology as well as a topic of enquiry, the study seeks to employ ‘incongruity’ as a productive tool for exploring the experiences and practices of science communicators, as well as the differences between participants, disciplines and theoretical concerns that the fieldwork revealed. Employing a weak ontological and epistemological social constructivism, the study explores the ways in which practices and figured understandings of science communication are constructed and sustained, not as a basis for ironic derision, but rather to explore the specific concerns and problems that emerge in practice.

A qualitative, ethnographic case-study approach was used to develop the research design, employing multiple methods to explore the research questions. Participants were recruited through their pre-existing and ongoing participation in a training scheme that provides the case study for this thesis. The methods used in this study were participant observation, both of live events and of day to day online interactions through the platform ‘Slack’, as well as interviews with participants throughout the year. The multiple methods and data sources meant that the validity and reliability of the research could be strengthened through a degree of methodological triangulation. Data was analysed in an on-going, iterative process, identifying emergent themes and narratives, as well as divergent cases to permit continual comparison and calibration of the narratives and themes found in the data. In the following chapters, the findings of this case study are presented and discussed.

Chapter Five: How to be a Good Science Communicator

5.1: Introduction

The training scheme that forms the ethnographic site of this thesis arguably set itself an impossible task, by seeking to prepare a group of participants with different experiences and aspirations as science communicators to enter a field that is itself acutely heterogenous. Science Communication encompasses a multitude of different professional roles and seemingly lacks a clear shared sense of purpose as to who science communicators are or what they should seek to do (Kurath and Gisler 2009; Burns and Medvecky 2016). Consequently, quite what science communicators should learn within their training would seem particularly difficult to define. Science Communication is a field where notions of purpose are multiple and often contested, simultaneously encompassing the celebration of science, political and social advocacy, recruitment to further study, knowledge brokering and attempts to transform science-society relationships (Davies and Horst 2016). If the scheme sought to offer participants peripheral membership of the field, or to ensure that their activities within the scheme could serve as forms of legitimate peripheral participation within the field that were legible of forms of 'doing' science communication, there was not necessarily a clear sense of 'core' practice through which this peripheral membership could be understood, nor a clear sense of the trajectories that should be followed in achieving such membership (Laver and Wenger 1991, Wenger 1998).

Thus if participants in the scheme imagined their participation as a form of apprenticeship, they had joined a field in which the practices and identity of 'master' science communicators were far from set. Participants were learning to be a science communicator within a period of wider negotiation concerning what it meant to be a science communicator, the attributes and dispositions a science communicator should have, and the reified forms in which such attributes would be evidenced: they were joining a world evidently in the making. Yet the scheme simultaneously presumed that the rules of engagement were set enough that conventional notions of professionalism might be challenged, adopting a second more transformative goal. It would aim not only to prepare participants for and support them within the field, but also to foster a vanguard, publicly promoting participants on the scheme's website as the 'new elite' of science communication. Both embodying excellence and change within the field, participants were tasked with learning both the 'rules of the game' (Bourdieu 1990; Bourdieu 1993) and fostering a new form of professional excellence. Yet where the field of science communication seems particularly nebulous, it was not clear how such excellence would be constructed or realised.

This chapter is motivated by a discussion of what it means to be, and how one learns to be, good at science communication. As noted in chapter two, accounts of training in science communication have often presumed a straightforward story of skill acquisition, implicitly equating good learning – and good science communicators – to communicators' ability to make use of such skills (e.g. Baram-Tsabari and Lewenstein 2013 and 2017). However, simultaneous discussion of the ways in which science communication has been – or might be – professionalised suggest a much broader story. As Mellor (2013) suggests, the process of training to be a science communicator might simultaneously permit a transformation of identity, involving inculcation within specific moral economies and prerogatives. This is also to acknowledge that learning is far more than the acquisition of specific concrete skills and items and participants learnt to belong within the scheme and – they hoped – the broader field (Wenger 1998). Examining the practices of training offers analytical purchase in exploring the imaginative architectures of science communication.

In this chapter, I analyse the scheme through a narrative that permeated the group's practice and the ways in which participants described their experience of joining the cohort. Within the scheme, the topology of science communication was frequently narrated in a way that can be framed through the contrasting figures of the 'good' member of the cohort and, following Thornton (1995), the 'mainstream' science communicator found elsewhere in the field. I argue that the scheme sought to foster a version of professional identity and practice predicated primarily on goodness to one another, so that a good science communicator was a good member of the community. Good practice was consequently predicated on mutual support and opportunity building, rather than any particular 'scientific' competence or output. Thus while participants devoted a large amount of time to learning the skills of performance and event planning, this training was understood to underwrite a broader change in participants. Science communication training would serve as a space for participants to articulate and realise a form of good practice within the scheme, that might eventually supplant and correct problems perceived to inhibit mainstream practice. However, in highlighting the formulation of the new type of professional, I argue that its successful realisation relied upon the relatively isolated confines of the scheme, where good science communicators and good cohort members could be understood as the same thing, with the task of learning to be a science communicator primarily that of learning to exist within the specific local community participants had joined. Consequently, participants were aware that such a definition might offer little purchase or exchange

value elsewhere, and that increasing commitment to the scheme might risk isolation from the field working within different economies of value.

This analysis of the 'good science communicator' as a good cohort member draws from the entire data set, though focuses particularly on discussion of the purpose of the scheme, and characterisations of science communicators outside the scheme that were manifest in the group's online communication, as well as explicit discussion of these topics within interviews. As noted in chapter four, while data analysis focused on interviews, online communication and observations, only data from interviews and observations are reproduced here, as demonstrative examples of the group's practice and discourse. Where applicable, divergent cases are highlighted to show the diversity of practices and discussion that emerged within the scheme. One such case is examined in section 5.4.3, exploring a participant who broke the rules.

5.2: How Not to Be a 'Mainstream' Science Communicator

In both years that the scheme ran, a cohort of between 14 and 16 participants were recruited to join a collaborative network in which they received group training sessions, individual mentorship, and numerous opportunities to perform science content. These performances were enabled through privileged access to an established network of science comedy performance nights affiliated to the scheme, and by developing their own formats and shows with the organisers' backing. Upon entry, few participants had formal training in the sector, beyond occasional training days as part of their post-graduate education, with only one participant having completed a science communication degree. Similarly, though some of the cohort had already begun to work professionally in the sector, mostly in enabling and programming roles, the majority had little professional experience in the field, beyond volunteering and performing in pre-existing science communication provision affiliated to their academic training.

As one of the few training schemes at the time that sought to train science communicators outside of a higher education setting, the group was run in a freelance capacity by organisers who had extensive experience working in enabling roles in the British science communication and public engagement sector. Supported by external funding, which paid primarily for the group organisers' time, participants did not have to pay for their training. Conversely, they could not expect remuneration for their work in these public events, though they might acquire paid work through the networks they developed during their time in the scheme.

Formal training was provided through monthly sessions, focused primarily on skills related to comedy performance and the competencies needed to enter the field (see 4.4.2 for list of training events). Delivered in-house either by the scheme organisers or by trainers known to them through their established professional networks, and exclusively for members of the scheme, these sessions included training in voice and movement, joke-writing, improvisation, performing in panel shows and MC-ing gigs. To bolster their professional awareness of the field, participants also received training in evaluation practice, working in TV, and explicit instruction in developing a brand that they might mobilise to identify and occupy niches within the field. Thus the content of training incorporated both skills related to the public performance of science content (Besley et al. 2013; Hassol 2008) as well more tacit training in learning the local lay of the land. Alongside this formal training, participants had regular opportunities to perform science comedy through the scheme's affiliated public shows. Expected to take part in at least 10 public events over the course of the year, participants could gain experience on stage, receiving feedback from other participants on their performances and potentially gaining public exposure as performers.

In addition to the opportunities for formal training and performance opportunities, and as mentioned in chapter four, participants were given access to Slack, a shared online communication platform, which served as the forum for the majority of the group's interaction. Here participants could ask for help and support from one another, request feedback on their performances or share working copies of sets, share opportunities and plan future events. As a private space, the platform allowed participants and organisers to relate their experiences in the field – particularly negative ones – and provided a space for the course organisers to share their own knowledge of the field and discuss the world of science communication. Always accessible to participants through desktop and mobile app, this platform generated a continual stream of posts and conversations, which participants were expected to keep on top of, responding to requests, providing support and keeping up to date with the concerns that were raised within it.

5.2.1: Motivations for the scheme

Not being tied to formal institutional structures, though drawing heavily from the expertise acquired within them, the scheme was imagined as standing outside conventional practice. During informal conversations with the organisers throughout the year, while both often noted that science communication seemed too diverse to allow a singular account of what science communication was or sought to do, they nevertheless expressed a view that forms of conventional practice had been

established, many of which they viewed negatively. In this vein, the development of a cohort-based training was framed by the organisers as a means of response to multiple problems they perceived to exist within the field. These problems were a frequent topic of discussion, both in interviews and in more general discussion recorded both in fieldwork and communication on Slack, with both organisers frequently posting about their experiences in the sector and their concerns regarding the field's progression. Two principal concerns recurred in these spaces that were positioned as motivating the architecture of the scheme: the lack of opportunity for training in the sector and the need for mutual support amongst practitioners. In line with numerous practitioner voices within the sector (e.g. Featherstone et al. 2017; NCCPE 2017; BSA 2016), issues of access and working conditions were framed as fundamental problems for the ability of science communication and public engagement to professionalise and improve.

In noting the apparent lack of training opportunities, both organisers appeared to concur with a wider set of voices that future work in the field was dependent upon specific, disciplinary bound forms of training[26]. While formal training schemes have become increasingly prevalent in the United Kingdom, opportunities for systematic training in Science Communication and Public Engagement that incorporates training in both theoretical and practical expertise is largely restricted to a limited number of specialist Masters' programmes and in-house training available within the academy. With in-house training hugely variable in scope and focus, and typically designed for those working in universities for whom science communication and public engagement might be only a part of their work, the lack of other opportunities for training has frequently been positioned as a hindrance to the professionalization of the field, both in ensuring requisite competencies across the sector and in sustaining a representative workforce (e.g. Katz-Kimchi and Atkinson 2004; Scheitle and Ecklund 2017). For the scheme's organisers, the limited range of opportunities was seen as profoundly unfair:

[26] The content of this disciplinary specific training, for instance in providing training in branding, self-presentation and an awareness of the structure of different aspects of the field might look quite different to other calls for discrete professional science communication and public engagement training (e.g. McKinnon and Bryant 2017; Carletti and Massarani 2015; Leshner 2007). Where these accounts of training have often framed the distinctiveness of training in relation to 'science', so that science communication training might be understood as the application of technical and communication skills to explicit STEM contexts, here the disciplinary knowledge was perhaps more mercantile, focused on teaching participants how to stand out in the field, how to navigate expectations and promote their 'brand', as forms of cultural capital that benefit their progression.

> **Organiser 1**: […] if you want to get a job in [science communication], you need to do the Imperial Scicomm masters, which is essentially a tax on the dreams of young people who want to get involved in Scicomm, you had to, erm, to get to do a gig at a science festival is just nigh on impossible unless you became somehow a celebrity in another way, or you had a £3000 chunk of money to pay, erm it was very hard and I thought very unfair.[27]

Highlighting the forms of 'tax' that neophytes needed to pay to work professionally in the field, this appraisal of training highlighted a sense frequently raised within the group that training opportunities were at once highly exclusive and mandatory for success in the field, almost as an obligatory passage point for those wishing to enter the field (Callon 1984). Entry into Science Communication thus required either the symbolic and social capital acquired through formal training – both in gaining forms of certification and through the opportunity to meet the right people – or through having already experience in programming in science communication spaces before being paid to do so. While not doubting the need for training, the scheme was positioned as an attempt to disrupt formal training within institutions as a unique site of translation, by extending the opportunity and network building outside of institutional spaces and, as will be discussed, by challenging the commitments and notions of success that enrolment in the official practice of science communication seemingly necessitated.

The second motivation concerned working conditions, which were seen to offer little security, support, advice or opportunities for ongoing development. Discussing the position of research scientists entering enabling and professional services roles, the organisers highlighted the fragmented and isolated contexts in which they might find themselves working:

> **Organiser 2**: … and then [laughs] then you get this, group that I'm normally quite disparaging of, which is people who've done a PhD and then maybe a post-doc, decided they want another job at the same institution, the public engagement role has come up, they've gone for it and they've got it, and they know nothing about what public engagement, science communication is, maybe they've done some with their research, but they certainly haven't done any as support staff, they are then abandoned in that role with not enough budget or power to do anything, and they have a terrible time

[27] While both organisers frequently discussed the state of the field, both in conversation with me and by posting on Slack, the interviews provided a discrete opportunity for both organisers to speak at length regarding they felt the problems to be and to relate the problems to their own experience working in the sector. Having noted that both organisers frequently made negative references to the ways in which opportunities were organised and distributed, the 'problems' of science communication were noted as a core focus for the first interview, from which quotes both organisers are taken.

Wishing to build a supportive space that was not seen to exist elsewhere, the organisers envisaged training predicated on collaborative working and mutual support within the scheme as a potential corrective, ensuring that participants would have access to support, recognition and the opportunity for ongoing mentorship and training, echoing the conditions noted in discussion of professionalisation as the signs that Science Communication had matured (Trench 2017; Trench and Bucchi 2010), but without any sense that these systems needed to be tied to the broader field. While neither critique of the field was unique to the scheme, echoing calls from professional bodies for the need for collective spaces for learning and support, the scheme potentially did differ in locating these concerns at the core of the project's architecture. Participants would gain opportunities to perform and gain exposure in the field, but only when they simultaneously worked to foster a supportive environment for the entire cohort. The scheme would not just offer participants a space in which to learn, but rather they would be explicitly tasked with forming a viable community that could deliver these desirable forms of work (Wenger et al. 2002). Offering participants opportunities for training and performance, on the condition that they work together and see one another as the primary beneficiaries of their practice, would underwrite the scheme.

5.2.2: The Spectre of the 'Mainstream' Science Communicator

As the quotes from the previous section suggest, discussion with organisers in interviews often focused upon the barriers faced by those seeking to enter science communication, as a field structured to preclude participants from opportunities unless they could access elite forms of training, and one resistant to supportive and collaborative practice. Yet this structural story was rarely reproduced more generally within the scheme. Instead, the problems of the field were related in a way that was embodied and personalised: the problems of the field lay primarily in the habits, dispositions and attitudes of 'mainstream' science communicators elsewhere. The science communicators who lay outside the scheme were often constructed negatively, as disreputable "others"' (Michael and Burke 1994) in whom the problems of science communication lay.

The characteristics of these 'mainstream' science communicators were various, sometimes contradictory, and not always needing to be explicitly substantiated within the scheme, yet nevertheless evoked a notion of a type of science communicator who did not – and could not – exist within the confines of the group. The term 'mainstream'

was not used directly by participants, but is used here as a catch-all term, following Thornton's (1995) use of the 'mainstream' as a discursive tool through which a community might understand themselves through their difference to a group presumed to exist beyond the confines of their own bounded space, who could be easily disparaged as a means for articulating who the group were by who they were not.

Characterisations of 'mainstream' science communicators were often highly varied, as an amalgamation of various negative traits. Thus mainstream communicators were likely to be 'old straight white men from the 80s'[28] seen to be oversaturating the field, or be characterised by negative personal and professional characteristics they were seen to embody. Mainstream science communicators were liable to self-serving, seeking personal gain at the expense of creating opportunities for others, to overvalue their expertise, claim competencies they did not have or overstate the impact of their work, and seek to mobilise claims to public impact and value where they had no right to. They were uncritical 'fans' of science, seeking to sell science to the public rather than engage in 'real' science communication and public engagement work. Who specifically embodied these characteristics was not always clear, nor did it necessarily matter whether individual characteristics were themselves seen as bad, as collectively, this image of the 'mainstream' communicator to be found outside the scheme served as an icon of a field going wrong, and as a means for articulating a sense of the possibility for the scheme to offer an alternative. Mainstream science communicators were everything the scheme did not want to be, as a spectre of practice, through which participants could define themselves negatively.

Collating and sustaining these negative images of 'mainstream' practice formed a routine part of the group's activity (see Figure 4). The organisers would frequently discuss their professional experience on Slack, often naming communicators in the field whom they had found difficult to work with or held negative views. Similarly, participants would often use Slack to ask for insider knowledge regarding people they had begun to meet, with Slack allowing the collection of opinions, experiences and anecdotes related to various members of the field.

[28] These formulations were frequently used in the introductions to comedy nights, to mark how participants' comedy would differ from 'usual' science communication.

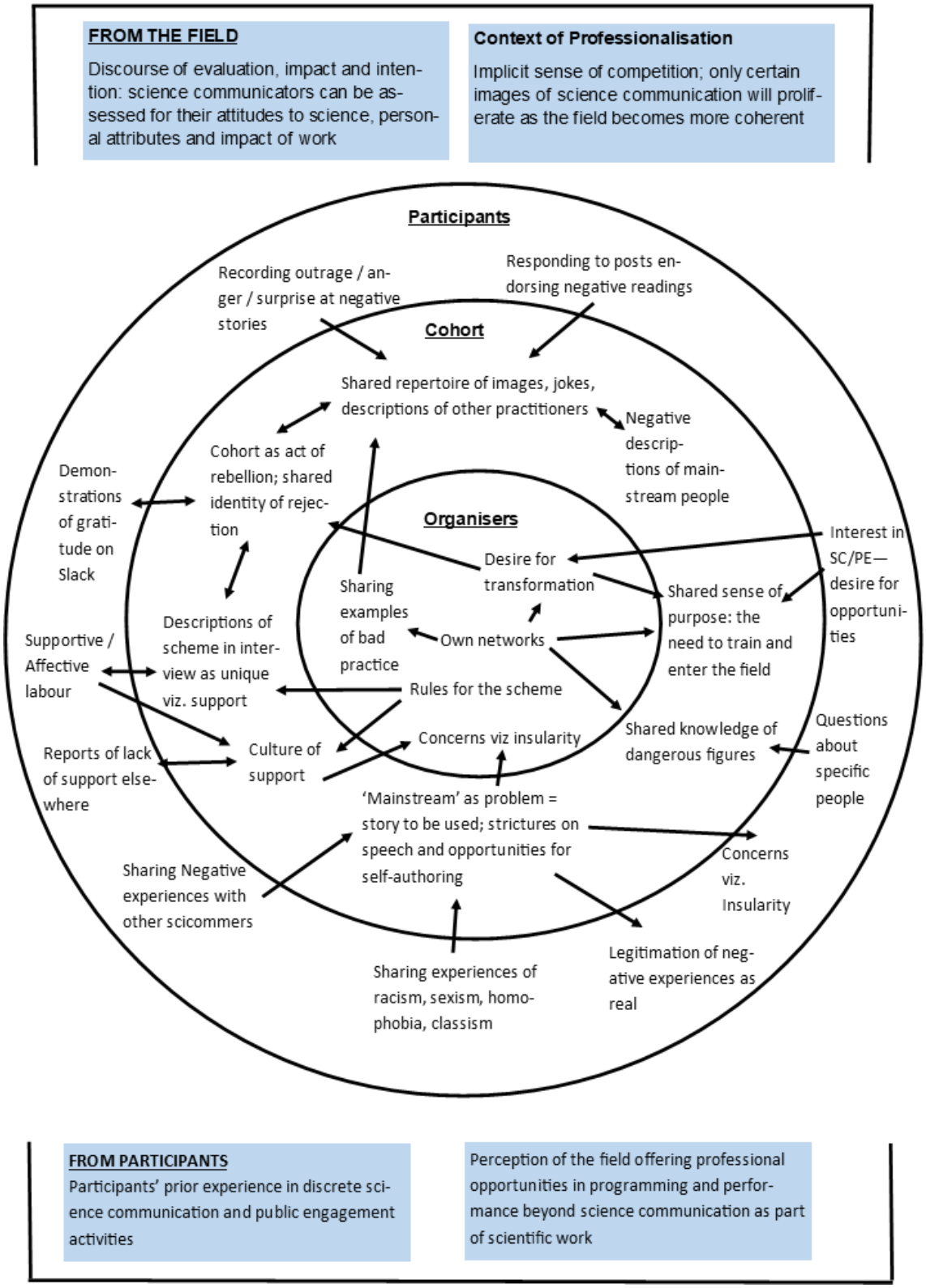

Figure 3: the role of the 'mainstream' in constructing group identity within the scheme

Though both participants and organisers would use Slack to promote contacts they valued, and highlight people outside the scheme that participants could contact and hope to work with, this collation of experiences from the field was for the most part

negative. Negative assessments of other members of the field – or indeed a generalised sense of who science communicators were – abounded, sustained through numerous forms of response. Participants would frequently respond to these posts through the use of emojis or short textual responses that endorsed negative readings of the field, expressing outrage, anger or surprise at the behaviour and personal characteristics of science communicators, or relating personal experiences where they had encountered similar traits and attitudes. As will be discussed more fully in chapter six, participants would also post jokes about and impressions of 'mainstream' communicators, often highlighting the negative traits associated with this distanced group. In this way, an image of the 'mainstream' emerged as a shared repertoire within the scheme (Wenger 1998), as a collection of images and forms of discourse that marked science communicators elsewhere as radically different to members of the cohort. Implicitly, where this repertoire relied upon the introduction of encounters and memories from the outside the scheme within the group's communication, the figure found its most pertinent use in furnishing the internal dynamics of the group, as a short hand for identifying who was not, and could never be, a member of the cohort.

As a figure of the scheme, the 'mainstream' science communicator served as the story that participants needed to tell about the topology of the field, describing the structure, problems and future opportunities for science communication available to them, with also bolstering a 'regime of accountability' (Wenger 1998), with which the community would identify shared problems and forms of practice worth valuing. With the organisers frequently leading discussion early on in the scheme, participants were immediately exposed to account of a field that saw its problems to lie in the characteristics of mainstream science communicators unfairly occupying the spaces participants should aspire to, and whom they should aim to replace. Membership of the scheme thus relied in part on participants' ability to narrate their own experience within these narrative terms (Holland et al. 1998, Chapter 4). Whether or not participants believed the problems of the field to lie in the dominant personal characteristics of the field – and indeed to perceive problems within science communication – or viewed this traits as negative, group communication quickly oriented towards viewing science communicators elsewhere with suspicion.

Participants did not simply mechanically reproduce this discourse however. As a means for describing the structure and experience of science communication, the notion of a (negative) mainstream form of practice and person allowed participants a means for making sense of their own engagement in the field. Participants were often

encouraged to discuss their concerns and negative experiences, which often related to broader issues of gender, 'race' and ethnicity, and class.[29] Though participants often expressed hesitancy in relaying these stories, particularly in being unsure whether their experiences did relate to these issues, the negative account of the field enabled these experiences to be recognised and validated: their experiences were real, because the field was populated by too many 'mainstream' science communicators who were themselves racist or sexist. Though this will be discussed more explicitly in Chapter seven where I report on participants' sense of personal transformation within the scheme, this sharing of negative experiences is reported to highlight the potential for 'self-authoring' that emerged through this figure (Bakhtin 1981). To claim they were a member of the scheme was also to carry a sense of who they were not. Participants had a means for narrating their own experiences in a way that was legible within the community, as having been side-lined through dominant forms of practice rather than, for instance, lacking particular skills or dispositions that they themselves should seek to correct.[30] What drew these stories and forms of interaction together was not the purported reality of 'mainstream' science communicators as truly embodying these characteristics, but rather the proliferation of a discourse that continually reiterated the sense that the cohort was different.

5.2.3: The Good Cohort Member as the agent of change

The tendency of participants and organisers to characterise the problems of science communication as lying primarily in the characteristics of 'mainstream' science communicators, rather than the structure of the field, could well be interpreted as an act of misrecognition, viewing the problems of the field to lie in the aberration of particular 'mainstream' individuals, rather than the broader power relations sustaining such activity (Bourdieu and Passeron 1977). If the characterisation of mainstream was read

[29] . In part this curation of examples of 'mainstream' communicators served a very specific function of bolstering participants' safety, identifying individuals known to be dangerous to work with, particularly where most of the cohort were women. Where participants began to meet and potentially work with practitioners in the field, they could check what was known about them, allowing access to an implicit institutional memory that could mark members of the field known to have a history, particularly related to sexual harassment. Thus the cohort collectively identified specific individuals known to be dangerous

[30] Applying a Bourdieusian lens in this specific instance would of course urge consideration of the validity of such a distinction. If the structure of the field is understood to set the terms of the 'game', and in doing so differentiate legitimate performances and forms of capital, then both accounts of the 'problem' would appear simultaneously true. Science Communication (as a field) would structured in classed, racialised and sexualised forms that would disallow certain performances, so that participants were deficient, precisely for being unable to adhere to the rules of the field. For discussion of the relationship between the field and legitimate performances of science and science communication see Dawson (2014) and Archer et al. (2015).

as a ‘true’ account of the state of affairs, its legitimacy might well be questioned, for being focused upon the habitus of individual science communicators, rather than the field in which the habitus gains meaning, presenting a story of personal deficit and science communication corrupted, contained within the bodies – but not beyond – of certain ‘mainstream’ individuals. If the figure of the ‘mainstream’ science communicator was understood as an attempt to characterise the field as a whole, it might invite the uncharitable conclusion that the organisers and participant did not understand the world around them. Conversely, the invocation of the ‘mainstream’ science communicator standing in contrast to members of the cohort could be read as an attempt to mobilise an ideological level, valorising the scheme through its negative relationship to the world beyond it (Gieryn 1986). Neither interpretation would attend to the specific local conditions in which these characterisations emerged, where they provided a clear rationale for action within the scheme and a notion of change the scheme might aspire to realise. If the field was constricted by the individual actions of mainstream professionals, then different science communicators were the answer.

Where the problems of the field lay in its personnel, there was an opportunity for real change through the mentoring and development of new practitioners, who might embody and emblematise transformative forms of practice. Rather than seeking a highly idealised goal of ‘transforming the field’, which would require the transformation of the representation of science in science communication, how it was consumed by the ‘public’ and the regulation of these activities (DuGay et al. 1997), attention could instead be focused on the transformation of communicators, for whom participants in the scheme might serve as a vanguard. By recruiting, training and broadcasting participants who were already seen to embody a rejection of ‘mainstream’ characteristics, the scheme could aspire to effect change by participants’ abilities to enter the field and, once they had gained prominence and replaced their ‘mainstream’ predecessors, effect the structural change needed to ensure the field’s transformation.

This problem definition also permitted a delayed temporality for transformation. As an imagined future event, the ability of participants to eventually bring about positive change in the field was cited by both the course organisers and participants as a key motivation for the scheme; one organiser suggested that in 8-10 years, this change would become apparent, even when he was unsure what this transformation would look like. Acknowledging that a small-scale scheme focused almost entirely on training events and performance opportunities for the benefit of science communication practitioners was unlikely to deliver immediate broader change, both organisers and participants stated in interviews that the fostering forms of labour predicated on mutual

support might offer a blueprint for their subsequent work in the field, instituting supportive working environments and infrastructures in their own future professional practice.[31] Transforming the field might appear too great a goal, but such transformation could be imagined so long as the scheme could succeed in fostering a new type of science communicator, allowing a more local and grounded definition of success.

5.2.4: Learning through comedy

The group's practice largely coalesced around science comedy performance. Though participants were encouraged to experiment with various communication formats, their access to a network of shows curated by one of the group organisers furnished them with ready-made performance spaces that had been developed through the organiser's own experience of using comedy as a training tool in academic institutions. Rather than being employed for any belief in its efficacy as a mode of public communication, science comedy – both as a form of performance and as a means for building communities around these performances – was understood to offer a potent means for participants to grow in confidence, gain performance skills as well as gaining experience in building the collaborative relationships needed to produce content and support one another in its development.

The use of comedy as a training tool echoed previous university-based schemes that had used researcher comedy nights as a catalyst for institutionalising public engagement. Projects such as 'Bright Club', founded at UCL in 2009, had been initiated as an 'experiment' in both public engagement work and academic-society relations. Pitched in promotional materials as 'the thinking person's comedy night', the public face of the project consisted of regular live comedy nights in which researchers communicated their work as a stand-up set. While promotional and evaluation materials often presented Bright Club as an event intended to build new audiences for academic work, who might be drawn by the promise of new, previously unseen version of science, the project was simultaneously a means for training academics in communication skills and recruiting them to participate in an emerging public engagement infrastructure. Indeed, as described by the organisers who had been involved in producing a version of Bright Club, academics were imagined as the key

[31] Multiple participants, particularly in later interviews, expressed a desire to emulate the scheme by establishing their own networks, using some of the same apparatus, including Slack. Specifically noting the potential to foster a community based on mutual support, these participants hoped to establish a version of the scheme – without the science comedy component – for other groups they felt would benefit from this style of work, including PhD students in the natural sciences and BAME scientists and science communicators.

audience for this work. Where participants overcame the fear of performing their work in a new environment and with different communicative priorities, academics would, it was hoped, realise the importance of public engagement and their ability to participate in public-facing work.

Founded by a newly created unit dedicated to fostering public engagement across the institution, the scheme simultaneously offered a means for the unit to meet and recruit academics to a burgeoning network across the university:

> **Organiser 1**: Bright Club was only a tiny bit of what the Public Engagement Unit did, and it's meant to synch in with all their other projects, so it's a good way of meeting new academics and researchers, because we would theme it, so we'd do one on money, to force us to go and meet the Economics department, and once they've had a good experience doing Bright Club, you can then feed them into the other kinds of Public Engagement, so, I always used to use the analogy of the Public Engagement Unit is a sausage factory, and the raw material is academics who've never done Public Engagement, and the thing that comes out are academics who are working with communities in interesting ways.

While these events might incidentally deliver public value, comedy was awarded far more value as a means for enculturating academics in world of public engagement, with comedy offering a transformative experience that would enrol academics. The opportunity to laugh at their research and enter a space in which academia would be treated with far less reverence offered academics access to a more carnivalesque form of academic practice, where they might lose access to conventional means for conveying their authority, yet simultaneously revel in the opportunity to promote the unexpected, profane aspects of their work and view themselves in a new way (Bakhtin 1984). Moved outside the prerogatives and trajectories of university public engagement wor, within the scheme, comedy would serve as a tool for building a nascent community, through the shared experience of performance. Thus rather than seeking to employ humour as a facet of interactions within education, as it has been used within medical education (see Chapter 2.6.1), comedy would lie at the heart of the scheme's pedagogy, as the core activity around which group work would be based. For a scheme aiming to foster a new, alternative construction of who a science communicator might be, comedy would serve as the engine, as the means to recruit participants through the promise of an exhilarating, terrifying and transformative experience, build their professional competencies and facilitate the constructive space that would form the basis of their trajectory within the broader field.

5.3: Creating a new type of science communicator

As a project for fostering a new type of communicator, the scheme represented a conscious attempt to cultivate a community of practice, with the scheme often being explicitly parsed by the group organisers in terms of Lave and Wenger's work on apprenticeship and community building (Lave and Wenger 1991; Wenger 1998). The community space was imagined as one in which participants would learn how to embody a new ideal for science communicators through close collaborative practice, with the group organisers seeking to engineer situations in which participants would have to work together and respond to problems and meaningful practices that emerged within the group (Wenger et al. 2002). Yet where Wenger characterises learning primarily as a means for ensuring the production of useful, marketable knowledge and products, the process of learning and their outcomes were elided as the forms of meaningful practice: participants' own learning were viewed as the key product of the scheme, and the criterion of its success:

> **Organiser 1**: And then the [scheme] was the extension of that, so saying to a group of people, erm, getting development in your scicomm skills, it's very unfair or it costs you loads of money, I'd say to a bunch of you, we'll do that for nothing, erm, and in return, all I want is a sense of achievement at the end of the year.

Rather than needing to produce a valuable product, enabled through the cultivation of a community of practice, these collaborative practices were themselves awarded a far higher value: the community would be at once the means and outcome of the scheme. Where the aim of the scheme was to produce good science communicators, their practice would demonstrate their ability to work in specific desirable ways. Personal benefit and development, as the outcome of the scheme, would be predicated on participants' ability to exist within the cohort, building a community through which they could collaborate and gain more opportunities. With little restriction on what they produced, participants were instead tasked with fostering forms of practice that would allow them all to become marketable products in the field.

5.3.1: Recruitment

Recruitment to the scheme occurred through an open call, with potential participants submitting a written application alongside an expectation they would have performed science comedy at an affiliated night at least once before applying[32]. Rather than

[32] One organiser framed this requirement as a need for applicants to not be total strangers when applying, particularly where they would be judged on their ability to join a cohort. This condition was alternatively framed at other points in the year as 'I need to have met you'.

seeking specific forms of expertise, experience or professional aspirations, what mattered most was demonstrating a commitment to working within a collaborative and supportive cohort. The written application asked only two questions: what they wanted to get out of the scheme, and what they would contribute to the community. Discussing unsuccessful applications, traits such as wanting too much, overvaluing their prior experience or being unwilling to work collaboratively were seen to position 'bad' applicants as a type of person that could not be accommodated within the scheme:

> **Organiser 2**: Yeah, there were a couple of terrible applications that we, you know, were clear no, there were um, you know people who were more interested in teaching it than being on it, you know I will bring my expertise, it's not about that, it's about what you'll learn as well as what you'll put in. I'm trying to think what else there were. There were people who just wanted to be made famous and that is not a thing that scheme can offer, you know, it's not, like getting an agent, you know […] that's not what it was designed for, and they, no one would have been happy with that situation

Having too much experience would preclude potential participants' ability to work within the cohort, if they sought to enter the scheme as an expert, rather than a cohort member. Where the scheme sought to create a viable community that could provide the basis for future collaboration and work, the need for participants to demonstrate their ability in – and commitment to – working within a cohort simultaneously sought to find participants who might readily align to the values of the scheme and understand their own practice and identity in relation to their membership of the community (See Figure 1, Chapter 3.4.2). Prior expertise was imagined to preclude the opportunity to collaborate and learn, as personal opportunity would emerge through, rather than instead of, this community work: participants would need to want to learn, if they were to fully participate in the community (Wenger 1998, Ch 8)[33]. Rather than seek to transform science communicators who had the (bad) habits and dispositions of 'mainstream' communicators, participants were instead recruited for being seen as a good fit for the community, in need of opportunities and support, but not in need of a radical change in how they viewed themselves or their future role in the field.

5.3.2: Delivering on expectations

As participants were the primary product of the scheme, clear expectations were placed on their participation. While there was little regulation on their outputs, rules concerning how they should behave were codified early in the programme through

[33] In interviews, participants often eschewed any sense that they had a distinct 'role' within the scheme, particularly if this meant claiming a discrete form of expertise. More often than not, they would characterise their role as one amongst many, contributing to one another's projects and offering support, like everyone else.

explicit instructions on how they should make best use of their year in the scheme. Members of the first cohort were asked to provide three pieces of advice for new members, based on their experience of the previous year. Anonymised and collected by the scheme organiser, the advice provided a guide to newcomers of what they could expect to get out of the scheme, how to make the most of their time and, implicitly, the rules they were expected to follow within the community. Collated and paraphrased here, the advice could be read as indicative of what it meant, at least for the first cohort, to succeed within the scheme:

- Don't be afraid to ask for help. People will always want to help you, whether it's professional or emotional. Don't be intimidated by other people in the group: they're amazing, but so are you. But, don't expect too much from people and remember you have to put it what you get.
- The only way to get better at performing is to do more. It'll take you less time to prepare the more practice you have.
- Take the initiative, say yes and try things out. Use every opportunity to get better as a performer and reach the goals you have. Take the opportunity to experiment, you won't get it again.
- Donate your time to helping others. Be in their shows, give them feedback on performances and be there to offer advice and support.
- Work out your brand as soon as you can. It will change, but work out what your core identity is and how you're perceived. Plan the future you want, and make sure you can market yourself in a way that will get you there. Make business cards.
- Keep up to date on Slack so you know what's happening and can be a part of it. Participation relies on you responding quickly.
- Respect other participants and take seriously what they take seriously. Not everything is an experiment, and not every event exists just for you to try something new.
- Don't overburden yourself. You'll burn out, you won't produce as much good stuff, and you won't be able to participate.

Rather than identify communicative competencies participants should seek to develop, public outcomes for their work or indeed any form of practice specifically related to science, as have appeared as desirable training outcomes elsewhere, these definitions of good practice related exclusively to participants' behaviour to one another within the scheme. Participants were promised enormous benefit in membership, though only through sustained engagement and participation. Working primarily within and for the community, participants were urged to focus their time on forms of practice that would simultaneously bolster the community's own permanence, much like Wenger noting the importance of sustained mutual engagement for the development of community

practices and repertoires (1998, Chapter 2). Participants' opportunities to explore and experiment with public engagement and to access professional and emotional support would come only through providing similar support and commitment to others. Stipulating the need *that* participants contribute to the scheme, rather than mandating what this participation should lead to, supporting and sustaining the community would be participants' primary goal, and basis for their own development.

5.3.3: Becoming a professional in isolation

Where the model of good practice was predicated on participants' ability and willingness to work together rather than on the cultivation of specific communicative or scientific competencies, regulating participants' conduct within the scheme proved a greater concern than their public outputs. Where characterisations of professionalism in the literature have frequently foregrounded the exceptional 'scientific' features of science communication, so that competence is understood to depend at least in part on specific attitudes and knowledge related to science (e.g. Besley et al. 2013, Carletti and Massarani 2015), good practice within the scheme relied far more upon participants' behaviour towards one another. Good practice in this sense would depend more upon instituting personal characteristics such as humility and collegiality within the forms of practice carried out by the group. Rather than requiring participants to deliver public value, reach new or specific audiences and deliver measurable public outcomes, as might elsewhere be seen as markers of 'good science communication' (see Medvecky and Leach 2017; Burns and Medvecky 2016) participants would need for the most part to learn how to work in a way that exemplified a more localised ideal.

The ability of the scheme to prioritise a new type of science communicator as its key outcome rested upon its relative dislocation from the field. Though the scheme had emerged through and in response to the larger field of science communication and public engagement, and most participants aspired to eventually establish a professional role within it, the structure of the scheme nevertheless permitted a degree of autonomy, allowing participants to play – and be judged – by different rules (Thornton 1995; Holland et al. 1998). While participants were in the scheme, there was space for experimentation and play, predicated on the scheme serving as a rehearsal space in which they could receive training, support and opportunities to build their confidence, primarily serving participants' own development and learning. In this way, the scheme offered a form of simulacrum (Baudrillard 1994), real in so far as their performances were public, the skills they acquired having relevance for the field, and training delivered by experts in science communication, without the need for

participants to be immediately assessed as professional science communicators. Consequently, the implicit rules for science communication discussed in the literature review concerning science communication as a form of dialogic event were less crucial, and indeed never enforced. Participants did not have to prioritise, for instance, ensuring the active role of the audience in events, the tailoring of communication styles to audience need and expectation, or to ensure mutual learning and benefit (see sections 2.2.2/2.2.3). Able to imagine their future trajectory in the field from afar, this training could nevertheless occur in a space autonomous enough to allow forms of practice engineered to foster the type of science communicator desired by the course organisers, so that participants could learn in relative isolation.

The creation of a space designed to support and reward participants perceived to lack opportunities elsewhere and to already embody the characteristics of the good science communicator suggests parallels to the science capital project (Archer et al. 2015). Where science capital urges the transformation of the field, rather than the participant, the composition of the scheme suggests a similar purpose, albeit through the creation of a new, restricted space dislocated from the field in which participants could flourish. Potentially possible only through this dislocation, the scheme organisers aimed to build a space where different performances of science communication could be both manifest and legitimated, free of the structural restrictions inhibiting equitable practice, at least in regards to the opportunities and systems of recognition afforded to practitioners. The scheme would be one that was designed to recognise and reward participants' own characteristics, as embodying a new version of a science communicator, rather than perceiving a deficit in need of correction.

However, this autonomy did not mean that participants were entirely free from any expectation that they would adapt themselves to the demands of the field. Following Archer et al (2015) in adopting a Bourdieusian lens, while the figure of the 'mainstream science communicator' provided a means to parse dissatisfaction with the field, highlighting the symbolic, cultural and social capital and dispositions of science communicators that were thought to unjustly imbue success, it did not challenge the notion that such a profile existed, and that participants might be assessed in terms of their ability to perform an alternative. The reliance upon a narrative that placed the problems of science communication within the bodies of practitioners elsewhere entailed a sense that only certain people could be good cohort members and participants would need to ensure that they were seen to similarly – and authentically - embody this new type of professional practice. Thus, while the science capital

approach has sought to disrupt the naturalisation of only certain identities as being appropriate for science, by highlighting the composition of the field in which such performances are rewarded, the scheme engaged in the opposite, seeking to naturalise a new understanding of what it meant to be a good science communicator, even if this version of a good science communicator would not yet be recognised outside the confines of the scheme. The move away from the broader field was not necessarily an attempt to remove rules and hierarchy, but rather to redefine them (Thornton 1995). Participants would need to learn how to be flourish within the scheme, learning what it meant to be supportive, selfless and collaborative, and how to demonstrate that their practice fulfilled the role expected of them.

5.4: Learning to be a good science communicator

Within an imaginative architecture that positioned the scheme simultaneously as a space of experimentation, a refuge from the field and as a site in which to prepare for their future roles as science communicators, participants were expected to occupy multiple positions simultaneously. As a community of practice, the scheme was both organic and cultivated (Wenger 1998; Wenger 2002), as a terrain with little restriction on the production of content, yet one in which they were expected to learn the rules and work to stabilise an emergent community. Learning to be a science communicator thus coalesced primarily in learning how to belong within this localised world. Granted access to a discrete community seeking to play by its own rules, learning to be a good science communicator was realised in the more localised task of learning to be a good cohort member. Where, as Wenger notes, the activity of learning can be characterised as the acquisition of competencies related to meaningful activities within a community and increasing involvement in the negotiation of these matters of concern (1998, Ch 1), participants would need to learn what mattered within the cohort. Across the year, two primary forms of practice emerged: learning to plan and deliver comedy content and events and learning to support one another.

5.4.1: Learning to belong

While the project goals of fostering a supportive and mutually beneficial working environment suggested rather abstract aims, these aims were quickly concretised in a raft of discrete activities. Event planning, preparation and delivery emerged in the scheme predominantly as a logistical task. Supported by specific input related to joke writing, performance and event planning, participants devoted a large amount of time to scripting sets and producing content. Often using Slack to record this work, participants would scout and liaise with venues, identify roles for one another, discuss formats and ideas for shows, produce publicity material and promote the events using their own

networks. A large amount of the data produced throughout the year on Slack related to event planning, and participants produced a record of their negotiations with one another and showed that events were being managed. With these tasks requiring substantial amounts of labour, far less attention was paid to reflexive discussion of the purpose of their practice, as participants rarely explicitly discussed the purpose of this work or the formats they were producing. Echoing Stilgoe et al's (2014) characterisation of science communication being a field dominated by questions of 'how' over questions of 'why', the delivery of public events appeared within the scheme as an enterprise mediated for the most part by technical concerns of performance and planning.

Yet these labours were rarely awarded prominence within the scheme, either in the amount of work that participants contributed, or in how they imagined and described the scheme. In interviews, participants invariably described the principal purpose of the scheme to be the explicit forms of support they received and could provide to one another. Participants frequently reported that the feature of the scheme they most valued was knowing they could ask for help or emotional support, vent, or share negative experiences related to their professional and personal lives, confident they would gain a response. Providing support was concretised as a specific form of labour within the scheme, in part through the creation of a specific communication channel on Slack [#support], which participants were expected to regularly check, with many participants reporting in interview that it was the channel they used the most. Though conversations on this specific channel were not collected, these labours of support appeared on every channel. Participants would respond to posts to show that they had read them, posting encouraging replies and messages, frequently announce when they had free time to read over sets or other work, publicly congratulate one another on successes and achievements and use Slack to check in on other participants. Beyond Slack, participants reported that support often took more tangible forms, such as meeting other participants for coffee, reading and commenting on draft comedy scripts, website designs or event formats, or providing advice in response to specific problems that were raised within the community.

Learning how to, and demonstrating that they could, offer one another support proved a key aspect of their membership of the scheme, as participants often noted that the offer of support was contingent on their ability to support others and be recognised as doing so. Support needed to be evidenced and documented, particularly where Slack offered a textual record of group interactions and thus a chance to verify participants'

supportive labour. Discussing how support worked within the scheme, one participant highlighted the need for support to be conspicuous to the rest of the community:

> **Participant 1 (C2)**: I try to be as helpful as possible, but in the past, like, cos obviously, erm…everything's that happened in the like past six months has been a little bit mad, so I think that now that I'm like alright again, I'll be able to take on a lot more than I have been doing
> **ETB**: But you think it's important to put it on Slack and make it-
> **Participant 1 (C2)**: I think so, I think it's important to have it so everyone can see, because if you're, if you're doing what I've been doing, which is like saying to XX, by the way that was really good but also, also you might want to do this, or to other people, no one else knows that you're doing that, but everyone else can see that, you know, people are putting stuff on Slack so they might not respond to me in that manner.

Learning to be collaborative and supportive within the scheme entailed, at least in part, the ways in which support could be evidenced to ensure its continuation and that individuals would be recognised for their work. This is not to suggest that these displays of support were cynical, or that participants felt the support they received was not genuine, but rather to note that where support emerged as a specific concern and form of practice for the community, it acquired particular repertories and forms of reification that facilitated its continued emergence (Wenger 1998). Consequently, participants' standing in the scheme depended on their familiarity with these local practices and being seen on carrying them out authentically. If participants did not act within these specific constraints, they could not guarantee future opportunities within the scheme. 'Being supportive' served provided a crucial form of capital within the scheme, with participants aware they might status should they be seen not to embody such an attitude.

5.4.2: The Good Cohort Member / Not being 'mainstream'

Immersed within these labours, the scheme was transformative in participants' understandings of what made a good science communicator. In both discussions recorded on Slack and at events across the year and in interviews, participants frequently reported a perception that good members of the cohort, as those most committed to the ethos of the group and known to be adept at providing support, could expect – or least deserved – success within the broader field. Goodness would travel. To be a good member of the cohort was to be a good science communicator, with the two discussed together as though identical. Participants' assessments of one another as good science communicators were formulated in the language of the scheme, particularly when these assessments were negative, highlighting other participants' inability to collaborate effectively or fully commit themselves to the ethos of the group.

A ‘regime of mutual accountability’ (Wenger 1998, 81-82) was evident, if not reified, as participants commented on the appropriateness of one another’s membership. Envisaging the ‘good’ cohort member largely through the absence of negative characteristics, participants often noted where they felt other members of the cohort were falling short.

In assessing one another’s contributions to the scheme, the failure to develop collaborative practices and not making the most of opportunities were both positioned as hindering the group’s development:

> **Participant 2 (C2)**: Yeah, I think that, there’s two different types of people in the scheme, there’s people that, [organiser’s] team, you know, they are the ones that go on and want to help others, and then there’s others that just generally, don’t [laugh]. They’re more than willing to attend things that will benefit them, but when it comes to progressing further than that, they don’t really do that much, or they’re very flaky, or it’s sporadic, and I think [the organiser is] very good at identifying who those are, and they invest less people there…but for instance like I did an event recently with [other participants] and it was cancelled and then it wasn’t cancelled and I was just, the lack of organisation and the lack of communication really frustrated me, [other participant] is predominantly been a really difficult to me because she is just so flaky and she is so like, she’s a nice person, but as a [scheme] collaborator, she’s been very unreliable

For being unreliable, the participant was positioned both as a bad member of the cohort, ignoring the directive that participants work with another, and as a questionable future collaborator, assumed to be a bad person to work with outside for lacking the characteristics valued within the scheme. Eliding participants’ work within the scheme and their suitability within the field, a good science communicator was one who excelled with the scheme. Though participants did not explicitly evoke, and were potentially unaware of, Lave and Wenger’s work, it is notable how a good science communicator was positioned by this participants largely in terms of core membership, moving from peripheral and sporadic participation to something more involved. As a member of the organiser’s ‘team’, this participant could present their own participation as a model for how all participants should behave, participating in the negotiation of what constituted good membership (Lave and Wenger 1991). Within this definition, participants occupying a more peripheral position could be criticised for being flaky or prioritising events that carried personal benefit, demonstrating – above all - that they were not part of the ‘team’.

Concurrently, criticism was levelled at participants who were seen not to be making the most of their time. As a space of experimentation and opportunity, the imperative that

participants contribute was evoked as a means of assessing participants' suitability for the broader field. Speaking half-way through the project, multiple participants expressed disappointment that other members of the cohort were failing to capitalise on opportunities made available to them:

> **Participant 3 (C2)**: Is that the part I go really shady? I feel like the people who didn't take part well enough, it depends how you're considering success, isn't it, they might have done what they wanted to do but just not taken part, but I just think it's a shame the people who aren't as involved when they can be, because obviously there are people who have to take time out because it's extremely overwhelming sometimes, the amount that people are doing, and the amount the Slack goes off, I'll probably have 46 messages on it after this when I check my phone, but yeah people who didn't take part for the whole year, it felt like a shame, because there are people like XX who could have been in that year of the scheme and would have done every single thing under the sun and probably cooked for everybody at every event, so yeah.

Characterising the strength of science communicators by metrics closely aligned to the ethos of the group, the narratives structuring the scheme provided participants with a discursive resource for narrating their own and others' practice, albeit often negatively, as models to be followed within the scheme. Rather than rely on metrics found elsewhere in the field, such as the symbolic capital mobilised through academic or professional accreditation, or the delivery of particular desired public outcomes or performance skills (e.g. Baram-Tsabari and Lewenstein 2013; 2017), participants' position within the scheme became a proxy for elucidating the type of person they were.

While the figure of the mainstream science communicator offered a language to imagine participants' relation to and future trajectories within the field, it simultaneously offered a more immediate means of regulation and discipline, so that participants performed and documented their behaviours in ways that showed they were the right sort of cohort member. As an implicit stricture on how they should behave if they wished to retain membership, this discourse at once permitted participants to identify failures elsewhere and serve as a reminder that they could be interpreted in a similar way. A clear tension in the mobility of this highly negative account was the absence of its alternative: if the 'mainstream' science communication served as an emblem of science communication gone wrong, it was far less certain how to get it right. If supportive labours and dispositions offered a form of sub-cultural capital, lacking this capital might be clearly detrimental, but possession was no guarantee to be enough to succeed. The mainstream science communicator offered a contingent repertoire without an empiricist counterpart, other than an implicit sense that good practice and

good communicators did not need explanation (Mulkay 1976; Gilbert and Mulkay 1984). In seeking to show they were good, participants would need to rely for the most part on not getting it wrong.

Knowing only that they were expected to participate, a recurring theme within interviews concerned the ambiguities of the scheme's rules and expectations. Rarely voiced elsewhere, participants often stated that they unsure what was expected of them and particularly whether they were contributing enough. Where the scheme had developed a repertoire to explain the failures of participants to meet expectations, participants often expressed concern that their conduct within the scheme might be read in such a way. Participants often reported in interviews that they felt they were doing too little in the scheme, particularly in comparison to others, and that their gratitude for the opportunities in the scheme had not been fully communicated. In these discussions, participants often sought to assert their commitment to the project, particularly when commitments outside the scheme had limited their participation:

> **Participant 4 (C2)**: I guess like, I struggle, I had a lot of like fear of missing out, or feeling like I wasn't doing enough when I was living [outside London], but it couldn't really be helped, you know, but I definitely felt less a part of the group then, but the more I've spoken to people, everyone's felt like that at different times, even like, even people based in London feel like that when they've gone through a busy few weeks or anything, yeah.

Non-participation was an activity that elicited explicit justification within the scheme. With new calls for help appearing almost daily on Slack, urging participants to perform in shows, attend as audience members or provide feedback, participants unable to do so would frequently respond to the comment with an explanation of why they could not take part, often at once stating a willingness to participate and a regret that it was not possible. By contrast, silence might well be read as avoidance. In interviews, questions concerning their experience and participation in the scheme often prompted negative forms of self-evaluation, with participants perceiving their involvement in the scheme to be less than that of other members of the cohort, and a problem in need of redress, with a concurrent aspiration that they would participate more fully in the future. Aware that expectations had been placed upon them, participants frequently made use of available spaces, including interviews, to publicly state at once their commitment to the scheme, and to present their non-participation as a source of guilt.

Participants who were ostensibly more involved in the scheme, by performing more often in comedy nights, regularly assuming responsibility for event logistics and contributing more frequently to online discussion, similarly sought to demonstrate that

their participation adhered to the principles of the scheme. They frequently noted a concern that the frequency of their involvement might be read as an attempt to monopolise opportunities within the scheme at the expense of other participants. While all participants were expected to take part, participants often expressed a concern that they might be taking too much and sought to show that they did not intend to deny others the same opportunity. When accounting for why they felt they received more opportunities to perform and produce content than others, participants sought to explain their relative distinction in the space in terms of the scheme's architecture, rather than any claim about themselves:

> **Participant 3 (C2)**: I think, there is a feedback loop with it, I think if, if you're the kind of person who participates a lot in Slack and helps others a lot, when you ask for help, the people you've helped are going to help you back, whereas some people who've been less involved possibly, and then just reappear to have a massive crisis and be like can you all help me do this thing now, when they haven't been there for others, I don't think people are always necessarily the most supportive to them, but even then I think a lot of the time people are, pretty good with, with supporting others.

Rather than attributing their success to any personal strength or skill as a comedian, the participant characterised their more central position in the scheme as a natural outcome of an equitable transactional economy. Those who achieved a privileged position within the scheme did so simply by contributing more and gaining more opportunities in turn. Presenting their own position as a function of the general structure of the scheme, the participant negated an interpretation whereby they gained prominence through ability or through deliberately taking up a disproportionate number of opportunities, positioning opportunities within the scheme as available to all, yet distributed through participation.

Together, these extracts suggest that the figure of the 'mainstream science communicator' did far more than simply describe the problems of the field and to implicitly evoke an apparent corrective and alternative to be found amongst the cohort. As a means for organising, understanding and regulating their work, these narratives served as a the story that participants needed to tell about themselves while they were in the scheme, at once constraining and enabling participants in their collective negotiation of problems and the development of practice (Holland et al. 1998, ch.4). The articulation of science communication gone wrong urged particular responses and the development of complex forms of labour that facilitated the growth of the community. Similarly, in the absence of a clearly articulated counter-narrative, which would state clearly how the ethos of the scheme would be cultivated and protected,

and what it meant to be good, the figure was similarly generative, as participants developed means for framing their participation in the scheme as positive and demonstrating their commitment and the legitimacy of their membership. Where the scheme sought to cultivate a new form of communicator, participants acquired the specific local competencies that allowed the 'good science communicator's' realisation: through the ways that they learnt to behave and speak about the scheme, they became the science communicator they were expected to be.

5.4.3: Breaking the rules

Where a moral economy circulated within the group that sought primarily to measure and regulate participants' conduct within the group, failure to adhere to the rules of the group - or being seen to - placed participants at risk of marginalisation. Given the repeated articulation of the need for the group to work above all for one another, and never to take too much, participants who worked in ways thought to inhibit a broader group benefit were likely to be censured and have their opportunities within the scheme curtailed. For one participant who had spent most of the scheme working independently and gaining paid professional work, working outside the delineated events and labours of the scheme were read as evidence that they had failed to become a good cohort member:

> **Participant 5 (C2)**: […] like I've been committing what I promised to commit, which is coming to London and performing at [the comedy night] for free, obviously I'm outside of London so it's a bit more of an effort to do that, but I did – [one of the organisers] did make me aware that that was going to be part of the commitment and I did agree to that, but I suppose I hadn't collaborated a lot with different people in the group, and that's largely because I had my own independent projects happening, and lots of talks being booked and things like that, so I wasn't necessarily performing under the umbrella of the [scheme], I was just performing as an individual performer, and as a result I got a result saying that like, we're going to remove you from all content groups, we don't want you skimming for opportunities, we, er, you know, don't forget that you need – you're so focused on your own success that you've forgotten you need other people's help to get there, um, and things that were, like came across as quite rude to me and quite, quite cruel, particularly because, I think there's a lot on women not to, like to focus on their own success, and not to be selfish, you know […] And, and like quite hurt I guess, because, it was quite a, like, it felt like it was quite a, worded in quite a personal way, like to say you're focused on your own success, you've forgotten you need other people's help to get there, it wasn't just a kind of functional […] it was quite – it felt like, almost, yeah quite personal, so it was quite hurtful, but I didn't respond, because I didn't know how to appropriately respond

As an ‘individual performer’, rather than someone working ‘under the umbrella’ of the scheme, this independence marked their status as an outsider. However, rather than meaning they were not *yet* a full member of the cohort and retained only peripheral membership, this outsider status indicated that they were a danger to the group, as an individual who could never belong. Their very presence in the cohort’s shared spaces threatened the moral economy of exchange and mutual benefit: they were ‘skimming for opportunities’, stealing from the group rather than working for it.

In transgressing the group space, the participant did more than simply reveal forms of practice that could not be tolerated, however. While the participants’ actions, and subsequent exclusion made clear the expectations placed on participants’ labour (Jenks 2003), these actions permanently marked the participant as the wrong type of person, as one who did not - and could not - belong within the scheme. Noting how personal this criticism felt, the participant reported that they had been censured less for what they had done, but rather who they were, with their lack of contribution indicating they were selfish, opportunistic and unwilling to work in ways expected by the group. Their actions had revealed who they ‘really’ were, at least when measured against the expectations of a good cohort member, which required aligning their practice to the demands of the community, which in this instance appeared a more coercive demand (Gee 2000-01). In doing so, they had shown that they were just like everyone else, tainted by the ‘mainstream’ and in need of reproach.

In responding to the accusations they felt had been made against them, the participant offered an alternative narrative. Rather than being the wrong type of person, who did not - and could not - exist within the scheme, they had instead moved beyond it, achieving the success they perceived the scheme to promise and expect:

> **Participant 5 (C2)**: If the message – I understand the removal, like we don’t want, like essentially dead weight, someone who doesn’t participate, I do understand that, but I think if the message had been, you seem to have outgrown the group, or you’ve got a lot going on, we understand but like, because of that we’re going to remove you from the website, we don’t feel it’s reflective of, like active participants, I would have been that’s completely fine. But the way it was phrased and the way it happened, it felt very unceremonious and I feel a bit awkward communicating with any of the group now, because of, because of that happening, I see myself as like booted out.

As a story of transition, the participant stressed their graduation, positioning the scheme as a training ground from which they expected to leave, so that their non-participation in the scheme should be interpreted as a sign that they no longer needed

the scheme, having the competences required to do science communication 'for real'. They did not need to aspire to central membership of the scheme, when they already gained what centrality presumably promised, that of easy translation to the field at large. Yet as an attempt to construct a personal narrative from the figures within the scheme, the participant nevertheless had to 'wear' the designations placed upon them within the community (Holland and Lave 2001), so that their attempts to recast as a stepping stone they no longer needed simultaneously marked an awareness they could not return. Where a good cohort member and a good science communicator were the same person, their success was decidedly illegitimate, at least within the logic of the scheme. The participant's success was an act of transgression, acknowledged within the scheme as evidence that the participant's engagement with the cohort had been inauthentic (Thornton 1995), threatening the stability of a space that sought autonomy as a goal in its own right.

5.5: The Good Cohort Member within the broader field

While the scheme offered participants a wealth of opportunities within the space, the resources available to participants could not guarantee their success elsewhere. While within the scheme they were able to play by local rules, and participants' practice was acutely focused on the articulation and reification of the community's own norms, this achievement might yet prove detrimental. Where participants had moved from peripheral to core membership of the simulacrum of science communication offered within the scheme, they did not know for certain whether membership of the scheme would offer a form of apprenticeship within the broader field (Wenger 1998, Ch 5). While participants might presume that the specific skills they had acquired would be useful elsewhere, where the community focused upon fostering a new type of science communicator mediated through the demands of their shared space, the relative isolation of the scheme might result in a performance of science communication that could not work elsewhere, particularly if their subsequent performances of science communication would invoke traces of the group's desire for exclusivity and alterity (Bakhtin 1981). While participants had engaged in the cultivation of a deliberately dislocated and alternative space within the field, they might have become too dislocated for the training to be 'real'.

5.5.1: Out of the cohort, into the field

> ***ETB**: I've been asking everyone who's been finishing their year first, so how would you describe it [the scheme]?*
> ***Participant 6 (C1)**: A cult.*
> ***ETB**: OK*
> ***Participant 6 (C1)**: It's not a cult, I'm sure everyone else has said that as well.*

Where participants discussed in interviews whether they valued the scheme, responses often pointed simultaneously to the scheme having intrinsic value and a concern that this value would not be recognised elsewhere. Science communicators who were not embedded in the scheme would not be able to see the mechanisms and labours of support fostered within the group, or the ways that participants had been transformed through their participation. The isolation of the scheme might render the boundaries of the scheme are impermeable (Wenger 1998, Ch4), disallowing other members of the field to acknowledge its value:

> **Participant 7 (C2)**: No, no I don't think it's easy to show the value of it because I think it's very, it's very subjective. It's very personal, when you're within it, so I think people who are, who are on the Slack and people who take part, would probably say that it's something very different to people externally saying, oh you're a group of people who do […] often funders or particularly things within academia, they want like numbers, they want audience participation, they want follow ups, they want evaluations, is not really what is done, so, no maybe it's not as easy to quantify.

With other science communicators unable to bear witness to the practices that had been fostered in isolation – and in opposition – to the field, participants were aware that their membership of the scheme, both in itself as a form of symbolic capital, and through the practices they had developed, might lack broader recognition, problematising their ability to mobilise their experiences in establishing themselves as professionals.

Moreover, rather than membership of a scheme simply allowing the acquisition of capital that might lack exchange value within the field, participants recognised that belonging to a scheme engineered to stand outside the field might prove damaging, almost as a form of negative capital. Participants' commitment to building the community might be read as a rejection of and unwillingness to engage with mainstream practice and other science communications. The amount of labour devoted to fostering a new type of good science communicator might ironically be read as a sign that they were bad for the field:

> **Participant 4 (C2)**: I think like there's so – there's so…again because like science communication doesn't have a unifying voice and there's so many different things going on, like I don't – there is very little of it that is all good or all bad. Like, [the scheme] has its own negative reputation in certain circles…you know, and I think all of us staying away from those circles isn't going to help any of us get booked by certain organisations or groups, erm…I mean I was told at [professional event] that I was falling in with a bad crowd, because I'd just, had just been announced [that participant was in the scheme]

If participation in the scheme entailed commitment to membership of just one local community amongst many, as just one niche within a broader ecology (Davies and Horst 2016), commitment to the scheme might entail the loss of opportunity to enter other spaces: while the scheme was necessarily embedded within a broader constellation of science communication spaces, their ability to traverse their spaces was not assured (see Wenger 1998, Ch 5). As the participants' comment suggests, if the field consisted of multiple local communities with their own rules rather than an homogenous whole against which the scheme could be defined, these communities might be similarly localised in their expectation of alignment and engagement with their own communal understanding of what mattered. Participants' time training might well be read less as a precursor to engaging with and eventually transforming the field, but rather a refusal to engage with other communities.

A similar concern was expressed by participants discussing the relationship between the scheme and their role as PhD students in the formal sciences. Where science communication was not part of their workload, participants reported that they often felt compelled to conceal the extent of their participation in the scheme from their supervisors, concerned that substantial commitments outside of their PhD research might be interpreted as a lack of dedication to their research:

> **ETB**: Had you, had you deliberately not told them?
> **Participant 3 (C2)**: Yeah, because I didn't want them to think I was spending a lot of time doing stuff that wasn't my PhD – which I am! -…yeah, I didn't want it to be something they could beat me with, if I wasn't, I don't know, hitting targets or whatever.[34]

Where science communication work – at least to the extent required by the scheme – was not recognised as a legitimate form of scientific practice, participants risked losing standing as a scientist, in lacking due commitment to their research project (see Wright et al. 2015 for discussion of the barriers to participation in science communication). While these participants did report that their supervisors in general were often supportive of science communication work, as they worked within the particular confines of a PhD, too much attention to science communication could easily backfire.

[34] Though the relationship between the scheme and academic research was frequently discussed explicitly in interviews, it also recurred as a frequent topic of discussion on Slack. Participants often expressed concern if members of their lab discovered the extent of their involvement in the scheme, or sought advice as to whether to tell their supervisors about their science communication work, concerned that they would be seen to be lacking commitment. Other participants often sought to assure them that they could – and would be advised to– say little about the scheme.

5.2.2: Spending too much time in the scheme

When discussing the relationship between the scheme and the broader field, participants highlighted a related concern that the time spent within the scheme, in which they had devoted large amounts of time responding to the local demands of the cohort, precluded them from developing the skills and attitudes that would enable them to join the field. The 'safety' of the scheme and focus upon mutual support risked inhibiting opportunities for critique, with members of the first cohort noting an unwillingness to receive criticism:

> **Participant 8 (C1)**: Yeah, but they never take me up on it. So I did one, so I'm trying to get, like I've offered to do it a couple of times and I gave one person some feedback and I thought they were really receptive to the feedback, and then I've asked a couple of other if people want feedback for stuff and they, have, I don't know, I think they need a bit more time, because they, maybe aren't as much as, I don't know actually how long it took us, [the first cohort], to bond properly, um, but I don't think that they trust each other enough, which I completely empathise with, when I first started in [the scheme] I was like…you haven't got anything like, that I wouldn't be able to work out myself.[35]

Where the scheme had been positioned as a supportive, communal space, members of the first cohort and the group organisers noted that criticism was not seen as a form of support by the second cohort. Despite frequent calls from the organisers that participants be more critical of one another's work and performance style precisely to help them improve, such calls were rarely heeded.[36]

The labours of support constructed by the group, focused primarily on ensuring emotional support for one another and building a communal space, while often celebrated, were acknowledged to potentially preclude the acquisition of professional competencies the scheme intended to develop:

> **Organiser 2:** I think there has been a spiral in [the scheme] in that, the kind of, I'm too busy to do anything, self-care language, which is really lovely, because they say I'm struggling with someone and everybody rallies round and says,

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[35] Unexpectedly, such comments were not found on Slack, but were recorded in interviews and conversations outside the purview of members of the second cohort, for instance at events which members of the first cohort attended to support the new cohort. A frequent criticism of the second scheme was that they didn't know each other well enough to be critical, and were too wary of being unkind and upsetting the supportive infrastructure of the community, to the detriment of their own development. Whether members of the cohort deliberately withheld from being critiqued is unclear, particularly in offering their scripts for comments from other members, as many participants reported that they spent increasingly little time scripting and writing sets, becoming more confident in partially improvising stand-up or writing their sets on the day, so that there wasn't time for this criticism.

[36] The organisers would frequently post on Slack the day after shows instructing participants to provide feedback on one another's sets, as well as offering their own – largely constructive - criticism

> let's help you, has occasionally gone too far the other way in that, it's like the best way of being in [the scheme] is to do nothing, to make sure that you don't get overstressed, and actually I think sometimes it would have been nicer if everyone had gone, you should try and do this thing, because it will make you happy, even if you're stressed. And I think I fell foul of that a few times, when I said 'Ah I'm really struggling with this thing' and everyone would be like oh you should take two days off, and I'd be like 'Oh yeah'. Actually no I'd feel better if I got the thing done because…it's my job. And that's going to lead to better outcomes if I've done the work, so I think there has been a potential negative feeling around [the scheme], the kind of woe is me, I can't do anything life's so hard, which hasn't turned into interesting comedy in a way that I think, some of the other people have managed to take that feeling which we all have and use it in a productive way.

Where the scheme allowed and encouraged participants on the one hand to experiment with different forms of science communication and build collaborative networks within the scheme, and on the other to use the scheme as a bridge for future work, spending too much time working for the community might backfire, as a move away from the field writ large. The vibrancy of the community was, in this organiser's view, to its possible detriment, where the strength of the community and identification of share enterprises has coalesced around concerns that were potentially less translatable to the field, even if valuable within the community. Given the highly localised figures of good science communication and the good science communicator that emerged within the scheme, too much attention to these forms of practice was positioned by some participants as a waste of effort, committing to local practices and concerns that carried little value elsewhere. For these participants, the move to cultivate a new type of professionalism rested, counter-intuitively, on an abnegation of professional responsibility:

> **Participant 9 (C2):** I would have been happy with a more professional relationship, like, just, you know commit to something and if you commit to something, like be honest about what level you want to commit and then follow through, and don't waste time kind of, faffing around and going Can I do it, Can I not, in an emotional way, rather than like, a commitment kind of way, just – just I would have been happy with a professional relationship, and I feel like that professionalism has been missing.

Rather than providing a clear trajectory into science communication, as a form of peripheral membership through which participants gain increasing influence and centrality (Lave and Wenger 1991), the autonomy of the scheme suggests a trade-off. Success in one sphere might not guarantee success in another, and would depend on participants' ability to balance the different demands placed on them by seeking membership of what might prove highly differentiated communities within the field.

Where participants had acquired the competencies to excel within the scheme, they would need to ensure that they had the skills and dispositions required to gain entry and standing within the broader constellation of the field.

5.6: Summary

This chapter has analysed the structure, activities and rationales underpinning the scheme through the lens of the 'mainstream science communicator' as an arch-narrative that identified problems in the broader field, highlighted achievable forms of correction and provided a shared repertoire with which participants might understand, narrate and regulate their work. It is clear from the analysis that where this figure appeared to offer a substantive account of the composition and dispositions of members of the broader field, the veracity of this account mattered little for the ways in which it was used. Indeed, where participants' labour was so often focused on working within the scheme, there was arguably little opportunity to discover what 'other' science communicators were really like. Despite evoking the broader field, the figure of the 'mainstream' science communicator found elsewhere found valence within the specific confines of the scheme, as a means for sustaining the group's sense of cohesion, and justifying its dislocation from the broader field. Without needing to substantiate a clear account of how they were different, a negative account of practice and personnel elsewhere provided the discursive means for forging a separate niche in the field and space in which to support one another and produce comedy events as means for fostering a seemingly new type of professional science communication.

The primary contribution of this chapter has been to substantiate a likely uncontroversial claim that the training in science communication is far more than the acquisition of particular competencies, but reflects a much broader process of socialisation, which in this specific instance was mediated by attempts to learn and embody good membership of the community. This scheme thus represented a form of community of practice in which group membership was both the means and marketable outcome of learning. Indeed, characterising training as a process of participants encountering, internalising and mobilising professional norms and discourses within practice and their practice coheres to Lave and Wenger's work on learning and more broadly aligns to STS accounts of scientific enculturation (e.g. Merton 1973; Mulkay 1976). This is not to claim that scholars who have written specifically on training would deny that learning science communication is more than the acquisition of technical skills, but has instead sought to explore the specific local meanings and implications of professionalism and good practice that general accounts of training do not have the space to discuss.

However, where accounts of training in the literature suggest a universal story, I have adopted a more local view. In doing so, the chapter has highlighted specific narratives that emerged within the scheme, for instance the elision of good science communicators and good cohort members, working primarily for the benefit of other communicators. Crucially, the locality of these narratives was both productive and restrictive to participants. As participants navigated the scheme, they encountered opportunities that were often unavailable elsewhere, gaining the opportunity to try out various forms of performance without the need to deliver particular outcomes, and support in doing so, so long as they adhered to the rules. Yet increasing centrality within the scheme did not guarantee a concurrent move from peripherality within the field. While participants might have presumed – or at least hoped for – a degree of homology between being a good member of the cohort and being a good science communicator elsewhere, the local practices of the scheme could not be guaranteed to carry exchange value. Commitment to membership of the scheme might well be read as a rejection of the field, potentially nullifying the opportunity for participants to effect the transformation of the field the scheme was intended to provide.

While this chapter has predominantly focused upon the internal dynamics of the scheme, this practice did not occur entirely in isolation. Though continued membership of the scheme may well have emerged as a goal in its own right, participants' practice in public spaces entailed an expectation that participation would enable movement into the broader field. Questions of audience, reception and the relationship between the scheme and the field remain unexplored and form the basis of the subsequent empirical chapters. Where this chapter has been structured around of the figure of the 'good science communicator', the next chapter moves to the role of the 'consumer', 'audience' and 'public' in the practice and imagination of the scheme. Chapter seven moves to examining question of the purpose of training and science communication more generally. Where discussion of the purpose of science communication in this chapter has been decidedly agnostic, untangling the multiple and often contradictory senses of the goals of science communication encountered in fieldwork will furnish an examination of the multiple understandings of purpose that coalesced within the scheme.

Chapter Six: Consumers, Audiences and the 'public': Learning the language of public engagement

6.1: Introduction

The previous chapter argued that the practices of the cohort largely reflected the internal concerns of being a good member of the shared space, so that participants' work and learning was evaluated predominantly in terms of their behaviour towards one another. However, in seeking to build and bolster an autonomous social world, participants frequently discussed their practice, and science communication as having broader reach, being for the 'public', as the audience and beneficiaries of, and justification for, science communication work. The 'public' was used to discuss and explain even deliberately insular practices. Accounting for the 'public' would appear a methodological necessity in understanding the 'meaning' of science comedy and science communication work, in acknowledging the importance of consumption in the circulation of cultural objects and meanings (du Gay et al. 1997; Bourdieu 1986 and 1993; Friedman 2015). However, without access to these patterns and practices of consumption, it is not possible to conduct such an audience study (see Chapter four). This chapter takes an alternative approach, asking how the 'public' was figured within practice and the discursive role of the 'public' for science communicators in developing, describing and understanding their work.

By asking what the 'public' was used to do within the scheme, I resist asking whether participants 'got the public right', either in their descriptions of the public or within the practices they developed that engaged with this nebulous group. Instead, I attend to the imaginative work of the 'audience' and the 'public' in the practice of science communication, as the primary form of audience work conducted within the scheme. Discussion of the 'audience' and 'public' occurred more frequently than interactions with external, 'out-there' audiences or publics, suggesting that discussion of the 'public' was a largely in-house affair. In this vein, I argue that the discourse of the 'public' enabled participants to describe, negotiate with and differentiate themselves from their most immediate audience: other science communicators. As participants gained increasing competence in the language of the 'public', they could employ this discourse to position their work as legible forms of science communication, show their suitability to work in the field and characterise their relationship to different science communicators through their imagined engagement with different versions of the 'public'. A key contention of this chapter is, therefore, that discussion of the 'public' did not aim at an external referent, but rather furnished an internal discourse which did not depend on the voice of the 'public'.

6.2: Public Engagement without the public?

A group of participants have just finished a practice session for the first show that they are producing together. The show will be an improvised panel game, headed by one participant in the persona of an evil scientist recruiting researchers for her post-apocalyptic vision. After advertising the show through the scheme and their own networks, roughly 30 tickets have been sold, enough to fill the venue. The participants are reading through the list of names. With one exception, the audience members are named as other members of the scheme, friends and family of the performers and regular attendees at other science comedy shows. The participants joke about who this mysterious audience member might be. One participant laughs, 'A stranger! At a public gig!' [Fieldnote memo, February 2018]

As a space of experimentation and development away from the professional demands of the broader field, the scheme was seemingly bolstered by the safety it offered participants. However, where such development rested on public comedy performances, the space might yet prove more dangerous. Participants were expected to bare themselves on stage, instil a clear personal attitude into their performance and make themselves vulnerable before their audience[37], which they reported to be as terrifying as it was exhilarating, particularly in the moments before they took to the stage (see Scott 2017)[38]. Where comedy served a pedagogical purpose, this fear was seemingly necessary: as noted previously in reference to Bright Club, overcoming the fear of performance was imagined as a transformative moment for learning the value of science communication and public engagement. However, in ensuring participants' continual development, rather than a one-time introduction and inculturation into the sector that would emerge through less personally exposing formats, ensuring the safety of these spaces was a priority of the scheme.

This safety was in part sustained by a largely self-restricting audience. While events were publicly advertised, participants could often rely upon their own networks to sufficiently populate events, including other cohort members who often attended when they were not performing. Often performing almost exclusively to friends, colleagues and a small cadre of recognisable science comedy fans, the familiarity of the audience

[37] These markers of 'good' comedy were instilled in several training events. Sessions on joke writing and developing a comic voice and persona drew heavily from Scott's guide to stand-up, where the 'rules' of any stand-up performance included specificity, developing a clear attitude to the content presented, and developing asides. Participants were offered opportunities to practise these skills through training exercises. Sat in a circle, participants had to in turn describe an experience they'd found strange, and add detail until they developed an extreme emotion associated with this experience. Similarly, improvisation games such as 'Yes and' were used to urge participants to build stories by adding extra details and asides.

[38] These claims from participants often emerged 'on the night' at the performance venues. Before going on stage, participants would frequently talk about their nerves and how they dealt with the pressure of performing, with many noting that fear quickly turned to elation once they had completed their set.

permitted a degree of security, as they could be relied upon to endorse the project of science comedy, both as a form of entertainment and as a means for participants to develop as science communicators. The MC often made his expectations for the audience explicit at the start of the show: their role was to ‘clap, cheer and go wild’, with a warning that if they failed to suitably support performers, he had no issue with ‘bullying nerds’ into behaving. While always clearly marking these threats as jokes, this introduction nevertheless sought to position the role of the audience primarily as a form of support for comedians on stage, rather than, for instance, their own enjoyment, if this would lead them to misbehave.

This audience was however well behaved throughout the year, attending events, laughing where they were meant to and ensuring that science comedy nights simulated other comedy sites enough that they could provide an authentic training space for participants. Yet the composition of the audience proved a lingering concern. Where participants could rely on a relatively small cadre of friends, family and science-fans to make comedy nights happens, discussion frequently emerged, often away from Slack, as to whether science comedy had a real ‘public’ audience. If the sustainability of science comedy did not depend on the consolidation of a non-scientific public audience, left answered was the question of whether comedy could reach such a group, particularly where science communication was ostensibly concerned with expanding the community that engaged with science, where the ‘public’ has been frequently defined primarily for not being scientists (see Gregory 2016). While within the scheme, the value of science comedy lay in the opportunities made available to participants, conversations amongst both participants and organisers, though rarely between the two, suggested a concern that participants were devoting themselves to cultivating a product that no-one wanted, a potential problem given the sheer amount of work they were contributing to the scheme.

When discussing this tension in interviews with organisers, the relative absence of the ‘public’ from science comedy nights was suggested to indicate a deeper problem of training. The organisers noted that where participants could rely upon a relatively safe audience attending shows, the broader ‘public’ did not seem to feature in how participants imagined their work and that participants often struggled to articulate the public need motivating their projects, despite being able to produce high quality content and events. For one of the organisers, this had become particularly apparent in running evaluation training, which occurred in November at the time that participants were beginning to produce their own formats, introducing participants to the languages and methods of evaluation used within the field. Rather than demonstrating these methods,

however, the organiser instead focused on stressing the purpose of evaluation as a tool to ensure that projects responded to a genuine public need, with participants working in small groups to identify the rationales for projects they had already completed or wished to run in the future. The organiser noted how difficult participants had found this task:

> **Organiser 2**: Erm, I think that they'd obviously thought about why they wanted to do the things they wanted to do, but I don't think they'd ever had a framework or, why would you write aims of a thing, or why would you think about what change you want to make. Putting those ideas you have into that format was I think, brand new, and I think, I noticed that [cohort 1] struggled with that, when I expected them to be brilliant at it, when they'd done a year of really good projects.
> **ETB:** Oh OK, so they'd been doing projects and then –
> **Organiser 2**: Yeah, so a lot of [the scheme], so I ran the training at the beginning of [second cohort], and a lot of [first cohort] came to it because they hadn't it in their year, and yeah I expected them to be fine with it, and it looked like it was a bit of a headscratcher, but you know they've gone and have done brilliant work, it's not a criticism, but I think – I like the fact we did that first for [cohort 2] and I, that's something I'm going to take away and go, actually even though it feels a bit bombardy with information, this is the right thing to do, do it right at the start, why would you do a project like this.

Concerned that the training had already come too late, the organiser noted the need to foreground 'public thinking' in training from the outset so that it might become more easily manifest in practice, which for the organisers was apparent in its absence. Where participants' attention had coalesced predominantly in event production and support, the 'public' served a form of 'undone' work (Frickel 2010), as a concern that had not become realised as essential for science communication practice. The knowledge that had emerged and been discretely fostered within the scheme, including how to support one another and evidence this work and what a good cohort member looked like – or at least what they did not look like – had co-emerged with various forms of non-knowledge, in knowing what the scheme might mean to those outside. Aware that a different audience for science comedy might well exist, but remained unknown, the public featured heavily in this discussion as a form of ignorance in need of remedy (see section 2.5). Potentially emerging to allow the development of other more immediately meaningful practices, this was a form of strategic ignorance nevertheless seen to be in need of eventual redress, as a form of strategic ignorance that could only be justified within the time in which participants were 'training'. Where (real) science communication is 'for' the public, participants' progression might consequently be hindered.

6.2.1: The wrong type of consumer: the Imagined Audiences of Science Comedy

The organiser's assessment of participants' experience of trainings suggested that work within the scheme was not yet matching a desired version of science communication predicated on the public. Indeed, in the resources provided to participants during evaluation training, the technical concerns of event planning only gained meaning by the prior identification of public need and the aims of engagement (see Appendix Five). A key problem, participants were told, was how often issues of public need were obfuscated, or retro-engineered to justify a commitment to extant forms of practice, defining the public in terms of what such practice could provide. Yet the mechanics of the scheme potentially precluded this form of 'public thinking': the need to perform and create new content as means for developing the professional skills of the field could easily override a desire for a more restricted form of production emerging only in the face of clear public need. Though participants were performing to real audiences, they were deliberately not doing so according to the expectations of the field. As the scheme's own concerns and prerogatives were increasingly reified through their practice, the need and ability to negotiate their work the 'public' became a concern that could not be simultaneously realised.

Where participants' labour often focus on the technical demands of delivering this content, the 'audience' and 'public' often emerged as similarly technical concerns of delivering good comedy. As participants workshopped their sets on Slack, they often sought advice on adapting their material to the audience they expected to attend. Developing a sense of whether the audience would 'get' the joke and being able to read the room were key elements of stagecraft participants sought to develop. In performing science comedy, knowing what type of 'science' the audience were expecting was crucial:

> **Participant 7 (C2):** My comedy is science comedy in the sense that, I'm expecting an audience that wants science comedy, so I'm expecting a certain kind of, level of, the jokes that are funny, like, in my last gig – the one I'm repeating – like the jokes I'm doing about the Meyers-Brigg test, you can't do that on kind of, a – you couldn't do that at a gig of just random people off the street, because you couldn't assume that they'd know it, whereas at that gig, […] you can kind of assume that and tailor the jokes to it, in a sense.

Participants often highlighted the importance of 'tailoring' content, both as a restriction on the jokes they could tell and as an opportunity to employ scientific ideas and discourses that might prove too niche or knowledge-dependent in other venues. Participants could be confident they would not be performing to 'random people off the street', and consequently discussed more often what audiences would expect from

comedy explicitly about science, aware that science comedy audiences would likely be differentiated. Consequently, when participants were tasked with preparing a show at the Royal Society, presuming they would be performing to an older and more 'sciency' audience, many sought to incorporate more explicit science content into their sets. The audience were presumed to expect more humour about scientific knowledge rather than, for instance, their experiences of being a scientist. During interviews, one participant noted that preparing a night specifically for historians and sociologists of science required similar tailoring:

> **Participant 10 (C1)**: […] you could make more specific jokes, which is way better, um because you know, sometimes I will say, you know if someone's not feminist enough, I'll say you need Beyoncé, but in this crowd I could say you need Londa Schiebinger.
> **ETB:** Did you get the same laugh?
> **Participant 10 (C1):** Oh yeah. I got a bigger laugh. More, in comedy the more specific you can be the more your group identifies with each other, and they laugh bigger.

As a facet of good comedy, participants needed to know, as in this instance, which feminist science studies scholars could take the place of Beyoncé Knowles. These descriptions of course align to characteristics of good practice found throughout the literature, where knowing your audience and being to adapt the adapt content and the style of delivery are invariably positioned as crucial facets of good communication (e.g. Brake and Weitkamp 2009; Brake 2009; Bennett and Jennings 2011)[39]. However, beyond these communicative competencies, there was nevertheless a sense of absence that amongst the organisers was a cause for concern: where the 'public' mattered most in differentiating and tailoring material, audience thinking did not necessarily need to go further.

However, the 'public' permitted much broader discussion within the scheme beyond the calibration of content. Participants often discussed the characteristics and motivations of the 'public' engaging in science and sought clarification from the organisers on Slack on technical concepts such as the deficit model or the meaning of 'dialogue' as a rationale for science communication work. Similarly, the organisers shared resources such as public attitude surveys or academic research that illustrated what the public thought of science. Yet these discussions of the public served a far broader purpose, furnishing participants and organisers with a language to discuss the nature and status

[39] It should be noted that these guides are primarily written for a different audience, as guides for scientists and researchers wishing to communicate their research, rather than necessarily seeking an enabling role, where more reflexive forms of engagement with the public are awarded greater importance.

of science comedy within the broader ecology of science communication. In interviews, the organisers narrated the emergence of science comedy, and particularly its move away from institutional public engagement, as an attempt to overcome problems posed by science comedy's restricted audience, who were seen to inhibit science comedy working as public engagement:

> **Organiser 1:** A problem with Bright Club was, Bright Club was meant to be stand up by real researchers from every bit of a university, and what would happen was lots of people who worked in scicomm would come up to me and go, Can I do Bright Club, and I'd go No!, But I want to do, I want to do Bright Club, I'm going to do my show about colour changing in cocktails, No. I got so many of them, and then the other problem that happened with the rise of the informal pub science gig, loads of people who worked for universities and loved Pub Science gigs would start coming to Bright Club, and it got to the point where I could name about 3 quarters of the audience and they're the same people who went to Robin Ince's shows and we wanted comedy fans, we didn't want, nerds…

These 'nerds' were the wrong type of audience where Bright Club sought to meet new 'publics' through comedy, as they already possessed the awareness of and engagement with academic culture that the project sought to build. An audience that already 'loved' research and simultaneously sought to make Bright Club about science over other forms of research were unruly for being tame, occupying a space intended for a more general and difficult to reach public. This unruly public, at least within the context of public engagement practice, needed to be quarantined to ensure that the intended 'public' could fill the spaces that had been designed for them. Where their continued enthusiasm for Bright Club suggested a market for science comedy, they might be better served elsewhere.

It is instructive to consider how this story was relayed in terms of the 'public'. In explaining why science comedy had come to be situated largely outside institutional frameworks, this isolation was an outcome of a public that needed to be kept out of other spaces. Where Bright Club served as a tool to engage the public, the emergence of discrete science comedy spaces could cater to the demand for comedy content amongst an audience not in need of such engagement. Employing the discourse of public engagement and science communication that is saturated with the language of 'publics' and 'audiences', the organiser could make use of the 'public' and the 'audience' as tools for describing and positioning science comedy without necessarily needing to make substantive claims about who the public really were: whether the audience of Bright Club really were disruptive 'nerds' seems a moot point. The language of the 'public' could be used to facilitate a broader discourse of the position,

substance and quality of science communication practice.

The problematic audience did not go away once science comedy became established as a discrete event. Participants often expressed frustration that the audience did not 'get' the content. Often voiced at the end of shows, when only members of the scheme remained in the venue, participants would note that 'easy' jokes were getting laughs, or that the audience did not laugh loudest at what they considered their best content. Participants also recorded on Slack instances in which audience members had fact-checked their jokes after their performances, correcting them on claims they had made in their sets and seemingly failing to understand that they were deliberately skewing scientific issues to make them funny. These specific examples underwrote a more general criticism of science comedy that circulated within the scheme, predicated on its perceived deficiency and failure to match the standards of 'good' comedy elsewhere. Science comedy was – at least outside the scheme – too reliant upon presenting 'fun facts' about nature, particularly related to sex and animals, relied on jokes that often targeted the perceived stupidity of non-scientific audiences, or offered little beyond reproducing academic formats with the 'addition' of humour. This characterisation of 'bad' science comedy was strongly influenced by the organisers' frequent critiques of such tropes, both on Slack and within comedy nights. Participants were urged to resist relying on these types of jokes and to instead aim for comedy more aligned to conventional stand-up:

> **Organiser 1**: But yeah the idea is, we're not going to be a very simple, 8 amazing things about animals, at least not the people who are good, they're going to be doing something more fundamental about being people, existing in a scientific arena, rather than, yeah, I hate astrology. Astrology's quite useful. No-one ever got laid because of astronomy, apart from some people who got non consensually, etc, where astrology, right, if you read someone's horoscope who you want to ask out, and you know they read their horoscope, and it says, you will get an offer today that you should accept, you ask them out that day. Can't do that with astronomy.

While ostensibly a criticism primarily of bad comedy and bad comedians, implicit to this characterisation was a view of the wrong type of audience attending science comedy. Where science comedy could consist of broad attacks on the irrational public, encouraging the audience to laugh at those not scientific enough to understand the ridiculousness of astrology, it could do so because of an audience that wanted the wrong things from comedy. These audiences, it would seem, wanted confirmation of their scientific identity and confirmation that they were more intelligent than the public, rather than the opportunity to hear something 'fundamental about being people'. In the sense, the generic science comedy audience lacked the dispositions to consume

comedy in a way that was legitimate, lacking the literacy and cultural capital needed to authentically serve as a comedy audience (Kuipers and Friedman 2013). Aspiring to a more confrontational, insightful and political form of comedy that might align to stand-up modelled on alternative comedy (Friedman 2015), in this quote and elsewhere, the audience were figured as inhibiting the possibility for science comedy to be anything more than 'fun facts'.

6.2.2: Heckling

An additional feature of the audience that caused tension, particularly for the organisers, was the fact that science comedy audiences did not heckle. Where this audience was primed to support participants, they shared characteristics often reported in comedy training literature such as being willing to laugh and being on the side of the comedian and wanting the night to be a success (e.g. Ritchie 2012; Murray 2007; Johnstone 1981). Yet this literature also stresses that audiences will not necessarily make the comedian's job easy, as they may be combative, requiring comedians to anticipate and learn to deal with heckling and audience attempts to disrupt sets as an integral part of their apprenticeship in comedy. However, such incursions rarely occurred during shows observed in my fieldwork. When audience members shouted out, they invariably did so to add additional information to sets, mark to the rest of the audience that they understood the scientific content or had a similar experience to the speaker. Audience members might therefore shout out, for example, that they too had failed to get a Western Blot test to work, knew of other phenomena that shared a particular biological mechanism, or pre-empt jokes that relied upon a particular item of knowledge. Though these interventions could be disruptive in forcing participants to respond unexpectedly to audience members, these interventions appeared during observations as a means – albeit infrequent – through which audience members could mark their own scientific understanding and identity within the space. Rather than trying to challenge whether the comedian belonged on stage, they instead sought to show that they did, proving disruptive in a different way by attempting to make the space emphatically one 'about' science.

While this lack of heckling was generally viewed as positive, as a mark that the shows were friendly and a safe space for participants to experiment with comedy, there was a simultaneous sense that participants were missing out on the opportunity to cope with such incursions.[40] Seeking to ensure that participants would have experience of how

[40] Several participants noted that even professional comedians had explicitly commented on how friendly science comedy audiences were. Professional comedians hired to work as MCs and headliners in the participants' own shows were reported as saying that the shows were some of their favourites to have worked at.

'real' audiences would heckle, the organiser arranged a special iteration of one of the formats in which audience members would be permitted and actively encouraged to heckle and try to put performers off. Intended for participants who were going to be performing science comedy content at the Edinburgh Fringe, this 'heckle night' was positioned as the only opportunity participants would have to gain experience of the combative audiences they would expect to encounter. Yet the event was seen as a failure. Few members of the audience took the opportunity to heckle, despite explicit instructions on what they should shout from the MC. Expected once more to align themselves to the needs of participants, in this instance, the audience was once more seen as deficient.

6.2.3: Science Comedy as Easy Comedy

Alongside preventing participants from learning the full raft of skills required for comedy, participants frequently suggested that the audience's difference to conventional comedy audiences might diminish the quality of comedy. Where audiences were too friendly or too easily impressed by science content, numerous participants noted that these audiences lowered the stakes of performance, allowing 'lazy' performances:

> **Participant 5 (C2):** I think it's [the difference between science comedy and mainstream comedy] seen as, there are bad comedians in both, but if you're a comedian that's bad in mainstream comedy, you can't justify yourself, and you just have to get better, but I think it was perceived as, if you're a science comedian you could then just make the excuse and be lazy of, oh well I'm not a proper comedian, but I'm not going to like, try and get better […] the, agreement between some people was that, science comedians rest on their laurels as comedians, because they're like, oh I'm not a real comedian, so I don't have to actually be funny […] So I think if I pitched myself as an actual comedian and went to a comedy night and failed…it would be terrifying and it would be a huge knock to my confidence, but if I went as a science comedian, to a science comedy night, and no one laughed, the I'd say then at least they learned something, so for me it makes me a lot more comfortable to see myself in that way.

Where science comedy audiences did not laugh, knowing that they favoured science over comedy provided a justification not to interpret this response as a need to improve as a comedian. If performers understood the purpose of science comedy to be different to that of conventional comedy, then presenting scientific content without a punchline might be as legitimate a goal as providing a personal narrative or clear comedic take on an issue, as participants had been taught good comedy required. Where science comedy aspired to be good science communication, its value did not necessarily depend on matching the aesthetic demands of good comedy. Though the data did not

suggest that participants endorsed this view, in consciously evoking a ‘deficit model’ image of the public needing to hear about and love science above all else, they nevertheless perceived a need to reject ‘bad’ comedy as justified and seek a more noble purpose. By setting the bar too low, the audience were implicated in allowing science comedians to not get better.

While these criticisms were usually levelled at science comedy elsewhere, some participants perceived this laziness to be playing out within the scheme, particularly when participants lacked sustained engagement with the wider world of comedy. In the second and third rounds of interviews, many participants noted that they were progressing quickly, identifying forms of performance they most liked and felt best suited them, particularly improvisation, and claimed that they were beginning to see themselves as comedians. The rapidity with which participants thought they were gaining competence as comedians was, as illustrated here, seen by other participants as indicating that they did not appreciate how difficult it was to be a comedian:

> **Participant 11 (C2):** I trust [participants to give feedback] and, really get on so well with a few of them…even like, I mean [XX] I get on with so well, but he said last time, me and [XX] weren’t very good at being a double act, and that we shouldn’t script anything, but I said, maybe that’s because we’ve never been a double act [laugh] and maybe we’re still learning, so maybe that’s, maybe we should just keep trying until we really know that we’re not good at it, rather than the first time you do it and it doesn’t go well, think that you’re not good at it, maybe it’s just you’re still learning that skill, and so…

The participant’s surprise was less that trying something new had not been successful, but rather the suggestion that she might gain the skill immediately. Later in the interview, the participant frequently drew comparisons between the length of time that participants in the scheme and comedians had been performing, reiterating how long it took for comedians to perform with confidence and awareness of what they were doing. In science comedy by contrast, participants might expect to make much more rapid progress, becoming a ‘good’ science comedian far more easily than they could a ‘good’ comedian.

Where participants characterised science comedy as distinct to mainstream comedy, and implicitly as a form of comedy that was not yet as good as regular comedy, mainstream venues were positioned as the only site where participants could find out whether their material depended on a science audience to work, and whether they were ‘actually’ funny. Participants were frequently encouraged – though few did – to perform at venues outside the scheme and participate in events frequented by stand-up comedians beginning their careers, including open-mic, bringer nights and unpaid

five- and ten-minute slots. While these spaces were more dangerous and less forgiving, they were also appeared to the organisers the only place to grow as a comedian:

> **Organiser 1**: Because if you want to do a five minutes at one of my nights, and you want to move up to one of the tens, going away and doing 10 other science shows isn't going to give you the skills you need, erm, you're not really our kind of act if that's the only thing that you do, erm, we're trying to get people more towards doing stuff that could be real comedy, for cross-over audiences.

Where participants aspired to achieve excellence in comedy – regardless of its status as science communication – and create a cultural product that did not rely on a small cadre of scientific consumers, participants would need to train away from an audience that would hold them back. This less scientific, more aggressive and seemingly better audience might serve as both the 'real' comedy audience that science comedy should seek to attract, and the means through which they would do so. Science comedy's maturation would depend on its ability to conquer such an audience.

The separateness of science comedy was not always seen as a problem, however, nor was leaning into the science necessarily seen to denote laziness. When participants solicited advice about their sets on Slack, for instance in whether the pacing worked or if there were enough punchlines, the advice participants invariably received was not to worry, as they were performing to an audience who were likely to either not notice or not mind the quality of the comedy. Many participants reported in interview that they felt more confident relaying interesting scientific content than necessarily going for the joke, and that this preference was permitted within science comedy:

> **Participant 12 (C1):** Um…yeah I think I've, I've become more comfortable with just being a pure comedian that isn't science based, like at first I – and to an extent I still do, I heavily lean on the science because I feel that if the talk isn't funny at least it's really interesting. People are there for the science as well, so you can give a really down to earth, cool science talk, even if it's not funny and people will still think it's amazing, but now I can, I could feel comfortable standing up, like right now and doing ten minutes of comedy, um, in front of an audience, on something that isn't science related

Rather than being weakened by leaning into conventional forms of scientific presentations, the ability for performers to prioritise the delivery of content over reaching for the joke was a benefit of the particular audience curated within the space. 'Talks' could still have value, being 'down to earth' and 'cool' without needing to match – or aspiring to match – the aesthetics of elite comedy. Once more, it was through the invocation of the audience that this value was articulated. A form of comedy performance focused more on the communication of interesting and educative science

content, facilitated by humour if not recognisable as conventional ‘comedy’, was made possible through an audience that did not demand continual jokes, and could cope with a more cerebral form of entertainment.

In discussing the publics and audiences of science comedy, multiple – and seemingly contradictory – images emerged, both in how audiences consumed science content and their purported attitudes to science. These contradictions highlight the discursive malleability of the notion of the ‘public’. The ‘public’ served as a tool for discussing the representation of science in comedy, the rationale for using comedy as a tool of science communication and as a means for assessing the quality of comedy content, drawing boundaries between ‘good’ and ‘bad’ science publics and ‘real’ and ‘science’ comedy audiences to articulate and rationalise the particular forms of practice within the scheme (Gieryn 1986). Thus science comedy would be positioned as comedy’s poor relation, hampered by an audience that set the bar too low, and as valuably autonomous, recognising the importance of communicating scientific knowledge and thus, unlike mainstream comedy, valuing interesting information as equal to punchlines. The ‘public’ thus provided participants with a generative means to discuss, describe and position their own work, a project far broader than articulating who they thought the public were.

6.3: Learning the language of public engagement

In highlighting the malleability of the ‘public’ as discursive resource, the reader might anticipate a condemnatory critique of the scheme for casting the ‘public’ as whoever they needed them to be, evoking deficient and obstructive publics as inhibiting and justifying the practice participants sought to foster. Where the ‘public’ was characterised less by their ‘real’ character or consumption of comedy and more by how they were imagined to do so, it would be possible to argue that the scheme (deliberately) misunderstood or misrepresented the ‘public’. Such an accusation is familiar within STS, which has frequently doubted the accuracy and sincerity of science communicators’ attempts to speak about the public, positioning these constructions as means to preclude the public from setting the agenda for public engagement work (discussed in Irwin 2006). Hence research has highlighted how the public is figured as simultaneously intrinsic to the governance of science and a hindrance to social order (Hagendijk 2004), as a group to be trusted while treated as a threat (de Saille 2015; Welsh and Wynne 2013) and as a community that justifies and inhibits science’s authority in the public sphere (Marris 2015). While discussion of the science communication landscape in the United Kingdom had often been predicated on presenting public engagement as offering substantive change in both understanding of

the public and the public's role in science (see Chapter 2.2.1), the discursive nature of the public could suggest that this change was merely talk.

Yet participants rarely sought to articulate a comprehensive vision for science and the public, as these accounts might suggest. Instead, the use of the 'public talk' within the scheme offered a means for accessing a field in which such discourse had become entrenched (Irwin 2006). Participants did not necessarily need to engage with higher order discussion of who the public were and the implications for how they imagined science-society relationships when engaged primarily with more local concerns of producing and delivering content and learning to belong within the community. Yet through these practices, participants began to acquire the resources through which they could speak like a science communicator, as a register they might be expected to use and as a demonstration of their suitability to work within the field: to speak like a science communicator was to talk in terms of the 'public'. This language thus served as a constriction on their trajectory, as a story they needed to tell about public engagement and their role within the field (Holland et al. 1998), and generative means through which they could demonstrate their credibility (Shapin 1991).

Participants were not formally taught how to speak like a science communicator, nor forced to identify and use the particular registers of the field. For some participants, this was surprising, as they had expected that they would be formally taught the rules and terminology of the field:

> **Participant 13 (C2):** Umm, I think, it sort of…cos there are certain, there are bits of what we're doing in [the scheme] that I feel reasonably confident with, so, I stand up performance, but everything outside of that, I don't really know much at all, like I don't really know much of the Science Communication terminology, I don't [know] much of the Science Communication community, and then things like what avenues there are actually, how these events work, how to balance some of the more educational aspects of it with just trying to make people laugh, and pacing and those kind of things, so all of the other things that we're doing these sessions on are stuff that I've got a take away from.

While not formally taught, participation in the scheme nevertheless offered recurring opportunities to encounter and experiment with the language of science communication. In the course of collating and sharing opportunities on Slack, Job adverts, event descriptions, evaluations of other projects and public attitudes surveys were frequently posted in the group, which often elicited explanations and commentary from the organisers and more experienced participants, particularly where the language appeared to be misused. Organisers would frequently criticise projects that they felt overstated their value or impact or cited project motivations they felt to be

disingenuous. These demonstrations highlighted facets of the local idiolect: you should talk about ‘publics’ rather than the ‘general public’, never describe the public as ignorant or deficient for lacking an interest in science, and affirm that the job of a science communicator was not to educate or convince people of the value of the science. In evaluation training, participants were provided with a list of suitable verbs for characterising different aspects of work, for instance describing aims with ‘increase’, ‘enable’ and ‘improve’ and objectives with ‘run’, ‘provide’ and ‘produce’ (see Appendix five). Without participants’ language being explicitly directed or monitored, they nevertheless had the opportunity to notice the particular registers in which they might be expected to speak as science communicators.

Within the interviews for this research, it became noticeable that participants were becoming aware of the registers that were appropriate to use when talking about the public. Participants would often correct themselves, particularly in later interviews, when making references to concepts such as the ‘general public’, hedging their responses with markers such as ‘I know it’s publics’ or a denial that the general public existed, but was a concept they wanted to discuss. Simultaneously, as interviews progressed through the year, participants increasingly wrote themselves out of their work. In preliminary interviews, participants discussed their motivations to join the scheme in terms of personal narratives, focusing on their own enthusiasm for science and the enjoyment that they had experienced when taking part in outreach or science communication activities. Yet similar discussion in consequent interviews reframed these discussions in terms of the public, with a tendency for participants to discuss what the public needed, and to assess the quality and suitability of their own work and practice in the field in terms of whether they were intrinsically valuable, to be determined in terms of the ‘public’. Science comedy progressed from a form of performance they had enjoyed and wanted to explore, to one that could offer the public a more truthful account of science and potentially public attitudes to scientists (see Chapter seven).

6.3.1: The Misuse of public talk

One of the course organisers has posted a survey measuring public attitudes to science, that will be used in the programming of a festival. The post is accompanied by the instruction, ‘Now watch as Edd rips this apart’. Several participants respond quickly, criticising the questions within the survey, and noting how the survey presumes that the more people know about science, the more they’ll love it, and that the ‘public’ will probably hate the activities proposed. The organiser posts again to say that the survey won’t be able to deal with his response, as someone who knows a lot about science, and hates it. The organiser then states that nothing will happen with the survey, that the organisers of the festival will not change their programming, but will rather use the

survey to demonstrate that they are providing what the public wants. [Fieldnote memo, April 2018]

The continual demonstrations of science communication discourse, as an implicit opportunity for participants to notice and learn the language of the field, served a further purpose, as a discrete attempt to demonstrate science communication done badly and educate participants in what the language 'really meant'. The 'real' meaning of the discourse, like the characteristics of mainstream science communicators, were varied, multiple and scattered, but demonstrated that many science communicators were invariably insincere and hypocritical when they claimed their work was 'for' the public. Thus comments on Slack, used to gloss examples of practice outside the scheme, claimed that the invocation of the 'general public' was invariably a smokescreen for a project serving the 'same old crowd' of science fans who had always attended science communication events. Similarly, projects motivated by 'diversity' and 'equity' emerged only because diversity was an issue that communicators had to pretend to care about. Alternative explanations that highlighted the 'real' motivations often accompanied discussion, for instance suggesting that male science communicators publicly advocating gender equality wanted in reality to amass women they could sleep with. Conversations on Slack thus frequently expressed a disbelief that such talk was genuine, and that 'public talk' in science communication was merely rhetoric.

Consequently, participants were implicitly primed to both learn the language of science communication and treat this language with scepticism. While the ability to speak like a science communicator might have offered a form of cultural capital that aided participants' sense of the rules of the field, this value would be most pronounced in knowing that the discourse had little intrinsic or substantive value. Within the scheme, the knowledge that the language of the 'public' was meaningless allowed a form of parody of the attitudes and practices of science communicators elsewhere, alternating between an official version couched in the language of 'publics' and another version in which they explicated what they were really saying. For instance, participants would claim that they wanted to be a leader in the field to stop other people having opportunities, that the goal of science communication was to trick people into loving science as revenge for how much they hated it. This pastiche provided a means for parsing and making sense of the landscape around them, predicated on their ability to use the language of the field.

The invocation of the public was not always so parodic, however. When discussing their progression in the scheme, participants reported increasing competence and

confidence in talking about science communication and the public. Participants knew how to talk like a science communicator, even where they felt the need to treat such talk with caution. Knowing the 'correct' ways to talk about the 'public', the value of science communication and the rationales that could be levered to describe their work – or at least, how *not* to talk about them – participants increasingly discussed their own work within a language of the 'public'. When discussing the formats they had produced within the scheme and hoped to produce in the future, it was the 'public' that was positioned to lie at the heart of their practice:

> **Participant 7 (C2):** We were talking about our dream audience at one point, and [participant] gave the most hilarious response, which was, she wants it to be, a science podcast, but for people who watch Love Island. Like that's her dream, which I think works really well. I think a lot of things that are science, are – obviously the danger is they're not accessible, people don't – people, if they can access it, they don't feel welcomed accessing it, which is inaccessible, so it's the same thing. So hopefully, what we'd like is to do, yeah, is reach those people that are just, they're listening as, just – as something entertaining, it happens to be science, but it is more than that, just a thing that you watch, like instead of TV – an episode of TV or this, a form of education that's sub half an hour you know?

Using the language of audience need, motivation, access to science and attitude to characterise their work, participants still made use of the language where it enabled them to understand their practice. As normative statements of practice, the 'public' offered a flexible resource that could be used for different ends (Merton 1942; Gilbert and Mulkay 1982). While their participation in the scheme might have primed participants to use such language with caution, they nevertheless increasingly used the language of publics and audiences both to explain their work, and to leverage critique against other practice in the field:

> **Participant 14 (C1):** [Participants' city] has an interestingly un-nuanced attitude towards public engagement, in that they think if you're talking to somebody who's not in your building or possibly someone who is in your building but not work time, that constitutes public engagement, the air quotes. Outreach, air quotes, and other such things, whereas er…I have a stricter definition that it has to be somebody who would not normally have a reason to interact with your research, and I would further segregate it into schools audiences, science audiences, other niche interest audiences and, but…even as much detail as I've gone into there, they're just not interested.

Through their immersion within the circulating discourses of science communication, publics and science communicators, participants began to acquire the language they needed to sound like a science communicator, a performance they could enact as they left the scheme.

6.3.2: Preaching to the choir? Public talk and positioning within the field

Academic discussion of science communication often presumes a particular location for 'public talk', as entwined within macro-level attempts to map science-society relationships and find positions for the public within processes of governance and policy (discussed in Jasanoff 2014; Horst 2014; Irwin 2006). The goal of such talk might seem to be the articulation of a total view of society, talking about the public in its widest and most general form to construct a generalised view of their role in science communication. This framing also presumes and constructs science communication as exclusively concerned with governance. Concerns that science communication gets the public 'wrong' make most sense where the public is enrolled as a form of civic action, with the concurrent risk of a democratic deficit if the public are misused. As noted in Chapter 2.2.1, the dominant frame in STS has been to foreground issues of governance, yet their applicability in this instance is less clear. At stake within the literature would appear to be broader disciplinary attempts to claim proper understanding of both the public and science communication, particularly where STS work has invariably criticised professional science communication's inability to understand either. Where STS has sought to promote this particular understanding of what science communication and public engagement should be, STS research engenders the possibility for normative critique of 'public' talk and work. However, the opportunity for such normative critique relies upon science communication, in all its forms, sharing similar goals. For the scheme, notions of governance were far more diffuse.

Within the scheme, 'public talk' responded to a more local concern, though not necessarily a less political one. As participants evoked the 'public' in describing their practice and articulating the differences between their content and other science communication to be found elsewhere, the 'public' served more as a discursive resource for describing themselves within the ecology of science communication, as a means to imagine the positions they might occupy within the field. When participants discussed work in the broader field, the 'public' was often evoked as means for drawing comparisons between the understandings and practices of science communication writ large and the specific practice of the scheme. These comparisons invariably cast the field in a negative light. For instance, one participant, who at the start of the scheme had been working at a large public-facing science institution, noted how her time in the scheme had made her particularly aware of just how outdated the institution's attitude to the public and public engagement appeared to be:

> **Participant 2 (C2)**: I think I spoke about this before, about like they're such an old institution and they've got a way of doing things and they, they, it's incredibly hard to move and change anything, um, considering that most people have been there a very long time and their upper management have just worked their way up from the very bottom, um…and, I think like, here, I have a fresh, blank slate, like they don't even know what a public engagement is, like I'm defining that term to them, let alone doing anything else, so it's like my canvas and, and I am really enjoying being able to shape the strategy, shape the direction, shape everything, and…hopefully make a real change, to make them think about how they can create impact, rather than just creating events

While providing a substantive critique of science communication in this institution, as a deficit of understanding and intractability in permitting change, this criticism was voiced with clear frustration as well as anticipation that the participant's entry into the field was the only type of intervention that could bring about real change. The participant needed a blank slate, an opportunity to define the terms for the scientists they would work with, and consequently lay the groundwork for their own practice. The field's seeming saturation with practitioners who got the public wrong and failed to understand the point of science communication was at once a point of umbrage, but also evidence of the need for something new. To talk about how others were currently perpetuating bad practice - and getting the public wrong – offered a discursive resource to imagine how they might offer something better, were they to gain a foothold.

Coached in the language of the field, participants' conversations about the public to one another (and in interviews) pointed to a growing competence in the discourses through which they might demonstrate and claim professional credibility (Shapin 2008) and provide a means for articulating and performing the potential roles they could aspire to occupy as professionals. Criticism of science communication did not need necessarily to be read as a call for its destruction or transformation but might instead demonstrate the participants were already the insiders capable of effecting change. Though they might have only acquired this language vicariously through their involvement in the scheme, they could nevertheless narrate their practice in a way that the field would expect, learning the shared repertoires of the field at a distance. Where participants could show they speak the language of the field correctly, they had access to the discursive resources for justifying and explicating the value of science communication and public engagement and their own future membership. Certainly, while the 'public' did emerge as an explicit empirical concern, as a question of who they were and what they wanted, their reality and presence reaffirmed, these empirical foci could be put to work, as demonstrations of the necessity of practice and a future for the field that included the participants.

6.3.3: Branding

As these discussions progressed over the year of my fieldwork, the use of the 'public' as a means for navigating the field gained greater weight, particularly as participants were increasingly pushed by the organisers to develop a brand that they could use to establish themselves as professional science communicators. As a form of branding, articulating a theoretical stance regarding science communication and the public could serve as a productive means for saying who they were as science communicators:

> **Organiser 1**: I think it's important to remember that when we have this conversation, I don't think we're talking about the nature of comedy, and the nature of science, what we're doing is communicating how we're positioning ourselves in different marketplaces, because I mean I, on the [the scheme] Slack, I am incredibly like, vocal about what I am not, and what I don't want to be, and I reject this model and I'm not saying, so and so's work is not comedy, it can't be comedy, it's not funny, what I'm doing is establishing what I want to do, and you – if you're doing any sort of creative work, you have to work out, where you don't want to go.

As a means for codifying and expressing a 'brand', the content of participants' 'public talk' mattered less for the scheme that their ability to make use of the 'public' in beginning to differentiate themselves within multiple crowded market-places. Participants' development as practitioners would depend instead on their awareness of their own desired trajectory and their ability to market themselves in a way that proved amenable to their aspirations. The ways in which they voiced the 'public' would be part of how they performed their role as science communicators to their most immediate, and potentially most important, audience, that of their own community.

Developing a brand became a key goal of training, codified roughly halfway through the scheme through formal training on personal branding, and a dedicated channel (#branding). Here participants could discuss ideas for what their brands might be, receive feedback from other participants on how they were perceived, and develop realia such as business cards. Alongside more pragmatic concerns of ensuring business cards were legible, had blank space for writing on and used complementary colour and font, the need to produce business cards elicited discussion regarding the terms participants would use to badge themselves. Brands based on concepts such 'curiosity' or 'wonder' were strongly discouraged by the organisers - even if participants felt they best represented their identity and attitude to science communication – for being overused and disallowing differentiation. The use of unmodified identifiers such as 'comedian' and 'performer' were often queried, for lacking the specificity to articulate what participants could offer to the field. Anticipating brands that would prove amenable to the field was taught to participants as a critical part of professionalisation.

Echoing the training they had received in evaluation, participants were pushed to position to market a brand that would respond to a need within the field, constructing a niche in which they might excel. Yet participants were simultaneously taught that their brand would largely depend on how they were read by others, nor could their brand simply reflect their own understanding of themselves as scientists and science communicators with complete autonomy. For example, multiple participants narrated their interest in science in terms of an intrinsic curiosity in the natural world, yet 'curiosity' had been explicitly prohibited as a branding tool. Their 'brand' within the field would be determined by how they were read by other members of the field, particularly those with the power to hire them and determine their future professional roles. Frequently repeating an anecdote from their training session where they were told that most impressions of them would be formed within ten seconds of first meeting people, participants often noted with concern a sense that their brand was out of their control:

> **Participant 5 (C2):** I think because I'm now an out LGBT presenter, and woman in STEM, that's gotten me gigs, and I don't like that that's a selling point but I think it is. And, I've spoken with, again like definitely put this on the internet, but I've spoken with a woman at the BBC about a fellow TED speaker, XX, who's a black, like presenter, and I asked her like how she got to where she is, and she said to be honest, part of it is visibility, we had like no non-white presenters, and he was like one of the few that were good, so he got a lot of gigs based on that. Which, like worries me, because I don't want to, like use LGBT as this like, marketing selling point, it's not what it is and it shouldn't make a difference, but it does seem to make a difference, because people want to tick diversity and – what's the work I'm thinking of? – yeah they want to tick boxes and have a diverse panel

Where participants wished to develop and promote brands that incorporated their difference, they frequently expressed the concern, as in this extract, that they might be branded for their alterity. Being different, whether in relation to gender, sexuality or 'race' and ethnicity, might offer a degree of value as a branding tool, but could too easily lead to participants have to wear the meanings attributed to this difference, such as permitting tick boxing or tokenism (Holland and Lave 2001). A common response from participants in interview was that where their participation in science communication might aid the 'representation' of their particular communities, they were wary of how easily they might be presumed to representative, having to both represent their community and serving as the summit of their community's inclusion into science communication (see Charteris and Smardon 2018).

Despite these concerns, the practices and discourse of branding that became manifest within the group once more proved highly generative. Through the work of developing

and articulating a brand, participants became increasingly confident in their ability to position their work in a way that would respond to both the needs of the field and offer a degree of control over their reception, bolstered by specific input from the course organisers when they needed it, in writing cover letters, CVs and practising interview responses. Knowing how to present their skills, their participation in the scheme, and the role of the public in their work, participants could expect some control over their trajectory when beginning to do science communication for real:

> **Participant 7 (C2):** I can talk to adults in a comedic way, I can talk to this in this way, and that's, all very useful and to say I've got the training, I've got the network. But I do think, if you put too much emphasis on, erm, I do two comedy gigs a month and I do this, they'll be like, OK, maybe you'd be better in a communication role, rather than a public engagement role, where the idea is, for you to be arranging events, where you bring in talent and you bring researchers and you get them to kind of, make things or do things

Participant 7 was keenly aware that their involvement in science comedy might be read as a statement of their ambitions in the field, wanting to be on stage rather than, as in this instance, as a training ground for the skills that made the participant suitable for a backstage facilitating role. Now performing to science communicators, the participant now knew how to depict the public as being best served by public engagement rather than communication, and stressing their desire not to be the 'star', consciously enacting these discursive constructions as a means of projecting the participant's aspirations in a form that could be easily read within the field. Where they knew what they wanted, the task for participants became ensuring that their brand would service their aspirations, for which their ability to talk the public, as one of the rules of the field, proved a crucial skill.

6.4: The Absent Public

As a means for talking about science communication and one another, 'public talk' effected a means for regulating the landscape of the field, delineating firstly who could be a science communicator and the relationships between these communicators. The necessity of speaking in a way considered legitimate within the field was figured as an obligatory, though implicit, part of training, despite misgivings that couching this discourse in terms of the 'public' was inaccurate and insincere. Fluency in the language of publics could be employed by participants as a sign that they were credible professionals and could claim legitimate membership within the field. Furthermore, if competence in 'public talk' acted to underwrite a stratification between who was and who was not a science communicator, so too could the discourse be employed to articulate further stratification within the community, employing the 'public' as an

evaluative repertoire to assess the success of science communication outputs, challenge other communicators' legitimacy within the field and carve out future professional roles. Within the scheme, 'public talk' provided a means for marking the group's difference from the rest of the field, invariably as a characterisation of who the scheme were not (Gieryn 1983). Without needing to provide a substantive account of who the public really were, the community could at least be one that acknowledged this talk was deceptive, valuable mostly as material for branding and negotiating the field.

Within the specific spaces of the cohort, 'public talk' also permitted a more local form of regulation. Where participants had been taught to treat any discussion of, or justifications for practice through, the public with scepticism, there were restrictions on how participants should narrate their work, at least within the scheme. While acquiring competence in the languages of science communication potentially offered reward elsewhere, such language gained little traction within the scheme, and could backfire. Appeals to the public as a demonstration of the efficacy or validity of their work could backfire within the scheme, as an attempt to mask their true motivations, misusing the language of 'public' just as 'mainstream' science communicators presumably did. If, as the stories told within the scheme would have it, discussions around the public were invariably used to justify far more self-interested practice, so too might participants reveal themselves as working against the community's desire for mutual benefit and collaboration should they do so. Returning to the case discussed in the previous chapter where a participant was side-lined for being seen to work against the group, it is worth noting how often the language of the public recurred in their own accounts of their work:

> **Participant 5 (C2):** […] so this weekend I'm performing at a festival, and it's a science talk, so that's something I want to continue to do. What I'm particularly trying to do now is reach lots of different audiences in different contexts, so I'll do, music festivals as well as science festivals as well as pubs […] I get like a lot of queer identifying people at my talks, and while obviously that's great and I really appreciate that, I feel they maybe already agree with what I'm saying, so what I think is potentially more useful is to challenge people with those ideas, and reach audiences that wouldn't necessarily already think that […] Personally, I don't think I've done very much for the community and society at large, and I feel like I could do much more and there's many more channels, so like online content I haven't really accessed, and I think there's a lot of people, on like social media especially, who could really, like, would appreciate content about like fact checking, critical checking, or like support, so I feel like there's a lot more to be done. I don't see myself as successful at all, yet, so that's why I was so shocked by it, too focused on your own success,

Rather than characterising her work in terms of her own experience and character, each facet of her practice was aligned to a 'public'. Her right to be proud could be evidenced by the different audiences who had accessed and appreciated the content she provided, allowing her to view the projects as personally successful only as they had been endorsed by the 'public', in this instance queer audiences or audiences on social media. Similarly, where the participant had been accused of being too focused on their own success, the public were evoked to temper this accusation, noting they had done little for the wider community and would not claim to have done more. Yet these justifications offered little purchase within the scheme, as the participant had noted that they had seen to be seeking to profit from the scheme without contributing, so that their invocation of the public might appear little more than a retroactive attempt to justify their behaviour. The use of the 'public' had instead been taken to indicate that, in talking like science communicators 'out there', the participants was predominantly focused upon personal success, violating the ethos of the group where serving the public was a poor substitute for the more legitimate activity of working for the cohort. Reliant upon the discourse of the 'public' precisely to deny that they had achieved the success they had been accused of, this discourse served a secondary function, as a mark that they did not belong.

Participants often noted in interviews that they perceived implicit rules for how they were expected to speak within the scheme. Alongside the seeming interdiction against buying in to the broader discourses of the field, knowing of whom to speak positively and negatively, and how to frame criticisms of other work and practitioners in the field, were concerns that participants reported restricted how they could speak within the scheme. A frequent target of criticism and jokes within the scheme was the physicist and science communicator Brian Cox, a prominent 'celebrity scientist' (Fahy 2015) and television personality in the United Kingdom known for presenting a range of science-based shows for the BBC on topics including physics, biology and the history of science. Cox was positioned as an emblem for everything wrong with Science Communication, and as a shorthand for characterising the field: science communicators who 'wanted to be like Brian Cox' could be dismissed as not worth knowing. Yet when discussing the jokes made about Cox in interviews, several participants noted that leveraging a critique against Cox or the particular ecology of science on television where he was working was not the purpose of such talk:

> **Participant 9 (C2):** Or some of it that does gets talked down a lot by [the scheme], so like, everyone likes to hate on Brian Cox, which…I don't really, like my- my parents watch Brian Cox, and my parents know more about science from Brian Cox, like…and I get that everything is problematic, but like

> everything is problematic. But yeah, he's done something. I feel like people get torn down without, and yeah, without thinking, without those bigger questions being asked…I don't know, I don't know I just find it hard to be as, as universally, he also has succeeded at his job, he's also done more science communication than like anyone in the scheme will ever do

As the participant here noted, the substantive claims made about Cox mattered less than the resources that 'hating Brian Cox' permitted in fostering a sense of the group's identity within the field, as the antithesis to the Brian Coxes of the world. In hating Brian Cox, participants could at once affirm their commitment to the group and participate in the scheme's own work to position its outputs as offering something different.

The ability for this discourse to furnish the internal dynamics of the field, both in drawing an inside-outsider boundary and allowing for differentiation within the bounded space, relied, perhaps ironically, on the absence of the 'public'. The raft of practices that cultivated 'public talk' as a form of discourse in which the 'public' featured did not rely upon the presence of the 'public' as active speakers. The stability of the discourse, as the means of characterising and involving the public in science communication suggested that the 'public' were already known, so that it was evident when science communicators got the public wrong. Where the identification of this error did not necessitate the construction of a 'true' picture of the 'public', in its broadest sense as the community outside of professional science communication, the 'public' could be absent (Rappert and Balmer 2015; Rappert and Bauchspies 2014). For participants within the scheme, the sheer amount of labour expected of them precluded the opportunity to learn in depth who the public were and what they wanted from science communication, fostering a form of strategic ignorance maintained by the public's continual exclusion from a discourse ostensibly about and for them (McGoey 2012). Simultaneously omnipresent and disembodied (Marris 2015), the 'public' were perhaps most visible within the 'public talk' participants learnt through their absence.

This is not to say that participants were afraid of what the public might do. Theoretical characterisations of 'public talk' have frequently attributed the absence of the public to a 'phobic' concern that the public might disrupt forms of political deliberation and governance by rejecting elite understandings of science and science-society relationships (Marris 2015; de Saille 2015). Participants did not wish to exclude the public entirely from their practice, however. While participants may have worried that the wrong public might be attending their shows, they nevertheless wanted a 'public' for their work, even if only to ensure the stability of an event format they valued as a tool of personal learning and growth. Thus the use of 'public talk' did not appear motivated by a fear of the public's own supposed fear and rejection of particular scientific

imaginaries, requiring the development of discourse and practice equipped to control public ignorance and disruption. Nor did participants seek to speak about (and for) the public as a deliberate means of obfuscation, silencing the public and preventing the need to learn who they were really engaging with. Instead, a less coercive linguistic game can be discerned: participants did not need to 'know' about the 'public', because this discourse was about the 'public' only in name, as a localised resource used to talk about one another. If the public could disrupt such public talk, it would not be for challenging the specific narratives told about the public, but rather in interrupting a discourse that was not intended to be about them.

If the public represented an ignorance of the field, it proved productive in enabling the 'public talk' of science communication to become increasingly self-referential. Where participants and organisers expressed the concern that the group's work lacked a 'real' public or the capacity to build such publics into their work, it was precisely the absence of this 'public' that permitted the proliferation and mobility of the 'public' as a discursive resource for describing and imagining practice. Problems of the quality or reception of content could be attributed to the audience, attributing a deficit to the public in their ability to properly engage with and appreciate comedy, for instance as noted previously, in stating that the audience were lowering the bar and permitting poor quality content. As has been noted in both science communication and comedy literatures (Dawson 2014; Dawson 2018; Friedman 2015), the burden of negotiating internal problems of efficacy, quality and audience expectation could be placed upon the public, underwriting an expectation that the public change and become more amenable to the specific content offered by science communicators, rather than science communicators needing themselves to change. With the ambiguous presence and absence of the public within the scheme, either as an object of knowledge or a group of knowers that might imagine science communication differently, the discourses of the public could be used as, potentially, they were designed to, in giving voice to communicators' understanding of themselves, one another and their relationships, within an environment in which science communicators were a principal audience for one another's work.

Versions of 'the public' were certainly present with the scheme, yet often defined by the publics seen to be absent. Thus at times the 'public' for science comedy was an extant group known to participants through their prior engagement with science, and often were produced through participants' personal engagement and relationships. Yet they also gained meaning for who they were not. As a group thought to already be interested in science, their presence brought to light the absence of a 'non-scientific'

public that the discourse of science communication would appear to favour, and their behaviour within shows similarly illuminated the comedy audiences whose absence risked making science comedy too safe. These absent publics were not entirely absent from the scheme however, as they were evoked as a resource with which to make sense of practice and imagine future iterations of science comedy in which the 'public' were more tangibly present, much like other absences such as secrets or ignorance, being continually foregrounded and backgrounded (Balmer 2012) as participants made sense of their work.

The relative 'presence' of the public could serve as a way of identifying where science comedy was not simulated training, but 'real' (Ghamari-Tabrizi 2000), alternating between being understood as a form of training that did not need to deliver public value, as a simulation of a form of comedy that might eventually find a 'real' comedy audience, and as a cultural form that succeeded as science communication precisely for reaching the wrong audience. As a means for navigating the meanings of practice, publics could serve as the object of both fear and gratitude. While participants might have had a 'fear' in that they wanted to be exposed to an 'unknown' public rather than the usual suspects, such an audience might have disrupted the safety of the scheme, and while such a safe audience attended the shows, a clear rationale could be evinced for science comedy. Yet these seemingly contradictory and alternating understandings of the public could proceed precisely because of the absence of the 'public', as an extant group capable of participating in conversations ostensibly about them.

6.5: Summary

This chapter has explored the role of the 'public' and the 'audience' as discursive features of science communication practice, arguing that the ability to properly 'speak' the language of the 'public' was framed as a crucial professional competence. Yet where discussion of 'public talk' in the STS literature has often presumed that discussions of the public are 'about' the public, I have argued that 'public talk' did not require concomitant engagement with the 'publics' to whom the discourse supposedly referred. Instead, the language of the public furnished participants with the resources to talk about one another, as a means for positioning science comedy practice and practitioners within the field and as a resource through which participants might gain a footing in the field. Where Irwin (2006) characterises 'public talk' as an emerging feature of the public engagement landscape, almost as a form of idiolect, this finding suggests that such talk has gained greater permanence and maturity, offering an internal register through which problems, concerns and identities within the field can be articulated. However, as a local language for branding and differentiation, 'public talk'

offered, perhaps ironically, the preclusion of the need for the voice of the 'public' *out-there* to enter into discussions of the purpose and consumption of science communication work.

This conclusion could well be read as an accusation of failure, in highlighting an apparent gap between talk and action as a mark of the scheme's deficiency. However, such a claim would depend on presuming that that the uses of 'public talk' can evidence broader claims about participants' attitudes towards engagement or the outcomes of their work. While the scheme participated in the broad narrative that science communication was 'for' the public, this figure took one a life of its own, broadly disconnected from the specific configuration found elsewhere, particularly in the STS literature, that to talk about the 'public' is to talk about society. Instead, this story was borrowed and repurposed, maintaining its reference to the field of science communication if not the public, as it was used to very different ends. Offering normative critique based upon the scheme's divergence would depend upon and likely reify 'the public' as a real entity on which to base a claim the scheme got the 'public' wrong (see Stengers 2000; Savransky 2018). I have sought a more constructive goal, highlighting what the discursive work of 'public talk' allowed participants to achieve, which as the chapter has demonstrated, was far more than a descriptive tool for a group targeted for enrolment within science communication practice.

In doing so, the contribution of this chapter lies in reframing the 'public', less as a nebulously-defined and little understood social group over which science communication (and STS) might seek control in delineating, defining and enrolling, and more as a generative discourse for practice. Asking what the 'public' allows science communication to do, rather than asking whether science communication gets the public 'right' offers an analytical lens that might complement and permit a more reflexive attitude towards such normative critique. Rather than the invocation of the 'public' raising questions of its character and composition, analysis of the 'public' within science communication might be better served by considering the role that the 'public' plays in permitting and constraining particular forms of practice and mediating broader discussions of purpose. The concerns of purpose motivate the next chapter, exploring discussion and actualisation of the goals of science comedy and science communication within a landscape where questions of purpose are particularly difficult to evince.

Chapter Seven: So What?! The Purpose of Science Comedy

7.1 Introduction

The previous chapters have characterised the process of learning to be a science communicator predominantly as a movement towards membership of multiple local communities. Where participants learned both how to be a good member of the specific cohort they had joined, and learned the discourse of the 'public' and science communication that furnished the broader field with a language to describe and position their work and one another, training provided participants with the means to become insiders in the internal affairs of the field, achieving a form of core membership within a delineated space (Lave and Wenger 1991, Wenger 1998). Whether or not participants had become 'science communicators' wholesale, many had certainly become intrinsic members of the scheme. Yet science communication is often presumed to have a broader purpose, existing not only for science communicators' own movement from peripherality to centrality but rather the 'public'. While participants committed substantial amounts of labour to learning the rules of the scheme, the acquisition of membership was not claimed to be an end in itself, but the groundwork for something more meaningful. What then, was the purpose of learning to be a science communicator?

This chapter explores the purpose of science comedy and science communication for participants in the scheme and the role of notions of purpose within the internal dynamics of science communication practice. This focus is motivated by a conviction that notions of purpose, change and transformation are generative in building the scheme, as facets of the figured world of science communication that became realised through the project. Thus rather than attempt to map discussion of purpose and change onto external metrics in the literature that might state what the purpose of science has historically been, or indeed should be, I explore how these figures enabled participants to make sense of their practice and their own development in the scheme. I argue that discussions of purpose were predicated on a simultaneous invocation of transformation and continuity, with transformation largely restricted to calibration within the field, as a means for changing the specific representations of science in public, or the identities of practitioners already on the inside, but not as a means for changing or challenging the rules of science communication. Where such transformation would occur through comedy, the simultaneous desire to change and preserve the field evokes a distinctly carnivalesque impulse: science comedy, more than other formats, might provide the opportunity to expose the conventions of science communication and the presumptions scientists particularly might have when talking to the public, but do so in a way that

could be easily contained and managed by science communicators. Thus I argue that notions of purpose, even when 'public', gained their greatest valence in mediating a largely internalised negotiation of the practices of science communication.

7.2: Science Comedy and the (non-)transformation of the field

The characterisation of training in the previous two chapters has been underwritten by an implicit discourse of transformation. Participants in the scheme had been recruited for their potential capability to embody a new type of science communicator, rejecting conventional practice thought to negatively dominate the field. Similarly, as participants learnt the language of science communication, they learnt it was a language not to be trusted and stood in need of correction. However, while the practices of the scheme were narrated in terms of the 'problems' of the field and the need for transformation, there was little concomitant articulation of what such transformation would look like. Indeed, where these figures were used primarily to foster the autonomy of the cohort and allow the scheme to play by different rules, furnishing the local repertoires and practices of a community that sought to be a form of subculture (Thornton 1995; Lamont and Laureau 1988), an alternative account was arguably not needed. The call for transformation was less an attempt to intervene in the broader field as to solidify its independence. The sense of the scheme being transformative thus provided a clear rationale for the group's practice and worked to furnish a group identity that could stand outside the auspices of the field (and regulate its members within) without necessary needing to demonstrate such transformation. While participants frequently reported that the scheme was different to the rest of the field, there was little explicit sense of how, and to what end, this difference would become manifest.

Discussions with organisers outside of interviews throughout the year suggested a predominantly agnostic position regarding what science communication should seek to do. Despite both in being in relatively strong positions of influence in the field, when assessed by the networks they participated in and could access, as well as the broader cultural capital of knowing how the field worked (Bourdieu 1993), neither felt it was possible to change the rules of science communication. The stories that the organisers shared with participants about their own experience working in the field were often highly negative, pointing to institutional resistance, the intractability of science communicators to change their practice and a refusal of scientists and science communicators to view public interactions as anything more than an attempt to 'sell' science.[41] Instead, the organisers sought to effect the change they saw as possible,

[41] These stories were often shared on Slack in two sets of circumstances. Firstly, the organisers shared their frustration with their current work, particularly where they were encountering

working to support practitioners by developing their skills and confidence. As was discussed in chapter five, rather than seeking wholescale structural change, focus would instead lie on working to better equip practitioners to work within an imperfect space, restricted within the scheme to those seen to already be 'good' and worthy of investment. The higher order activity of advocating what this future work should seek to achieve and the purpose of science communication were questions that did not necessarily need to be asked.

7.2.1: Laughing at power

This agnosticism relating to question of purpose was reflected in discussion of the purpose of science comedy as a tool for science communication. As noted in the previous chapters, the power of science comedy as a tool of transformation was seen to be muted both by the usual content of comedy performances and their audiences. Where science comedy predominantly attracted audiences who were already science 'fans', with positive attitudes towards science and a high level of scientific education and accreditation, its use as science communication would seem a poor way to reach and build audiences. Catering to those already enrolled in science, science comedy might struggle in the frequently stated mission of the field to extend the 'public' explicitly interacting with science (e.g. Baram-Tsabari and Lewenstein 2017; Bennett and Jennings 2011). If participants presumed this to be the goal of science communication, science comedy would appear an inappropriate format. Similarly, when science comedy was done right, it might look little like science communication. When participants received feedback and support in writing sets, they were frequently told to avoid trying to present discrete knowledge items, as this was liable to break the flow of a comic narrative. Positioning the presentation of facts as almost antithetical to good comedy – indeed, as was seen in chapter six, serving as the hallmark for 'lazy' performance – participants' training frequently reiterated the need to communicate their own experiences, rather than assume the role of a science educator. Though this division between science comedy and science communication relied on a very narrow framing of science communication as an activity of the transmission of concrete knowledge items, which might be rarely be claimed as the purpose of science communication (e.g. in section 2.2.2, where the need to foster dialogue has gained far greater interest), this differentiation allowed a sense that science comedy was

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barriers to programming projects, meeting people who devalued science communication and public engagement or the inability to gain buy in from other partners. Secondly, the organisers would often provide this negative account of the field when participants reported their own negative experiences, for instance when they were unsuccessful in job applications, presenting the intractability of the field as a barrier that had not been broken down enough to recognise participants' own suitability to enter the field.

intrinsically radical, at least within the broader field. Good science comedy was thus figured as that which, in rejecting any presumption to educate the 'public', might look the least like traditional science communication.

Within these constraints, a rationale for science comedy did emerge, however. While science comedy might not provide a means for changing the 'public' – with such a goal itself being questionable within the scheme - the audiences that were drawn to science comedy might instead be targeted for change. As noted in the previous chapter, while the audiences of science comedy may have been valued for allowing a low-stakes environments suited for training, they were frequently the object of suspicion, either for loving science too much - or too uncritically - or for too being too easily impressed by modes of performance that appeared to endorse the superiority of scientists. The concern that science comedy might further reify rather than disrupt the exclusivity of science culture was of course voiced in early academic work (e.g. Riesch 2015 and Marsh 2013), though here it was the audience specifically that were feared might crystallise a deficit assumption that only those who already loved science and viewed it in the right way be allowed to participate in public science spaces. If, however, science comedy could instead be suitably challenging and provocative, it might provide a means for challenging the understanding of science found amongst scientists and science communicators, turning the desire for transformation inwards:

> **Organiser 1:** I constantly joke now about how I built the cultural capital of science audiences by exposing them to stuff that's, more entertaining?, than they've seen at other science comedy shows.

Mimicking and parodying a discourse within the field that that they had elsewhere frequently criticised, wherein science communication provided the public with 'science capital' (Archer et al. 2015), the opportunity for science audience to experience genuine entertainment was positioned as key way in which science comedy might have impact. Though here presently humorously, in suggesting that science-fans engaging with entertainment would be a radical break in scientific culture, Imagining pre-existing science audiences to be in the same need of education and exposure to cultivated representations of science as the public, science comedy might serve to challenge and educate its closest audience.

The power of science comedy, within this rationale provided by the organisers, would come from its ability to challenge and expose the assumptions and attitudes towards science held by conventional science audiences. Science comedy might offer a form of carnivalesque inversion, through the referencing of comedic and scientific tropes (Bakhtin 1984; Denith 1994). Where the opportunity to employ comedy as a means for

talking about science might allow less celebratory and more profane accounts of science, the role of the audience would also change. Rather than forming an audience who could expect their own scientific identity would be endorsed or allow privileged access to the space, they might instead find themselves the butt of the joke, and marked for their ignorance, rather than their scientific credentials. Echoing the political ambitions of Alternative Comedy (as discussed in Chapter 1.3), science comedy might 'speak truth to power' precisely by performing a disruptive and iconoclastic version of science in front of an audience in which the authority of science appeared most secure and, beyond the event, hope that audience members would question and challenge their own assumptions about science. Discussing their own motivations for taking part in science comedy, the organiser articulated a specific image of comedy as a tool of disruption that underpinned the training they provided:

> **Organiser 1:** I'm not interested in jokes, yeah, about how people who aren't use are stupid I'm bored by, because it's not challenging. The whole point about doing comedy is that you're allowed to say things that you wouldn't otherwise say because you've always got the, I'm just doing a joke, you've got the jester, I am pushing at the edges of what society will allow me. There's no point in doing that to have a whole audience going We hate homeopathy don't we, so I, I would always prefer stuff that is making the audience slightly uncomfortable but in a good way, and challenging them and kind of exposing them a little bit, making them change their mind, because comedy as art, rather than comedy as pure entertainment. I mean you can learn to do it as entertainment, but at its best, and you'd have seen this in the scheme, the strongest performers now are the ones who are really digging into something that matters, erm, digging into their own emotions, how they feel about themselves, how science affects them, and where audiences are sucked all the way in and then sometimes thrown out because, you know, it will be a story about er, somebody doing some science and then the sexual harassment that results from it, and they're triumphing over the sexual harassment by doing comedy. That stuff I'm really interested in, I'm not interested in anything that is light and lazy, not really engaging with life as it is, it's why I don't listen to Radio 4 comedy, because it's all people not ever hitting, landing a punch, just kind of dancing around, doing very clever words, erm, I don't like any of that because it seems pointless to do comedy.

Science comedy would be at its most effective when most carnivalesque and profane. In the rare moments that the organiser criticised participants' comedy, it was for being too safe, urging them to take shots at powerful figures in science, discuss structural inequalities, or indeed target the audience, as means through which they could 'punch up' at powerful figures and imaginaries of science, as well as ensure they did not 'punch down' at easier targets, particularly the 'public'. In the organiser's own comedy, this impulse was particularly evident. Their own comedy frequently attacked prominent scientists, detailed how horrible it was to be a scientist, and sought to highlight the

audience's ignorance, often presenting HPS and STS accounts of science as definitive and mocking the audience's lack of awareness of the social studies of science.[42] In doing so, the imagined audience's own (uncritical) distaste for an alternative account of science, such as a celebration of astrology, would give meaning to science comedy, where these attitudes could be shown to be laughable. Imagining an audience who might attend science comedy nights expecting to have their identity as scientists endorsed at the expense of irrational others, the audience might instead discover that this assumption would serve as the most potent source for comedy.

7.2.2: Science comedy for the public

When discussing the purpose of science comedy, participants' views of the uses of humour and comedy were distinctly less combative compared to the view of the organiser. When asked whether they had followed the direction to ensure their comedy punched up rather than down, one participant responded by claiming they would 'rather not punch anyone'. Though participants frequently did make jokes that appeared to accuse the 'science audience' of having misconceptions and prejudices surrounding science, despite their engagement with the field, participants' understanding of the role of comedy usually focused on the public elsewhere, discussing the power science comedy might have were it to find a broader audience. The value and importance of science comedy proved a recurring theme of interviews, as participants to reflect on their work and what they hoped to achieve in the future. For this non-scientific 'public', comedy could offer a version of science that was as once more accessible as a format that was less intimidating for the uninitiated (as suggested by Bore and Reid 2014 and Pinto et al. 2015) as well as more authentic, providing the means to tell the 'public' what science was 'really' like. Presuming that the public incorrectly presumed that science – and scientists – were always serious and need to be treated with reverence, comedy might allow a different story to be told:

> **ETB:** I mean is communicating science important to you?
> **Participant 3 (C2):** Yeah, but I think this isn't, I think this isn't actually the way I do it, like, erm…I think more is important to me, in this realm, that people see scientists as people, and see scientists as…relatable, and not condescending and like, this is the science I do but I'm a bit shit at it, and therefore that it's accessible and that, yeah, I mean that, that's more my aim with, with science

[42] Though it was usually audiences thought to love science too much that were identified as the target for such humour, other communities within science were identified as suitable punchlines. For instance, the organiser recounted that in a show that was run specially for an audience of historians and sociologists of science, they forced the audience to sing 'There's only one scientific method' as a football chant.

> comedy that I'm, here's a fact about rocks, because, I don't know if anyone's every going to remember much that I said in a, in a comedy night.

Positioning communicating the experiences of scientific research as distinct to 'communicating science', science comedy was often imagined by participants as a tool that would allow the public to see that science did not need to be treated with reverence. With the permission awarded to performers to laugh at science and their own experiences of being scientists, comedy might then be used to show the 'public' that scientists were just like anyone else. Through a less authoritative account of science, the public might come to understand that, despite what they might think about science – or might have witnessed when watching science communicators elsewhere - scientists shared the same concerns and hang-ups, rarely treating science with the reverence expected from the public, and just like 'normal' members of the public, could laugh at themselves and be funny. Presuming that this message was something the public needed to know, comedy could still serve as a form of public education, by offering a seemingly more authentic and truthful account of what it meant to be a scientist. Rather than diminishing the credibility of scientists by highlighting their shortcomings through humour (Watson 2015; Bezuidenhout 2015) or failing to adhere to typical performances of credibility (Shapin 1991; 2008), humour might instead make scientists more relatable and understandable to the 'public', as figures the public could be imagined to be more willing to listen to. In communicating what it meant to be a scientist, participants evoked the need for translation. The public still needed the experiences and discourses of science to be melded into a form that was more accessible, for which comedy appeared a useful vehicle. Comedy might allow the 'Save the Cat' moment (Snyder 2005), not through the careful management of the public, but rather the public refusal to adopt an authoritative position.

While participants' accounts of the purpose of science comedy usually invoked the 'public' as the key beneficiaries of witnessing a science that was decidedly less serious, they did point to the potential to change scientists and science communicators' own attitudes to science, aligning to the organisers' view that 'science audiences' would prove the most transformative (and transformable) audience. If comedy encouraged scientists and science comedians to present an image of science to the public that was less serious and pious, the experience of performing comedy might allow them to take themselves less seriously. By either witnessing extant science comedy format or feeling able to joke in formal scientific venues, participants expressed a hope that engaging with science through humour might help to foster humility amongst scientists and science communicators:

> **Participant 12 (C1):** No, no way. People don't do that. No, you have to be, I think, you almost have to be confident to the point of being an arsehole to make a joke during an academic talk – I hope I'm not an arsehole, I think I just, also, as it got towards the end of my PhD, I just stopped giving a shit about they thought of me. At first it was terrifying and intimidating, but by – towards the end I was like, these people are as ridiculous as me, I'm just going to have some fun myself. […] I just, you know, at first you're so scared about these things, it seems like such a big deal and then by the end, what I'm giving an academic talk to maybe 100 people who are not going to care if I made a joke, or forget what I'm talking about, they just don't care, like no one cares, so it was like being a bit more humble about the whole thing, as well

While being the first to insert humour into scientific presentation might require 'arrogance', usually a characteristic participants would want to eschew, the permission to laugh within serious venues might affect a change that the participant had themselves experienced, that 'good' science did not need to be predicated on the scientist taking themselves too seriously. The carnival might live on if its lessons extended beyond the more ephemeral moment of performance. If the problems of science communication lay for the most part in the demeanour of those inhabiting the field, comedy might then offer both a rejoinder and a model, realised through the scheme, of what a good science communicator might look like instead. As a space to perform to and about the field, science comedy thus provided a means through participants could articulate who a scientist was, and what the field should look like.

7.2.3: Laughing from within

Where 'science audiences' were positioned as the principal target of science comedy, rather than the 'public', then the topics introduced to the public would need to be different. On the communication platform Slack, participants were urged by the organisers to present narratives that were considered hidden from mainstream science communication, with an implicit valorisation of material that was anti-authority and highlighted the 'negative' aspects of science. Moreover, participants were encouraged to present sets which appeared to challenge their own image as an authoritative scientist, highlighting their lack of expertise, their experience of sexism and racism (or pointing to science's historical entanglement with racist and sexist forms of stratification), or to perform through modes such as drag and burlesque. While 'bad' science comedy elsewhere might involve lists of fun facts or discussion of animal sex, performances of the 'Elements song' or jokes targeting the stupidity of the non-science public, here participants might perform sets about the Tuskegee syphilis trial, performing the Elements song as part of a burlesque strip show or develop material about sexist experiences in the lab.

While these approaches may have been recognised within the scheme as constituting 'good' comedy, their legibility elsewhere could not be guaranteed. Indeed, participants often noted that when performing to the 'usual crowd' of science show audience, few seemed to 'get' the joke, particularly if the joke was on them:

> **Participant 14 (C1):** [I'd go] on Cheltenham Science Festival and say, I know what you're thinking, how can anybody look this good and know about optics, well it turns out those things aren't related.
> **ETB:** How did that go down?
> **Participant 14 (C1):** They laughed at the wrong place. They laughed at the idea that someone might look this good and know optics ha ha ha! Hilarious. Yeah, they also laughed at the fact that my mum was a beauty queen and my dad was a physicist. Which is true. It's gospel truth that is, Beauty Queens do marry physicists, it happens.
> **ETB:** OK
> **Participant 14 (C1):** Erm, yes. No, I don't think people got the point, but there is a case for like, if the majority of people don't get it, a few people it trickles down later, and a few people are like, oh my god I feel heard, then maybe there is a point to it, it doesn't need to be everybody in the audience, particularly if it's a big audience. Also I am so glad that some people walked out of our show at Cheltenham Science Festival.

While the participant expressed disappointment that the audience had not got the joke, this miscommunication nevertheless served to confirm that the audience had the attitudes that the participant had sought to laugh at, rather than, for instance, evidencing that the joke had not been suitably constructed. It was clear, though regrettable, to the participant, that the incongruities of scientific attitudes, which appear to disallow 'looking good' coexisting with competence or beauty queens marrying physicists, were lost an audience who perceived a more basic incongruity, being invited to laugh at the presumption of a performer claiming to be both an expert and attractive. Where the very recognition of incongruity depends less on the intrinsic features of a joke and more the assumptions and worldview of its audience (Mulkay 1988), the audience's inability to get the joke confirmed an unwelcome ontological disparity.

Though potentially marking the failure of comedy to convert the audience into a more critical view, the lack of laughter might evidence that participants had got the story right, precisely for being illegible. This discourse of transformation thus potentially furnished a more local purpose, allowing a notion of success even in the face of a resistant audience. Participants often noted their disappointment on Slack to a perceived lack of audience response to their material, with the organiser frequently intervening to assure them that it was the audience's problem and not theirs: science comedy audiences simply did not *yet* get their joke. Similarly, the organiser would

frequently tell participants that even when performances did not appear to go well, they were still better than nearly every other science comedian, for aspiring to deliver a more political version of science comedy. Even without audience appreciation, science comedy could be understood as intrinsically valuable where it sought to be disruptive. Being transgressive was a good thing. By resisting comedy that was apolitical or too easy, participants might, at least within the scheme, be seen to be producing a more prestigious and legitimate version of comedy (Friedman 2015; 2016). Indeed, the audience 'not getting' the joke could serve as a badge of honour, as a form of capital that gained most value within the scheme's own logic of alterity, not needing the confirmation of the audience (Thornton 1995). At worst, this comedy would have no effect, simply being illegible and thus not constituting an act of communication. This comedy had done more than simply power relationships, as might be expected in a Bakhtinian reading, but gone further in negotiating a new narrative of science.

The risks involved in such performances were, however, rarely discussed, either in terms of the vulnerability demanded within performances or the professional risks of presenting confrontational images of science and seemingly not being motivated by the response of the audience, if distinction rested on a breakdown of communication. While participants might have valued one's another's feedback above that of the 'public', or indeed other science communicators, this did not mean that these alternative readings of their comedy would not impact them. If science comedy were a largely 'in-house' enterprise, participants' performances would be refracted through prevailing assumptions and understandings of their position in the field and the legibility of their identity on stage. Acts of transgression would not necessarily entail subsequent transformation but could easily be reincorporated into a more mundane reading of their performance (see Jenks 2003 for discussion). Commenting on a set they felt had not gone well, one participant identified the limits of science comedy for presenting an authentic version of themself on stage:

> **Participant 3 (C2):** Like I definitely can't do, jokes about…kind of, I tried to initially do a joke about, like, I was having a breakdown. But I've realised they don't work on stage, I think it's to do with being a woman, I think like the audience sees being a woman having like a comic breakdown and doesn't see it as a comic breakdown, they see it as an actual woman having a breakdown, erm, and it – I always, just get reactions of like, [pity sound] if I say something that's like, too, er, far down that route. Whereas, if it's more to do with me having done something embarrassing or getting stuck behind a door, then that works a lot better, so yeah there's that.

The participant was not seeking to be confrontational, but rather use the license of science comedy allowing different narratives of science to present a personal account

of their mental health in science, refracted through a comic persona they had developed for the stage. However, the irreality of this performance had not been recognised. The participant's performance of herself as a working class woman had been read more literally as indicative of the kind of person she was: a woman out of control to be pitied and laughed at, but not because she was being funny. Even if audiences were primed to expect 'transgressive' accounts of science that might include discussion of mental health, the participants' performance was viewed as one that could not be comic. While the participant may have sought to present an authentic version of themselves through comedy, repurposing discourse of science and comedy to create an 'I-for-me' (Lave and Holland 2009), presenting their experiences of mental health as a topic they wished to discuss and one that could be crafted within a comic persona, the resulting performance was not recognised as such, instead marking the participant as lacking credibility both as a scientist and comedian (Gee 200-01; Shanahan 2009).

While the account presented above highlighted the limits of transgression, 'subversive' performances might simultaneously gain leverage for the wrong reasons. Many participants, particularly women, noted that participation in the scheme had made them more aware of how their appearance, dress and the ways that they spoke about themselves would inflect on their perceived suitability and legitimacy as science communicators. One narrative that recurred across multiple interviews was a desire to present a 'hyper-feminine' image, to show audiences (both as an act of provocation and affirmation) that they could be both hyper-feminine and expert. Yet these participants simultaneously noted that consciously seeking to show a feminine version of science might have little purchase:

> **Participant 15 (C1):** I like dressing hyper-feminine, and I went go into a school to give a talk about me being a cancer scientist, I will make sure I'm in a dress, I'm wearing lipstick, I want to amp up the femininity that I didn't see when I was growing up, yeah.
> **ETB:** Do you think there is a space in science communication for being hyper feminine?
> **Participant 15 (C1)**: I think there is, I think there are a few, I would just wish there was more space. It seems to be, a box that is checked, like so many others, like, how do I articulate this, it sort of feels like at the moment, oh we have one or two famous, very feminine women who like dresses and, and jewellery, so that's OK, we don't need any more. It sort of feels a bit like that, or we have, we have, you know one black person therefore we don't need anymore, yeah, which is nonsense, it feels a bit like that. But I could be wrong, I hope I'm wrong.

While dressing in a consciously ‘hyper-feminine’ way might provide a means for demonstrating and challenging the gendered assumptions of the identity of scientists, it risked being read more prosaically, as a poor brand. Within an economy of ‘diversity’ that at once sought to promote different images of science, but potentially considered this work to be completed, the participants’ attempts to author themselves within science communication might all to easily be read simply as excess, appealing to a diversity target that was seemingly already covered. The participant could not guarantee that their message would gain reach. The urge for participants to be transgressive underwrote an unintentional pernicious potential outcome: by exposing themselves on stage, participants learnt that they did not belong without adaptation, requiring either that they change the performances of themselves on stage to be more amenable, or view their dress and character on stage, intended as an expression of their identity as something for themselves, in terms of its market value. Without the means for changing the field, these acts of transgression might simply be read as inability to know the rules of the game (Archer et al. 2015; Bourdieu 1984).

While the subversion of norms might then serve as a goal in its own right, participants would still need to play by the rules they were flouting. Indeed, where the legitimacy of science comedy still relied upon ‘being’ science communication, participants might expect that they would need to ‘wear’ the designations of science communicators in their performance, even if they wished to be a subversive one (Holland and Lave 2009). Offering a disruptive version of science would be limited on the one hand by hegemonic assumptions about the nature of scientists and science communicators, and on the other by offering a version of transgression and transformation that might only be recognisable to those already on the inside. Yet while they could not perform without restriction, but more often than not did not seek to. Comedy might have been positioned as offering dangerous and transgressive – though more truthful – versions of science, such incursions against science communication did not necessitate its destruction (Stallybrass and White 1986). Transgressive comedy might fulfil, rather than seek to destroy, science communication, by provoking and challenging scientists and ‘science-fans’’ own views on science, exceeding the limits of acceptable practice as a challenge to their seeming rigidity and in doing so, suggesting a better form of practice (Jenks 2003).

While the notion of transgressive performance may have provided a means for rationalising the particular work of the group, in explaining why they spoke to science fans rather than a more non-scientific ‘public’ and how these performances were not merely training, they nevertheless aligned to the topology of science communication.

After all, science comedians could only access these potentially transgressive performance spaces by already possessing the cultural, symbolic and social capital needed to enter the field, as the sort of person permitted to perform science to the public (Bourdieu 1985). Indeed, even where participants might have sought to move away from comedy that drew humour from scientific knowledge, it nevertheless traded in a restricted body of knowledge, that of being a scientist. While they sought to laugh at the incorrect versions of science felt to be endemic within science communication, these criticisms would still occur as science communication performances, at once challenging the field and affirming its legitimacy as the venue in which to talk science in public.

As an attempt to laugh at the presumption of science, scientists and science communicators, the risks of any move to transgress the confines of science communication would seem to echo Stenger's concerns regarding irony as a form of critique (Stengers 2000; Stengers 2011). Laughing derisively at scientists' own failures to properly understand science – particularly in seeking to obfuscate its faults – might reveal the assumptions and misconceptions of scientists, while reinforcing the belief that a true public account of science did exist, and that a better form of practice could be found and, moreover, that science communication would offer the venue for such work. Where this transgression/improvement was to occur within the pre-existing confines of a field that was already exclusive in relation to who could speak about science, attempts to transgress from the inside would seem to confirm that it was for scientists and science communicators to decide upon its representation. While, as an act of transgression from the margins, science comedy might reveal the landscape of the field, it would simultaneously reinforce the limits of science communication in which science comedy was already on the inside.

7.2.4: The need for science communication

While participants may have sought to challenge the representations of science they encountered in the field, the very need for science communication was never in doubt. Participants may have questioned whether current practice was over-celebratory or sought simply to communicate the public's need to accept the authority of science, but the need for encounters between scientists and the public – between experts and their beneficiaries – did not need explanation. When asked in interviews why they thought science communication was important, participants often struggled to articulate a rationale they understood to underpin their motivations, though no participant claimed that science communication was not important. These conversations were largely restricted to interviews, with very little concrete discussion of the purpose of science

communication appearing in the day to day activities of the scheme. In accounting for the 'need' for science communication, participants often drew on the technical registers they had acquired, pointing to means of calibrating content that might make science communication 'better', through formats that were more welcoming, for instance by making better use of techniques such as comedy to bring the audience on side

> **Participant 16 (C2):** Erm…well I…to try and get people exci… – as excited about science as I am, I don't think that you're going to teach them facts, but, if I can convey just a little bit of the enthusiasm and the weird wonderfulness of the world, then maybe they'll go and look at it for themselves, erm, and I think you know, doing comedy live feeds into my writing as well, and like, seeing things – seeing the ways of phrasing things that are more approachable, or putting a little bit of humour in things, that makes it easier for people to understand

Never in question was the unspoken premise that science communication would continue to offer scientists' and science communicators' own views on science to the 'public'. While questions of who could speak for science and what image of science should be presented might remain, such discussion presumed it would be those on the inside making these decisions and being afforded the spaces for performance.

Though the sheer need for science communication that participants endorsed in interviews could be read as reflecting 'deficit model' assumptions, participants rarely professed the attitudes often aligned to such a view. Participants did not state, either in interview or on Slack, that they thought the public to be profoundly ignorant, or that lack of engagement with science denoted an intellectual, civic or moral deficiency. Participants still maintained, however, that science communication needed to happen, serving as a form of doxa (Bourdieu 1972). Indeed, where participants were embedded in a training scheme designed specifically to prepare them for the field they were already committed to entering, there was little way in which the pre-existing structures of science communication might be resisted. Expecting participants to challenge the very existence of science communication was unlikely to prove fruitful. Seeking instead to improve science communication, the power of science comedy as a form of parody provided a clear rationale for a practice that by other metrics was seen wanting, as well as furnishing a justification for when things did not go well. Unable to change the public, science comedy could turn inwards, privileging the conversations within the field as those which mattered most, concretising who was 'in' and rendering discussion of the purpose of science communication as an internal matter.

Thus while science comedy was couched in the language of transformation, this rebellious impulse was predicated on the reproduction of an elite and deliberately exclusionary form of cultural output, reliant upon a restricted audience who knew

enough about science to consume science incorrectly. Needing to perform to those already enrolled in science, science comedy would provide a means for those already in the group to laugh with (and at) one another. For one organiser, who felt they were on the 'outside' of science, primarily for lacking the credentials of a scientist despite being an established public engagement practitioner, the outcome could be quite distasteful:

> **Organiser 2:** I'm really – good that they had that space [the opportunity to perform science comedy], but as an audience member that is someone complaining about an incredibly privileged life, oh how hard it is to this thing that you weren't able to do, because you couldn't afford it. And so that is very unpleasant, so there's a real split between, I'm really glad they had that space to do that because that's incredibly important, but I'm not sure if I'd want to invite a very large audience to watch it […] I can't remember the names of the people but he does, a guy got up and did – a PhD student but I'm really lazy and I hate it, I'm working on this particular medical condition and I spend most of my time playing with pipettes in the lab, and then the next person who got on was [], and went 'I've got that condition, thanks for taking it so seriously' [laugh] and it just, it was brilliant as a moment, calling out like, you know people have that and it's really really fucking serious, you could maybe be a bit more respectful.

While accounts of the political power of humour and parody have often assumed that it is the marginalised that are wielding humour (Palmer 2005; Duguid 2008; discussed in Lockyer and Pickering 2005), here comedy was performed by those by those on the inside, already possessing the cultural and symbolic capital that permitted them, as 'scientists', to participate in discussions regarding science's role in society. The carnivalesque impulse for disruptive and debasing humour could be accommodated and licensed precisely both comedian and audience were already part of the same world. While comedy might have been hoped by some members of the scheme to serve a more politically transformational goal, it could also serve as a reminder that the boundaries were already largely set, and that question of the purpose of science communication was for those already enrolled in the field. At stake would be the particular version of science that the public would receive, rather than an opportunity to transform how science-society relationships were envisaged. The attempts to reposition science communication as a means to change the attitudes of 'science fans' and those with 'high science capital' (Archer et al. 2015) already inculcated in the world that science communication sought to extend may have reproduced rather disrupted the assumptions and elisions of the field.

7.3 Transforming science communicators

As a moment of carnival, science comedy might well be understood in terms of the same tensions that have noted in responses to Bakhtin's work. Where Bakhtin has been taken as advocating the real transformative power of the carnivalesque as mode of thinking beyond the specific iterations of carnival, science comedy would seem hindered by the same processes through which transgressive impulses are all too readily reincorporated in hegemonic structures, particularly where transgression might only be legible to a restricted audience (Stallybrass and White 1986; Saltzman 1994). Reliant upon the hegemonic language of science and science communication, transgression could only gain meaning within the language in which it made any sense, and might remain ephemeral 'what ifs'. However, while the carnivalesque power of science comedy to highlight the contingencies of science and science communication practice may not have extended beyond specific performances and comedy nights, these experiences – even if ephemeral in themselves – proved transformative for participants. If Bakhtin's work on carnival is read as part of his broader philosophy of language, then the moments of inversion and ridicule to found in carnival suggest a broader truth: language, ideas, identities and power relations can change (Bostad et al. 2004; Bakhtin 1981). If comedy allowed a glimpse at an alternative narrative of science, it also offered participants to experiment in different narrations of their own position as scientists and science communicators and rewrite their own understanding of their prior engagement with science. Participation in science comedy, and the opportunity to join a vibrant community, positioned the scheme as an acute site for the realisation of participants' agency as scientists and science communicators (Holland and Lave 2001; Bakhtin 1981). Though constricted by the unlikelihood that their work would effect wholescale change in the scheme, they could nevertheless employ their engagement with science comedy as a site for enact a more desirable version of themselves.

Indeed, when participants discussed their time in the scheme and their sense of how they had changed, membership of the cohort and the opportunity to perform science comedy was frequently presented as a story of unprecedented personal transformation. Perhaps unsurprisingly, participants' accounts of the power of science comedy had little to do with the limits of transgression, and far more the ways in which membership of the scheme had furnished them with new resources for understanding their own lives and anticipating their future plans. As was argued in Chapter 5, the temporality of change described by the organisers in their motivations for building the scheme was defined largely by participants' trajectories in the field: science

communication would be improved once the right sort of communicators gained prominence. The opportunities within science comedy to experiment with modes of performance and different narratives of science might thus help bolster these participants in gaining the confidence and familiarity with the world of science communication to develop the trajectory that would eventually lead to transformation. The ephemerality of science comedy's own transgressive power might then benefit participants, precisely in allowing the explorations of possibilities that could be concretised within the field. Participants reported in interviews how the scheme had been tailored to enable this self-discovery, often highlighting the freedom to experiment without needing to abide by the professional expectations of the field as a key benefit of membership:

> **Participant 2 (C2):** The [scheme] for me, is a mentor programme to help you determine where you should sit within scicomm, so science communication is a huge beast that has yet, I feel, is completely untamed, no one really knows what, even the term science communication is […] [the scheme] opens that gateway, lets you test the waters, lets you decide areas that you would never have considered in the past, and pushes you towards them, and doing stand up comedy is [organiser's] way of getting people confident and giving them the ability to test new things.

Alongside the training and support networks that participants acquired through the scheme, this opportunity to experiment as science communicators was frequently pointed to by participants as one of the scheme's most valuable elements. The relative isolation of the scheme enabled the cultivation of practices specifically designed for participants' own development and benefit, through which participants reported that they had been transformed. When discussing whether they had changed through their membership of the scheme, three narratives of personal transformation recurred across the interviews: participants were more confident as science communicators, felt better able to 'improvise' and navigate professional situations, and now were able to recast negative experiences of science comedically.

7.3.1 Seeing science comedically

Building participants' confidence had been an integral part of the early stages of the scheme. The first training session that participants took part in concerned voice and movement, where participants were explicitly taught how project authority on stage, as well as the need to embody confidence if they were to be credible performers and communicators. As the scheme progressed, with numerous opportunities to gain increasing fluency in the techniques of performance and receive encouragement and celebration of their success, numerous participants reported that they had come to

embody and internalise this confidence, feeling – and not merely performing – the authority needed to be a science communicator:

> **Participant 17 (C2):** And, [organiser] just there going, a little voice in your head that's saying, you can do that, ask for more money you're worth more than that. Sometimes not the voice in your head, but the person in front of you yelling at you to do it [laugh], so I think that he just has this amazing way, of encouraging and, between him and [organiser], the – this combination had made me confident in a way that I probably wouldn't have been if I hadn't met them.

While many participants expressed doubts in the first round of interviews that they were funny or deserved their place in the scheme, few expressed such concerns by the end. The confidence to command space and believe that they had the right to occupy space within science communication, initially taught as a discrete form of performance, had been fossilised as part of who they were (Holland et al. 1998, 117-18). Instead, nearly all reported through the experience of training in science comedy, they were assured of their suitability to enter science communication and increasing surety that they would be able to work professionally:

> **Participant 7 (C2)**: The other stuff I take forward, like I've always been fairly confident in certain spheres, but now I know I can go out on stage and just talk stuff, shit, if I need to. That's obviously very valuable in a job point of view, if you need me to bullshit, I will. Like, [laugh] that's maybe not the nicest thing, but it's true [laugh], so yeah the confidence to just know that like, nothing can really, I mean obviously I'm scared sometimes, like things, some gigs and stuff still make me nervous, but now I know that if you're nervous and it goes tits up, all that's happened is it's gone tits up, like it's fine [laugh]

Less afraid of making mistakes and confident that they would be able to adapt to the demands of professional work, for instance in being able to 'bullshit' when needed, participants' confidence was simultaneously a mark of their preparedness to enter the field. If 'mainstream' science communicators' success was born out in part from being confident when they had no right to be, participants could now navigate the field on a more equal footing, similarly embodying a demeanour they considered essential for navigating science communication as a professional.

Where science comedy had enabled participants to embody certain forms of performance and self-presentation, the experience of writing comedy similarly furnished participants with tools they felt would aid them far beyond the specific context of making audiences laugh. Where science comedy had required participants to translate their experiences of science into comedy, several participants noted that they had increasing begun to look for the joke in stressful and negative experiences,

recasting them as a resource for comedy. In doing so, these experiences proved far easier to manage:

> **Participant 18 (C2):** Yeah, so I can like, well, use comedy for, like my own kind of mental health and like, therapy [laugh], just by writing stuff and like trying to see like the positive side, so that's been really good for me, but yeah because I find myself like, I've got this note on my phone where like, when stuff happens I write it down and like last night we were having a conversation, erm, what was I saying? It was something about like, I quit comedy, so like I could do counselling, and then the counselling was too expensive, so now I've come back to comedy, because it's cheaper. And then I was like, that's actually quite a good joke, so I need to write that down. […] I dunno if they'll ever be performed, but just the action of writing it down and trying to like take the mic of it or whatever or think of it in a funny way has probably just helped me get through it, even if it never gets verbalised in a set [laughs]

Where participants had been trained to base comedy writing on their personal and authentic experiences and attitudes, they could recast negative experiences humorously, even without the guarantee of a future performance, by imagining what they would say. Studies of humour in medicine have highlighted a routinisation of joke-making in responding with the demands of practice (e.g. Beck 1997; Bennett 2003), with medics developing a plethora of dark jokes that are shared amongst colleagues as a means of coping with stress. Participants' accounts of routinisation of joke-writing suggests a similar story, enabling them to feel better able to resolve and navigate their negative experiences of science and science communication.

Where the skills of joke-writing enabled participants to look for the punchlines in their own lives, the skills gained in learning improvisational techniques were similarly imagined to have wider applicability. Participants had been taught improvisational techniques in preparation for an improvised show modelled on Theatresports (Johnstone 1981; Johnstone 1999). As a test of their ability to react in the moment, read the room and respond to the unexpected, the organiser had introduced improvisation training with a distinct 'non-comedic' purpose. Learning improvisation served less to ensure the resulting show was funny and more to prime participants to view science communication as a field in which they needed to perform. Participants reported that these skills have already proven useful in their interactions within the field:

> **ETB:** Oh, you were saying you can go and then negotiate your day rate, do you see that as performing?
> **Participant 4 (C2):** No…but I feel like it's all linked together…I see it as Improv, that like, any, you can argue any conversation is Improv, Improv is, yeah…but I get like, you know there's a goal that you want, I guess is that's sort of thinking

> about what you're saying quite carefully as you say it, whereas now I'm just sort of rambling at you, is quite a different thing from a conversation I'd have with someone that I'm trying to get money out of.

Imagining the field at large as akin to the performance spaces found within the scheme, participants could mobilise performance techniques to gain leverage in interactions. Conscious that participating in an interview and negotiating payment with other professionals required different performances, participants could tailor the ways they communicated. Science comedy thus offered participants skills that could be instrumentalised as means for navigating the world of science communication, skills that participants reported they had begun to embody, acquiring the dispositions of a good science communicator.

7.3.2: A new space to be a scientist

Participants' assessments of the personal transformation they experienced through science comedy might suggest a way in which science comedy was working to effect change in the field. By recruiting participants thought to already be 'good', but in need of confidence building, the opportunity for experimentation and play within the scheme, and simultaneously the careful isolation of participants from professional demands or negative voices, allowed participants to acquire the skills they were thought to lack. They both learned to perform confidence, and in doing so, embodied this confidence and were consequently better primed to effect meaningful change so that it became who they really were (see Holland et al 1998, 34-38 for discussion of Vygotsky). However, for participants, the opportunities for personal transformation were far broader. Science communication was itself positioned as a space for their own transformation, as a new and more desirable site in which to be a scientist. Science communication offered both an 'escape' from the world of research and a space where participants' scientific identities could be fully realised.

Participants frequently positioned involvement in science communication as a route out of their scientific careers. The discovery of science communication as a viable career offered many participants the opportunity to move away from a field in which their experiences had been largely negative:

> **Participant 12 (C1):** Umm, a PhD, you're kind of expected to shut up, get on and work, um…yeah and kind of not to ask any silly questions, […] I mean like people, people just crying in the lab and I'd be like Wow, this girl's crazy, why is she crying in the middle of the lab, then when I got, to my PhD, I realised it was normal for people to cry during their, their PhDs. And there was also some conflict between lab members, just like over use of equipment, but it was

> quite…it was quite dark, it wasn't friendly like it was obvious to me that people in that lab weren't friends, in fact they were kind of, competing almost…

This quote is indicative of how many participants characterised their formal scientific training in interviews, particularly when moving to PhD study, with a concurrent sense that there appeared to be few professional options available to them, other than being a professional scientist. Negative accounts of science recurred throughout the year, particularly on Slack, where participants shared experiences with supervisors, other students and scientists. The accounts included specific experiences of sexism, racism, homophobia, and a more general sense that research science was an unsupportive environment, which they had not expected upon beginning doctoral research and felt ill-equipped to manage. By contrast, science communication was often figured as what science was not, a field – at least within the scheme – predicated on mutual support and the affirmation of practitioners' expertise and experience. Alongside the literal stage on which they could – and many did – air grievances at the experience of research, science communication offered participants a more desirable space in which to be a scientist. If participants lacked the habitus to authentically perform the role of the scientist as Bourdieu characterises the ease with which cultural capital is enacted (Bourdieu 1986), then the relative rapidity and ease with which they had acquired the confidence and knowledge they felt would stand them on an equal footing as science communicators would suggest the world of science communication was designed for people just like them.

Science communication thus offered participants a radical break and an opportunity for continuity. Training to be a science communicator could mark a move away from scientific research while continuing to 'be' a scientist. This sense of continuity reflected a characterisation of scientific identity expressed by multiple participants which stressed the permanency of being a scientist, as an identity that once acquired would never be lost, and was crucial for working as a science communicator:

> **Participant 19 (C2):** I would say, a good, almost 50, 75% [of working in science communication] comes from working as a scientist and understanding the value of critique and, sort of, the, almost like the scientific method like, before you even take on something new that might cost a lot, say right, let's review it, let's see has it been done before, to avoid problems further on like can we make sure this is even the right track we're going on, and then once you get started, I feel like that fact that I understand…understand the value of like critiquing things as they go and acknowledging problems and the approach to problem solving from a scientist perspective I think is, like, one of the main benefits […] Yeah, like me as a person, yeah. I've, it's [being a scientist] hugely important to me like, I've been very passionate about science in general and…I think I've made a lot of like, personal sacrifices to, to pursue it even though sometimes

> you know it's like, oh I think I could have done things that would have been maybe…a bit easier but I really want to, I've been passionate about this for a long time, I really wanted to be a scientist, to get involved in science, so…

The facets of what made someone a scientist were multifarious. Participants sometimes identified cognitive attributes as being intrinsic (and exclusive) to scientists, such as curiosity, scepticism or being 'nerdy', or highlighted their prior academic training, with little consensus on the extent of training required before one could legitimately call themselves a scientist. Despite this lack of clarity in what it meant to be a scientist, the permanence of the identity was frequently presumed, particularly when asked whether their understanding of themselves as scientists had changed during the scheme. The opportunities within the scheme may have made them more confident in being a scientist, without necessitating further transformation:

> **Participant 6 (C1):** I think so, yeah…yeah [laugh] don't know how to expand on that. I think because like my, my enthusiasm for the subject has gone up and down throughout like, formal education, like exams hated it, masters research hated it, PhD miserable time, but, actually doing the science communication is really, made me fall in love with it again, because when you're trying – when you're talking to other people about it, you're convincing them that it's a really cool thing, and in doing that you convince yourself it's a really cool thing, and you just pick the coolest bits of it and you tell people about them, erm, and yeah you – you end up convincing yourself that it's a really really cool thing, and as a result of that, I think, it's bled over into my kind of social life as well, so that I really enjoy now being the scientist around the dinner table or, I've got so many like science comedy friends now, that my social life is kind of, ingrained in it as well, so yeah, it's definitely part of my identity, yeah.

Though participants were often keen to point out that a scientist was just one aspect of who they were, they nevertheless framed their identification as scientists to have longevity beyond the specific times they had been studying science. When working in science communication, they could do so as scientists.

Despite participants reporting in interviews a sense that being a scientist was an intrinsic part of their identity, there was very little discussion of what it meant to be a scientist outside of this specific context. Participants often found the question very difficult to answer, with few having any clear sense of the nature of this scientific identity, quite possibly because it was the first time they had been asked to do so. Within the scheme, such a question might not have made sense. As noted in chapter five, where participation in the scheme required participants above all to become good cohort members, the characteristics of a good member of the scheme was never framed in terms of discretely 'scientific' attributes. Where learning to be a science communicator did not require the problematisation or articulation of participants'

identity as scientists, there were few opportunities and little necessity for participants to articulate or challenge an explicit understanding of the nature of being a scientist (see Mellor 2013). Indeed, in entering science communication, it is unclear whether such work would be necessary. Science communication was understood by participants as a field designed to meet their needs, and whether their legitimacy would be assured by the permanence of their scientific identity.

Under this framing, science communication as a field might then be understood as a 'science capital' project for scientists, creating a field in which to diversify and extend legitimate performances of science, which for participants would mean that their previous scientific credentials and experience would be enough to serve as the basis for a legitimate performance of science communication (Archer et al. 2015). Science communication offered more opportunities and reward for their identities and experiences as scientists than other fields: participants might leave science without necessarily having to sacrifice the symbolic, cultural and social capital that they had acquired in the process of scientific training. Where being a scientist was an intrinsic part of being a science communicator, this capital would underwrite their suitability to enter both the scheme and the field. When speaking to the public, even if they eschewed the role of the 'expert', they nevertheless occupied a position reserved for people like them, and when speaking to one another, they knew they had the legitimate background and knowledge to participate in 'public talk'. Science communication was transformative, offering a raft of new opportunities, but mostly for not being so, as a site that reified scientific authority and restricted opportunities to the right sort of people which participants presumed included them, as different, potentially more transgressive versions of scientists.

7.3.3: Science Communication as a space for scientists

The members of the cohort have just completed their first performances as members of the cohort. Their sets have covered topics such as managing anxiety when working in a lab, the sex lives of animals and procrastination techniques used to prolong writing up a PhD. The members of the scheme have largely remained in the performance space while the audience has left to go the bar upstairs. Three members of the scheme strike up a conversation, largely introductory, which turns to discussing their motivations for joining the scheme, where they agree that they don't want to be comedians but would hope that comedy would make them better at communicating science. One participant [Participant 17] then questions whether her set would work as science communication, commenting in developing the set, it had become harder to incorporate scientific knowledge into her set. She tells the other participants that "At first, I wanted to teach the public something about science, but now it's like 'Fuck It', I'm just going to rant about something" [Fieldnote memo – October 2017]

Despite comedy not necessarily changing how participants viewed themselves as scientists, the opportunities to perform science comedy were nevertheless powerfully transformative, if only for participants. As a space of experimentation, improvisation, and personal narration, as well as a refuge from the broader field of scientific practice, science communication emerged as a generative site of self-authoring (Bakhtin 1984; Holland and Lave 2009). Though Bakhtin of course notes that the process of self-authoring and the orchestration of the heteroglossia within the inner self as continual processes, with every utterance serving as a moment in which individuals are addressed and respond through language (Holquist 1990), participants saw the scheme as offering a particularly transformative moment in changing how they understood themselves within science and science communication. Participants had the opportunity and permission to fashion a version of themselves they considered more authentic to their experiences of science, with access to performance spaces in which they had begun to express these concerns on stage. Such performances were of course not entirely autonomous, as participants were necessarily constrained by the discourses of the field, restricting how they could speak and understand themselves. As Bakhtin notes, the 'I' can never be entirely autonomous or speak for itself, as it is always constructed through the history of individuals' exposure to discourse, their interactions and the attributions others place on them (Bakhtin 1981). However, where participants valued science communication precisely for offering a new space to be a scientist, and actively sought to recast previous experiences, the discourses within the field, while to some degree restricting their speech, were precisely the resources they sought to employ, where they wished to find a better place to be a scientist.

While the discourses of science communication might frequently suggest that it is the public that gain the opportunity for transformation through their engagement with science, here the opportunities were most immediate for already those on the inside. Within a scheme specifically designed to facilitate their own growth and experimentation, itself within a field often characterised – both positively and negatively – by the opportunities offered to those already recognised as scientists[43], the 'point' of doing science communication was perhaps most readily realised through the act of

[43] Positive descriptions of the experience of participating in science communication abound in professional literature, either for offering new perspectives on research through dialogic work with multiple publics (e.g. Brake and Weitkamp 2009; Brake 2009), or in training literature, in stressing the benefit - enjoyment if nothing else – that scientists can expect if they agree to participate (e.g. Bennett and Jennings 2011, Bultitude 2011) . Conversely, this focus on scientists has frequently been critiqued, particularly in STS literature (e.g. Jasanoff 2014; Smallman 2017) in prioritising scientists' own expectations and understandings of science, potentially precluding alternative voices from being heard.

participating in the field. Participants perhaps did not need an arch-narrative regarding the purpose of science communication, as they already embodied its function: science communication has been enacted to create a space for them. Training had been structured and discursively positioned to stress their personal transformation as its most achievable and desirable outcome, with the future of science communication dependent upon the right people gaining opportunities. Ensuring the longevity of the field would rely on good chances for good science communicators. From a position where the wholesale transformation of the field was both an unrealistic and unrealised goal, the scheme potentially reproduced a broader continuity, that while science communication might in name have existed for the 'public', its rationales and structures were more local and internally referential.

Science communication permitted participants to view their practice as existing for themselves, rather than, for example 'the public' (Irwin 2009; Irwin 2014; Stilgoe et al. 2014). However, this opportunity relied upon the reproduction of a particular image of scientists and science-society relationships which might prove beneficial to practitioners seeking personal transformation, an image that participants could not necessarily control. In a position equivalent to Bourdieu's notion of the dominated faction of the dominant class, participants stood at once in a position of power through their membership of the field, and in a position of vulnerability, as neophytes and apprentices within the field, unable to influence the field's trajectory, prerogatives or standards (Bourdieu 1993). While their training within their scheme, their previous experience in science communication and for most participants, their status as scientists, might eventually allow access to the sites of negotiation where internal discussion of the purpose of science communication and the versions of science to be made available to the public, they would nevertheless be subjected to the conditions of the field they had little scope to change until they gained a more central position (Lave and Wenger 1991). However, concurrently, there did not appear to be a strong interest in doing so. Even within the isolated confines of the scheme, the practices of the cohort appeared to strongly align to those of the field without coercion: participants independently created events predicated on the transmission of expert knowledge, and participants expressed a belief in the need for science communication, even if the grounds for such a need were harder to articulate. While participants may have queried the content of science communication, there was less contention regarding its very premise, reproducing forms of practice that positioned other science communicators as the producers and often key audience of science in public.

In recruiting for the scheme, organisers had explicitly sought to involve 'non-scientists' within both cohorts. Informal discussions with the researcher throughout the year pointed to two motivations for inclusion. Firstly, where formal science communication training elsewhere was thought to presume prior formal education in STEM as a prerequisite for accessing training, the organisers sought to award similar opportunities to participants without such credentials. Secondly, organisers hoped that non-scientists would help foster critical attitudes to science amongst the broader cohort, through the inclusion of broader attitudes and understandings of science that had emerged either through training in the social studies of science, or indeed a lack of scientific training, for instance in approaching science performance from the arts. For participants with scientific training, the opportunity to learn different ways of understanding science was positioned as both an advantageous and necessary feature of the scheme's architecture.

While participants generally spoke favourably of the inclusion of 'non-scientists' within the scheme, particularly in interviews, the value of being a 'non-scientist' within the field was far less certain. Thus while participants frequently disavowed the need to be a scientist to work in science communication, they simultaneously acknowledged a prevailing assumption that only scientists could do science communication. Those who spoke at greater length on this issue highlighted a tension that they had noticed in the field, particularly in relation to public engagement, that while the skills underpinning science communication work did not require scientific training, being a scientist was clearly advantageous. For one participant, who wanted to work in public engagement before starting their PhD, and decided to pursue a PhD as means for gaining the professional accreditation and experience needed to enter the field, this necessity of being a scientist to work in science communication proved particularly frustrating:

> **ETB**: Do you think being a Chemist is important for going into public engagement?
>
> **Participant 7 (C2):** No…so this is actually, so this is…I'm a…it's a tricky, here's a tricky one to phrase, because, I think the fact that…I've studied, a science…to like a PhD level or whatever, I think it will stand me in good stead, um…I think the fact that it will stand me in good stead, is what's annoying, because it shouldn't be. It really really infuriates me that people feel you've got to be a doctor, or you've got to have trained in this for x amount of time to be able to be
>
> **[Pause]**[44]

[44] The interview was paused at this point as it was being conducted outside and it had started raining.

> […] Um, like to be in good public engagement, because at the end of the day, public engagement is about, like I said earlier, facilitating that conversation between scientists and people, um…I don't need to know science to be able to do that. I need to be able to get you to look at your science in a certain way, and put it across best to those people and form some sort of environment where that conversation can happen most naturally, I shouldn't need to be a highly trained scientist to do that, so no I don't think it's important for public engagement. I think it will stand me in good stead, and I think, there's people…in kind of…senior positions now, who are trying to change that, and I think that's really exciting, um…but, as it stands, I think yeah, unfortunately.

Identifying the skill of public engagement to lie in the ability to foster 'conversation', echoing definitions in the literature noting the specific competencies of public engagement (e.g. McKinnon and Bryant 2017) such talk was not – in the participant's view- a skill possessed only by scientists, but instead a particular competence shared by all good public engagement workers. Yet in the broader field, such talk might only gain credibility when voiced by a scientist. Discussing their experience speaking to academics as a public engagement professional, one of the course organiser's own raft of experience and professional achievements mattered little when they were seen to lack the proper scientific and symbolic credentials to talk science with authority:

> **Organiser 2**: Yeah, I strategically deploy my boss quite a lot, so erm, Professor X, VP [in the university] , um, the way we work together is that if there are people who will only listen to a senior academic, I bring him in and he will do that, get their attention and then hand over to me and kind of confer his academic credibility on to me, by saying [I am] the one who does all of this, I trust them, listen to what they say.
> **ETB**: And his research is in public engagement?
> **Organiser 2**: No, he's a computer scientist.

The organiser's ability to engage in interactions in which they had expert knowledge depended on the conferral of authority by a seemingly more credible source: a scientist. While, like the participants, the organiser points to a particular way in which they were able to improvise to navigate the space, this performance was more constricted, dependent upon the patronage of a figure presumed to have greater right to speak.

Yet the presumption that a good science communicator was ultimately a scientist was not solely a feature of the field 'out there'. Where science communication served as a site in which participants could experiment with and foster new ways of being a scientist, so too might it serve as a site of exclusion for participants who lacked such backgrounds. Participants who lacked the training that might confer the status of being

'a scientist' were acutely aware that they occupied a different position within the scheme:

> **ETB:** Do you ever define yourself as a non-scientist?
> **Participant 9 (C2):** As a non-scientist?
> **ETB:** Yeah
> **Participant 9 (C2):** I think that label is horrific, let's divide the world into scientists and not-scientists, no I think that's part of the problem.
> **ETB:** I mean it has been noted it's the only thing where you're defined by not being something, it's the only job where that even exists.
> **Participant 9 (C2):** Yeah, that is, that is my experience of [the scheme] right there, the non-scientist.

While the participant rejected the 'non-scientist' as a category that should exist, they nevertheless noted how frequently their experience within the scheme came to be defined by what they were not.

In interviews, participants who were not scientists often pointed to moments which they felt evidenced a sense that the scheme was not designed for them. For one participant, attempts to contribute to the editing and development of sets led her to conclude that she was considered 'stupid':

> **Participant 11 (C2):** I said, I think, for me, you need what I would do is, you need a more complicated word [..] and I think that's quite funny and I would say that. And she replied saying we didn't [do that], how silly are you. And she genuinely meant it, like she was laughing at me, and I just didn't care, but then she said, I'm thinking of saying on stage, [Participant] thought I should say this, but it's incorrect, and, that – that is to me, an academic pointing out somebody who's dumb, and should know better, and I think that that's a shame.

Imagining themselves as figure of ignorance, to be laughed at on stage as the target of scientific humour, the participant pointed to their role in the scheme as a dummy audience member, rather than a collaborator:

> **Participant 11 (C2):** I think that there's a lot, in [the scheme] where we assume the audience will understand and I think I'm quite a good litmus test for actually them not understanding and I'm always like, I don't, I don't know that word [laugh], so I think that there's a lot of jokes that I – that go over my head, yeah, but, surely that happens to everyone. I think in especially this crowd, this environment when you're going to learn something scientific, I think it's important because I'm coming from that side to break it down to basics and not make anyone feel stupid, and if – if you tell me I'm stupid I don't care, then I've just lost respect and I don't want to learn, but if you explain something to me in, a really nice way, that I understand I will respect you immensely.

Contrasting a desire to explain specialist knowledge in a way that was accessible, against an urge to laugh at the ignorance of the outsider – and potentially use comedy

to mark the boundary between those who did and didn't 'get it' - the participant's description of the purpose of comedy aligned their own role in the scheme as providing a 'litmus test' for how their public would react. Where Participant 9 resisted the designation of being a 'non-scientist', while acknowledging it would be seen as one of their core attributes in science communication venues, Participant 11 would seem to have accepted this designation more readily, presuming that they held an intrinsically different role within the scheme. Rather than being acknowledged for their prior experience in performing, writing and watching comedy – which had been their principal motivation to enter the scheme – they were instead marked for the scientific training they lacked.

While 'non-scientists' had been recruited to broaden the range of expertise available within the cohort, these 'non-scientific' forms of expertise had a precarious value. While non-scientists reported that they felt disallowed from 'talking science' for lacking the credibility afforded by formal training, they noted a lack of reciprocity, as performers marked as scientists could engage with topics that they potentially knew little about:

> **Participant 9 (C2):** I've always found that…people feel they can dabble in talking about like history of science, with no expertise in it, but there's not that – you know if you tried to talk about science and you're not a scientist that's the worst thing you can possibly do.
> **ETB:** But [the organiser] challenged- seemed like he was challenging them on that
> **Participant 9 (C2):** Yeah, yeah – but he needs…you can't…yeah, [organiser] is not the scheme, like…you shouldn't, I don't, maybe it should have been my job to challenge that stuff, but I don't have the, they don't listen to me, like yeah, Why would they listen to me, I have no status, the best received set I've done was one on Terror Management Theory, which is psychology, which was part of my thesis, as much part of my thesis as the history, and yet – yeah when I do that set, suddenly I see people look at you differently, and you have credibility, yeah.

The exceptionalism of scientific expertise served as a barrier that the participant was not willing to overcome. Noting the disparity in responses to their performances 'as a scientist' and 'as a historian', credibility rested on their ability to be seen as authentically inhabiting the role of the scientist. Yet for both participants quoted above, these disparities highlighted that the architecture of the scheme, despite aspiring to facilitate transdisciplinary understandings of science and science communication, was not built to accommodate them, nor were they willing to change themselves. Noting that they occupied peripheral positions within the community, 'non-scientists' seemed to lack the habitus – and the desire to align their identity and perform the habitus – of an authentic science communicator (Bourdieu 1985; Wenger 1998 ch 8).

When asked in interviews explicitly whether it was necessary to be a scientist to be a science communicator, most participants denied that scientific accreditation was a precondition to entering the field, and few dwelled upon the question. While, as noted above, some participants acknowledged – often with frustration – the necessity of being a scientist to work in science communication, within the wider community, such frustration was rarely voiced. The presumption that a science communicator was firstly a scientist nevertheless appeared to have been naturalised within the group. That science communication had been (and should be) designed or scientists went 'without saying because it comes without saying' as the doxa of working in science communication (Bourdieu 1972), even within the scheme that explicitly sought to disrupt established patterns of access to training and opportunities. Indeed, in discussing the group's cohesion as a cohort, explanations frequently centred on the group's similarity:

> **Participant 1 (C2):** Just by the nature of, this programme, it undulated, like sometimes you're not able to be present as much or put as much in, and then when you did, like everyone is, because it's such a like minded environment, everyone really ends up putting a lot into it, so yeah I think the effort and the sort of, the amount I care about it was more than expected.

Participants could come together and develop a community because of their 'like-mindedness', yet for participants who were less 'like-minded', the scheme was seen to offer a continual reminder that as 'non-scientists', they did not belong. Where the scheme fostered a large amount of labour in assuring that participants had the skills, confidence and networks to enter the field with the same advantages presumed to be afforded elsewhere, the opportunities for self-transformation nevertheless occurred in a space that had already largely restricted access to those with the academic socialisation science communicators were presumed to need. 'Non-scientists' could learn the rules of the game but could not be guaranteed they would be allowed to play, where they might develop the cultural capital but still be seen to lack the authentic habitus of a science communicator (Bourdieu 1993). Where science communication offered a space for scientists' own self-expression and exploration, this was simultaneously to state for whom the space was not. The achievement of creating a space particularly suited to scientists who sought to communicate their research, or indeed to leave science and pursue an alternative career, was precisely this: a space for scientists, and not for other voices. Where this exclusion seemed natural, even amongst participants primed to presume the worst in the field, there appeared little scope for change.

7.3.4: Science Communication after the Carnival

Through the constellation of practices and discourses of parody, transformation and subversion and the identification of science as a site where participants could refashion themselves, the simultaneous invocation of transgression and commitment to hegemonic order permitted a form of carnival to gain a footing. As acts of rebellion that highlighted the possibility, but arguably not the desirability of revolution, the use of humour and comedy appeared particularly carnivalesque. Laughing at science suggested the possibility of unmasking the pretensions of science and scientists, ridiculing the unquestioned myths and narratives that underwrote science's undeserved and unexamined authority. Yet this authority was essential to participants' future in the field, justifying the very existence of science communication in making uniquely legitimate knowledge public and encoded in forms of capital that they amongst few might claim to legitimately embody. On stage, participants could blaspheme and debase science while simultaneously reinforcing its cultural authority, demonstrating to the public through its debasement why it should be revered, at once playing the role of the carnival king and the licenser of transgression (see Bell 2011). Knowing that these performances would be largely ephemeral, participants would not be required to act upon the images they transformation they might invoke, nor of course have the means to do so.

However, as long as they retain affiliation within the scheme, participants might hope for a more idealistic view of the carnival that might not need to end entirely. Though the scope of the scheme was limited, and participants knew they would need to go beyond its confines to find opportunities and establish professional trajectories, they did not need to leave the scheme entirely. The scheme came to a formal end in September 2018, with lack of funding preventing the recruitment of a new cohort and significantly reducing the opportunities for formal training and performance. Yet very few participants felt that their time in the scheme had ended. With the Slack still operational, they would continue to seek advice and support, air grievances and negative experiences, and seek collaborators for formats they developed independently. If the field did not yet resemble the scheme, it could remain a model of what was possible, as a space which participants could return to even as they needed to adhere to the demands of professional science communication elsewhere. While the opportunity to experience and participate in a different vision of science communication might exist only within the scheme, particularly where change was envisaged to occur predominantly amongst the cohort themselves, participants could nevertheless return to this space, remaining 'good' cohort members, if not good science communicators.

7.4: Summary

This chapter has explored the ways that participants articulated the purpose of science comedy within the ecology of science communication. Throughout the chapter, I have argued that notions of purpose were predicated on a simultaneous invocation of transformation and continuity. Where science comedy might offer a transformative experience for both public and practitioner, such transformation would be moderated by the need to preserve science communication as a site of opportunity for scientists. Thus the public might benefit from the opportunity to hear new, more authentic stories about science, but only where science comedy offered a space for scientists and science communicators to negotiate the public representation of science. Similarly, where science comedy might offer personal benefit and opportunities for transformation for participants, where the opportunities were orientated towards re-narrating negative experiences of science and gaining the confidence to enter the field, such opportunities potentially reinforced science communication as an exclusive space for scientists, and only those who were already seen to be legitimate actors within the field. Science comedy might provide participants with powerful resources of self-authorship, but not guarantee they would be recognised.

While the scheme organisers and participants expressed hopes for more extensive transformation within the field, in which science comedy would play a part, the analysis in this chapter has highlighted the constraints that might inhibit such change. Where the discourse of purpose and transformation was emmeshed within and was itself a product of the practice of the field, notions of changes emerged largely in terms of what was already permissible within science communication. The scheme's practice was not radical for being unrecognisable, as acts of resistance and transgression aligned heavily to the hegemonic practices of the field. As a tool of training, while science comedy might allow narratives of science otherwise untold in the field, it is was nevertheless employed for its perceived ability to engender the legitimate performances of confidence and scientific authority expected of science communicators. The contribution of this chapter is thus to highlight the contingencies and tensions through which notions of transformation and purpose emerged within the group's practice. While it may be productive to examine the validity of different notions of purpose in their own right, the chapter has evidenced a more immediate empirical concern in acknowledging how particular localised notions of purpose furnished the social world of the scheme, an understanding of which must serve as a precursor to such discussion.

Chapter Eight: Conclusions and Research Implications

8.1: Introduction

Accounts of science communication and public engagement within the STS literature would often seem to invite a discrete sense of alarm. Motivated by questions of the role of science in society, the relationship between scientific knowledge and governance and the putative role of the 'public' in ensuring the democratisation of knowledge production and decision making, accounts of science communication often highlight the apparent failures to achieve these political ambitions for a public form of science, or go further in suggesting the deliberate obfuscation of these goals. Where this work has emerged from specific investigation of the governance of science and the relationship between the science of the lab, the law court, government and the enrolment of the public within these structures, there is a need for caution in presuming that these accounts of science communication are able to capture the expanse of a science communication landscape that is acutely heterogenous. Quite often, science communication might fail to meet the expectations of good science communication precisely for seeking to do something else. In privileging STS's own account of what science communication should be as an account of the field in its totality, these divergences lead to a normative conclusion that something is going wrong. Indeed, as Riesch and Mendel (2017) note, it would frequently appear that science communication is 'broken'.

However, when examining the specific relationships and forms of practice that emerged within the scheme, there would seem to little that was 'broken'. Seeking to prepare and support participants in the broader field, the scheme was surely successful, continually evidenced through both the depth of work that emerged to foster the scheme's interests and participants' own sense of having experienced a radical transformation. Though far from autonomous, being dependent upon forms of practices and discourse found in the broader field, this raft of resources was repurposed and re-voiced to allow the cultivation of local concerns, form of practice and solutions. The scheme thus incorporated a language infused with notions of publics and governance, but only kept these meanings as far as they needed to, as the scheme realised a local substantiation of what science communication could mean. The vibrancy of the scheme would suggest a different conclusion: rather than serving as a case study of science communication gone wrong, the research in the thesis would suggest that science communication practice may be oriented towards different goals, concerns and outcomes, which STS's discrete focus upon science

communication as a form of governance may be ill-equipped to analyse in its specificity.

While the specific achievement of the scheme can be noted, as broadly succeeding in enacting a particular version of science communication, its incongruities with other forms of science communication are nevertheless apparent (Stengers 2000). The notion of science communication as a space designed to serve the needs of scientists, and the lack of work within the scheme to challenge this understanding would appear divergent from STS's sense – and indeed my own – of what science communication should be for. This specific claim regarding the purpose of science communication could well be read as part of a broader story of the cyclical history of British science communication, where attempts to transform the field invariably meet resistance and scientists seek to regain control (Smallman et al., in press). However, this divergence can be explained in its own terms, without needing to subsume analysis within an account of what the scheme should have been (Savransky 2018). The specific substantiation of this narrative could not occur 'from above', as the actions of scientists and policy makers able to shape the trajectory of the field through their access to science communication and policy networks. Instead, the desire of participants to rewrite their negative experiences of science and find a space in which they were welcome was realised within an understanding of the field in which they could claim science communication as their own, potentially reaching a similar end – and enabled through the broader configuration of the field that might be similarly aligned – yet through starkly different means. Attempting to simply resolve these incongruities through critique, presuming and reifying – though not necessarily articulating – an implicit notion of 'good science communication' on which to base normative assessment is likely to simply obfuscate the opportunity to expose and allow the contestation of the assumptions underpinning any sense of what science communication should do. STS analysis cannot hope to resolve these incongruities without careful analysis of the specific conditions in which 'broken' science communication has emerged. There is the need for much broader work, laughing with, rather than at, these incongruities as a means for investigating and imagining what science communication could be, and how it might be achieved (Stengers 2001).

This does not mean that the questions that STS poses no longer matter. Questions of power, the production of knowledge and the relationships and infrastructures enabled through science and technology are ever pertinent, though cannot be adjudicated from afar. While the concerns and solutions that developed within the scheme can be appreciated as the cohesive outcome of a particular moment in the broader ecology of

science communication, this is not to presume that their desirability or broader effects should not be interrogated. Indeed, the scheme's focus upon the internal dynamics of the field, bolstered through a clear sense of what was wrong, with far less clarity as to what was needed, provides just one substantiation of what science communication might mean, and invites comment from a much wider range of voices. As Riesch and Mendel argue, rather than attempt to 'fix' science communication, a more productive vision for research is to continually seek to understand and challenge the conventions of the field, disentangling the assumptions that underwrite the field to make them contestable. It may be better to act as a form of 'gadfly' to prevent the fossilisation of practices and self-evident and allow for speculation and play (Riesch and Mendel 2017). The ability to explore science communication on its own terms, and ask whether it could be different, depends upon the type of research presented in this thesis, exploring science communication in its specificity as a precursor to the much broader negotiation that might eventually lead to a more stabilised vision for science communication work.

8.2: Discussion of Research Findings and Empirical Contribution

This thesis has provided a detailed empirical account of a training scheme for early career scientists and science communicators predicated on the use of science comedy as a tool of training and community building. In doing so, the thesis has taken as its empirical focus a feature of the contemporary science-society landscape that received little critical attention within STS and Science Communication, that of the social world of professional science communication. This study thus contributes to work that has examined the production and representation of science in other areas of the public sphere, such as popular science writing or the use of the 'public' in policy and governance (e.g. Mellor 2010; Smallman 2017). While discussions of practice might be evinced in more professionally orientated literature usually dominated by technical concerns of the 'hardware' of science communication and rarely examining the location, assumptions and meanings of science communication practices, this thesis presents a deeper investigation of professional science communication as site for the production of science in public.

Adopting an ethnographic approach, both to make science communication 'strange' and to resist relying on a theoretical account of what science communication should be, the thesis has reached an arguably self-evident conclusion, that the world of science communication is far more than the sum of parts found in the professional literature. Indeed this 'finding' was presumed from the outside, particularly in drawing from Lave and Wenger's accounts of training and apprenticeship which highlight the acquisition of

professional competencies as just one facet of ‘learning’. However, in substantiating this account, the thesis has pushed beyond this initial conclusion and highlighted multiple concerns, questions and considerations that can guide future work in the field. Where the thesis was guided by three research questions, I now provide an initial answer to each of the questions, bringing the empirical findings of each chapter together to attend to the recurring themes that underwrote what it meant to ‘do’ science comedy as a form of science communication.

8.2.1 Overview of Empirical Chapters

Chapter five explored the architecture of the scheme, arguing that the scheme was designed to produce good science communicators, rather than specific cultural products or outputs. Attending to the local conditions and concerns that emerged within a scheme able to sit at the fringes of the field, the chapter argued that the definition of a ‘good’ science communicator was similarly localised, defined predominantly as a good member of the cohort. A good science communication was thus someone committed to providing support to other participants, working for the community before themselves, and developing collaborative forms of practice. Simultaneously, the ‘good’ science communicator was defined by who it was not, as the chapter highlighted the role of the ‘mainstream’ science communicator, as a figure of the field elsewhere, against which participants might define themselves.

In doing so, Chapter Five highlights the localisation of dominant narratives of purpose, quality and the topology of the field in the building of a discrete community. As a question of narrative, descriptions of the problems of the field were narrated in a way that gave meaning to the community’s specific forms of work and relative dislocation from broader practices. Reliant on narratives that placed the problems of the field to lie in - and not beyond - the bodies of its actors, the chapter has shown how characterisations of the field gained served less as a means for describing what the field was really like, but rather as a means for rationalising and producing a specific local space (RQ1). Consequently, as a question of practice (RQ2), while many of the discrete forms of labour that emerged within the scheme seem familiar as forms of science communication work, they can be best be understood as tools through which to learn how to belong within this community, rather than as the substantiation of an abstract of activity of ‘doing science communication’. The shared repertoires of the scheme drew heavily from the figure of ‘mainstream practice’ to substantiate and justifying the divergent responses found within the scheme. Concerns over the transferability of these practices raise specific consideration of the function of the

community for the scheme. Where the scheme's difference highlighted tensions in the scheme's position in the field, the problem was less that the scheme produced forms of science communication that could not be accommodated within the field, but rather that the degree of commitment to the scheme, both in terms of labour and the alignment of participants' understanding of science communication towards the community's own needs, highlighted the development of a community as a goal in its own right. Where the community coalesced in identifying the cultivation of shared practices as the key concern that would motivate engagement, the field was deliberately dislocated in the same way the organisers had sought to move participants' training away from dominant expectations and values (RQ3). This finding urges the question of whether the field is similarly composed of multiple divergent localities, which if so, would make the scheme far less 'alternative'.

Chapter six explored the role of the 'public' within the scheme and, following the STS account of 'public talk', argued that the public emerged for the most part within the scheme as an object of discourse. Learning to 'speak' the 'public' correctly was positioned as a key competence for entering and navigating both the scheme and the field and provided a language through which participants could describe their work, their relationship to the field, and comment upon the work of others. The chapter then argued that the success of this discourse relied upon the absence of the public as a community beyond the scheme. The foregrounding and backgrounding of the 'public' as a community that engaged with science comedy provided a discursive resource that could furnish an internal discourse of content, professional roles and differentiation.

In doing so, chapter six highlights the development and malleability of 'public talk' as both a dominant linguistic form in the field (Irwin 2006) and one which would appear to be maturing, through its repurposing and reuse within discrete local contexts. While both participants and organisers' discourse was restricted through the heritage of this public talk, so that the stories of science comedy and science communication could not be voiced in a register that was not 'about' the public or societal outcomes, this register could nevertheless be repurposed and negotiated as a local idiolect that gained most sense within the logic of the scheme. As a question of the narratives of science communication (RQ1), this use of public talk allowed a form of narration at once about the field as a whole and the specific world of the scheme, employing figures of the misuse of language, its inherent meaningless and the need for humility as both condemnation of the field writ large and as a means for enforcing forms of regulation, negotiating the value of the audiences participants did meet, and for imagining possible futures. As a question of experience (RQ2), the increasing narration of participants'

work and understanding of the field within this register highlights that a key facet of training was linguistic, in learning how to speak like a science communicator, and how to negotiate the possible tensions within dominant registers. Finally, as a question of the field (RQ3), the malleability of 'public talk' was surely its most valuable element: participants could speak in the language of the field, even if they thought they were speaking about something else, through a form of narration that was legible far beyond the scheme. This suggests that a strength of the field is the circulation of forms of narration that remain negotiable, a valuable resource for mediating divergent forms of interaction and negotiation.

Finally, chapter seven explored discussion of the purpose of science comedy and science communication more broadly. Examining the meanings that were awarded to science comedy and the role of the science communicator, the chapter argued that notions of purpose were expressed within a simultaneous carnivalesque invocation of change and continuity. Aspirations to transform the field simultaneously maintaining restrictions on who could speak within the field, and that the field could provide continuity as a new space in which to continue being a scientist. Consequently, the chapter suggested that science communication, despite calls for its transformation, was understood primarily as a space for scientists, in which discussions of purpose, the representation of science, and the role of the 'public' in science-society relationships were internal issues for the field.

In doing so, Chapter Seven highlights the analytical potential of 'the carnival' in making sense of Science Communication. As a form of discourse and linguistic performance for articulating the possibility of change and transformation, mediated through the hegemonic language of the field, this discussion of transformation can be understood as a simultaneous attempt to imagine and enact change while preserving the constitution of a field that would offer participants opportunities, while also making their versions of transformation and differentiation legible: this vision of transformation could only work within this specific world. Thus, as a question of narrative (RQ1), the purpose of change in science communication emerges primarily in terms of calibration, seeking to correct specific problems but not to imagine the field anew. Yet for participants, the notion of carnival also allowed a more expansive version of transformation, with participants' work to join the scheme and enter the field, while requiring substantial forms of practical and emotion labour, nevertheless frequently being understood as a means for realising a more true and desirable version of themselves (RQ2). The experience of science comedy was to learn how to become who they thought they really were. As a question of the field, this recursive duality of transformation and

continuity suggest a hybridised field, at once concretised and bounded enough to allow notions of change to be articulated in opposition to its supposed homogeneity, but also accommodating multiple accounts of the field's composition, purpose and problems (RQ3). These two facets of the field surely worked in tandem, as attempts to change the specific representations, dispositions or attitudes within the field simultaneously further concretise who the field is for. The very ability of participants to see the possibility of transformation and negotiation suggests a permanence that for those on the outside appeared unchangeable.

8.2.2 Building the World of Science Communication

Stories told about science communication are rarely about communicators. Instead, they invariable concern the 'public' and the hope for their transformation through science, the wonders of scientific knowledge or indeed the intrinsic power of scientific knowledge. The value of scientific knowledge and its communication is self-evident, while simultaneously at continual risk of misuse, distortion or misunderstanding and thus in need of careful stewardship. Only here might the science communicator come to prominence, to be recruited, trained and rewarded for maintaining the sanctity of scientific knowledge. However, adopting an ethnographic approach suggests a different story. Where the research questions asked how participants understood and experienced science comedy, the most common experience reported by participants would suggest that above all, science comedy provided participants with the means to access and sustain a form of community membership and support that had previously be unavailable to them. In this sense, science communication was emphatically a story of science communicators.

While participants certainly devoted large amounts of time to the hardware of science comedy, their labour, and indeed their descriptions of the scheme, were aligned predominantly to a broader project of belonging. Membership of the scheme offered far more than a venue for the acquisition of a discrete set of skills and knowledge items, in granting membership of a community that might stand as its own discrete space and enable peripheral membership of the broader field of science communication. With training becoming focused predominantly, if tacitly, on learning and enacting the rules and concerns of the community, once learnt, this training offered participants substantial benefit. Within the scheme, they were able to experiment, play and grow in confidence and foster a sense of their suitability and right to exist within the field. Through a raft of discursive resources, such as narratives of bad practice elsewhere, the nature of the 'public' and the purpose of science communication, participants were able to contribute to building a community that could at once stand within and outside

the broader field. They could be alternative or transgressive, though in a form perhaps only legible within the world of science communication. Seeking to fashion an alternative image of and world for science communication, the scheme was seemingly engaged in building a world of science communication for science communicators.

Despite their location, these practices shared a broader alignment to the field. Moving to the findings from later chapters, it is possible to contend that an understanding of science communication as a project of building a discrete world for science communicators was not limited to the scheme, or bound by the temporality of training. Indeed, criticisms of the scheme and the field more generally coalesced in highlighting their apparent insularity. In chapter five, critical voices highlighted concerns that the focus upon 'working for the scheme' potentially precluded the acquisition of the competencies that would be needed elsewhere, being too focused upon mutual support at the expense of other professional competencies including the ability to take and incorporate critique and a willingness to accept accountability for the delivery of projects. It was precisely the same voices that returned in Chapter seven discussing the tendency of the field to exclude and delegitimise 'non-scientists', noting that the opportunities for exploration and validation afforded to scientists within science communication simultaneously acted to mark that they did not, and would not belong, even when participants' motivations for working as science communicators was to expand the science-society terrain, a goal seemingly encoded within the logic of the field. If the goal of science communication was to build a viable alternative world for scientists, free from the pressures of research while still structured to reward the forms of capital acquired within science, the scheme may well have unintentionally reproduced a facet of the world they wanted to reject, committed to building a world that could only exist for (good) science communicators.

Where so much focus and work was committed by participants within the scheme, and more broadly in the field, was oriented towards the creation of discrete discourses, roles and methods of assessment that might underwrite a discrete and coherent world, questions of purpose recur: is there an end game to science communication? Discussion of the problems of the field, and the means through which it might be transformed, were largely responses to the problems within this autonomous world, rather than a reaction to its very autonomy. Seeking to change how science communicators worked together, the opportunities available to them and the specific representations of science that would be produced within science communication, these attempts at internal transformation did not necessarily require a clear sense of why such work was valuable. This observation had of course frequently served as the

basis of critique: for Stilgoe et al. (2014), a focus upon the 'how' rather than the 'why' risks losing sight of the broader goals of science communication, but potentially, this focus upon the 'how' provided such a purpose. The very existence of science communication necessitated its continuation and science communication's success was, at least in part, the very fact it existed. Why – and whether – this is an acceptable version of science communication of course remains unanswered.

8.2.3 The Nefarious Public

Where the research questions asked what stories are told about science communication, the 'public' recurred as a crucial narratival tool in the practices and imagination of the scheme. The characterisation of the public reported in this thesis aligns to work within STS on the governance of science that asks how 'present' the public are in discussions ostensibly about them. Indeed, within the scheme, where focus lay in ensuring participants' own development and in providing the space for the acquisitions of competencies that in themselves might offer little public benefit, it is unsurprising that discussion of the public was often conducted from afar. Of course, neither the organisers nor participants ever claimed that the scheme itself offered immediate public value, and the attempts to restrict the public from events designed for participant learning served a clear pedagogical purpose. Performing instead to a known, though potentially suspicious, and already scientised public permitted a version of practice curated to the needs of neophytes in the field.

This 'use' of the public and the concurrent ways in which the practices of the scheme were furnished by a 'public talk' that rarely invited public voices suggests a broader continuity with the field. The contours of this 'public' talk appeared particularly aligned to the internal dynamics and priorities of science communicators, as a register in which they could evaluate one another and their work, rationalise and justify the purpose of science communication by positioning discussion of the public as one best conducted behind closed doors. As was argued in chapter six, the exclusion of the public appeared motivated less by a fear of what they might say, but rather to prevent incursions into a professional discourse and understanding that was not intended to be about them.

Considering the findings from chapter seven, the mobilisation of the 'public' as a discourse to furnish internal discussion might be understood as an outcome of a broader understanding of science communication as a space for scientists to negotiate the representation and role science in the public sphere and a space of opportunity for scientists. Where notions of transformation were predicated on internal debates over

how science would and should be represented in the public sphere, the role was the public was employed precisely as a point of reference to furnish this discussion. The views and attitudes of the 'public' might be employed to advocate for particular versions of science – though as suggested in Chapter six, mostly for how they could be imagined to respond to these narratives – and could be incorporated in a professional discourse where they were needed. If the 'game' of science communication was for scientists to negotiate their public facing practice, then a discourse of the public detached from the 'public out there' would seem particularly well suited to the purpose. This discourse suggested that the public could be known, that science communication activities would be for their benefit and that science communication could be confident in ensuring public value, without the voices of this 'public' needing to be incorporated into discussion. The discourse of the public was thus not a misstep or misunderstanding of the public's attitudes and characteristics, but rather a reflection of a broader raft of practices that served a different audience.

While it might be tempting to, one the hand, view this discourse as a sign of the field's failure or, on the other, to adopt a conciliatory tone and view these discursive purposes as simply a reflection of the particular world of the scheme, this analysis does raise the question of whether it could be different: could the 'public' find a way into discussions seemingly about them? It would seem unlikely that it might prove possible to 'fix' this discourse; a discourse and imagination of the 'public' deliberately designed not to take the public as its referent might not be readily transformed. Indeed, while voluminous amounts of research and critique have pointed to the problems of discussing the public within science, it has proven far harder to create an alternative means of navigating science-society relations. Critique might be an end in itself, but possibly a similarly internal one to that found within this ethnography. Nevertheless, the question of who science communication is for remains pertinent and is a discussion far beyond the particular case highlighted in this thesis. While the research here has pointed to a specific answer to this question, where the scheme organisers were deliberately agnostic in regards to the purpose of science communication so as to offer participants a space for experimentation as a refraction of a broader logic of practice, many might question the validity of such a focus. Hoping simply for a better, or more accurate, account of the 'public' within science communication would seem a poor mode of redress, particularly when, as this research has highlighted, the discourse of the 'public' would appear specifically tailored to the needs of the community.

A pessimistic reading of the field would therefore be that the success of science communication's development of professional competencies and modes of speaking

has brought about a form of lock-in, a resilience that is particularly resistant to change. Yet the participants' own moves to attempt to identify and discuss the applicability of their training to the wider field suggests a more optimistic outcome. Where the unquestioned absence of the 'public' enabled the space of the scheme to be 'safe' and furnish the instrumental goals of the programme, it opened the door for participants to question how 'real' their training had been, and what they should expect once they began to face and engage with the 'real' public. This absence certainly enabled a form of reflexivity, as participants were well aware that they were not 'delivering public value' and were frequently urged to approach their work in the scheme with humility. Participants knew that the broader field – for better or worse – was different to the scheme, and the opportunity to discuss this difference was just one of the ways in which the scheme's isolation proved generative. Participants completed the scheme knowing they still had a lot to learn.

8.2.4 The meaning of professionalisation

The findings also highlight a facet of professionalisation that has potentially been neglected in previous work. The third research question asked specifically how the scheme was located, and imagined to be located, within the broader constellation of practices of science communication. Based on the empirical material, the position of the scheme within the broader field might seem counter-intuitive. The scheme was designed to prepare participants for the field through the apparent suspension of the normal rules of practice, not requiring – or indeed providing the opportunities for – participants to 'deliver' public value or indeed access the audiences that might be required to do so elsewhere. Similarly, training was unambiguously aligned to the needs of participants, through the cultivation of events primed to ensure practitioner benefit, and more broadly through an imaginary wherein science communication as a whole existed for science communicators.

These facets of training did not inhibit participants and appeared to be recognisable legitimate forms of practice; if the scheme sought to provide an experimental simulacrum, the similarity was enough to provide leverage into the field., The practices of the scheme evoked a broader field similarly focused upon internal concerns of which the scheme was just one iteration. If the scheme had taught participants that science communication existed primarily for science communicators – which as seen in chapters six and seven was one of the organisers' concerns in regards to training provision having not inculcated the 'public' as the centre of practice – potentially this was a key lesson to learn. As one participant noted in chapter five, a potential problem posed by the insularity of the scheme was not necessarily its isolation, but rather that it

is one community amongst many and that there were multiple localities to navigate within the field.

Discussion of the professionalisation of science communication, as well as attempts to gauge how far science communication has professionalised, have often rested on how far the field looks like other professional fields. In discussion of academic science communication (e.g. Gascoigne and Metcalfe 2017; McKinnon and Bryant 2017; Trench and Bucchi 2010), the hallmarks of science communication's maturation lies in its ability to align to the standards of other academic disciplines, through conferences, journals, theories and methodologies specific to the field, and the presence of discrete training, with science communication a course in its own right, rather than a part of another field's inquiry. Similarly, professional maturation has been imagined to rest on the existence and maintenance of professional bodies, the availability of ongoing training, awards and tailored systems of recognition and clear identities for practitioners. The hallmark of professionalisation and academic autonomy would appear to lie in the cultivation of practices that were distinctly 'science communication'.

In doing so, the criteria for gauging the professionalisation of the field would appear to be largely external: the existence of professional bodies, forms of accreditation and training that match other fields, the recognition of the field as discrete elsewhere, and more generally the ability of science communication to match the aesthetic composition of other, already professionalised, fields. This image of professionalisation might suggest that the success of science communication rests on the ability of the field to go beyond its own locality, and stand alongside other, more established academic disciplines and professions. Yet such a process also relies on a turn inwards, in cultivating specific, disciplinary-bound practices and understandings of science, scientists and the public (among others) that, as a means for science communication to gain autonomy, might also mark their unintelligibility elsewhere. Indeed, in seeking to create a form of practice that would be recognised elsewhere as 'professional', the empirical content of the thesis suggests that such processes relied on the cultivation of practice that might only have made sense locally.

What made a good science communicator was understood primarily as a question of who belonged in the community; where the scheme might have sought to cultivate a more 'professional' attitude to science communication in advocating specific forms of good practice seen to be missing elsewhere in the field, such understandings simultaneously served to foster a local community. Similarly, what science communication should seek to do, the role of the science communicator and

understandings of who the public were – and what they could be made to be – served less as a means to align science communication to broader professional work engaging with the 'public', but rather to construct a public tightly bound to the specific local demands of practitioners. If a facet of professionalisation is increased localisation and self-referentiality, the story of science communication might align to Shapin's concerns regarding 'hyperprofessionalism' (Shapin 2005), with the achievements of science communication in fostering local practices and meanings might simultaneously create a version of science communication that makes little sense to those outside.

8.2.5 Non-exceptional science communication

These conclusions raise the question of whether there is anything special about science communication. Where this thesis was motivated by the arch-question of 'What does it mean to do science communication?', the findings might seem familiar. In moving away from an account of science communication predicated on scientific knowledge, quite clearly the story of science communication is far more extensive, and rarely dependent on the epistemic claims about the natural world. In learning to belong within specific communities, the orientation of practices and discourse towards the often unspoken assumptions of science communications would seem just as pertinent, if not more so, for understanding practice as the qualities attributed to scientific knowledge, and cannot be explained in reference to the apparent nature of science. Such a conclusion is far from surprising: the analytical tradition of STS, particularly work inherited from laboratory studies, would surely prime a conclusion that science communication is just as 'social' as anything else. Where this thesis has attended to the conditions in which participants joined and learnt the rules of a community, developed local practices of meaning-making and evaluation, there would seem to be little that was exceptional about science communication.

However, while it might be possible to claim analytically that science communication might be examined and understood like any other social practice, it is nevertheless a field treated as though it is exceptional. Where academic work has positioned science communication as a story of scientific knowledge, there would appear to be an implicit claim that science communication does not need a sociology, in contrast, for instance, to the public, whose engagement with science is presumed to be more contingent and 'social' in every negative sense. The difficulty participants found in articulating the purpose of their work reflected less of a sense that, because science communication was like any other form of work or hobby, it did not need an arch-narrative, but rather that the need for science communication was so obvious it did not need articulation. Even for the scheme organisers, who were decidedly agnostic as to the purpose of

science communication, seeking primarily to fix problems in the world in which they had found themselves working, they were nevertheless engaged in the reproduction of a social world that is far less self-evident than it might be claimed to be. Acknowledging and interrogating the contingencies of the world of science communication – while not revolutionary in claiming they exist – is surely necessary for developing a critical account of what science communication can be said to 'do'.

8.4: Theoretical and Methodological Contributions

As an exploratory study, this thesis did not seek to provide theoretical or methodological innovation, rather drawing from established theoretical and methodological traditions in Science and Technology Studies, anthropology and sociology to examine an under-researched feature of the field. However, the thesis has demonstrated the applicability of this work in illuminating science communication as a complex and multi-faceted social world, one in which extant discussion of the field's composition, concerns and priorities might be understood not merely as either a reflection of an unchanging reality that might allow evaluative critique, but as ongoing concerns that members of the field participate in negotiating, reproducing and challenging. The theoretical and methodological tools used in the thesis highlight potential resources for ongoing examination of science communication as a sociological site in its own right.

The theoretical framework for the thesis drew from established work in both sociology and anthropology that enabled the study of science communication as an active site for the production of knowledge. Thus rather than viewing science communication as simply for the mechanical reproduction of knowledge, it became possible to examine training, professionalisation and the production of images of science and science-society relationships as lived, negotiated and often contested. Where previous work has foregrounded either the translation of scientific knowledge within science communication events, or attended to the particularities of representation with focus upon their production, the theoretical and methodological tools employed in this thesis have allowed for an account of science communication as a lived form of practice, concerned less with highlighting the topography of the field and the conditions enabling science communication, and instead asking how the features of the field are themselves part of an ongoing contingent process of emergence. Consequently, it has been possible to examine notions of value, audience and reception as facets of a world that science communicators are continually building, rather than needing to rely upon an externalist account of what science communication does, or should do.

By positioning science communication as a form of figured world, the thesis has demonstrated one way in which science communication can be understood in terms of the broader histories and economies of value through which it has taken shape, focused upon the science communication practitioner as a research subject that has been broadly overlooked in the development of science communication research (see Figure 4). Where Chapter Three presented a generic theoretical map of the relationship between Communities of Practice, Figured Worlds, Bourdieu and Bakhtin (Figure 2 – page 84), it is now possible and illuminate the more particular and local substantiations of these theoretical concerns for the study of science communication. A key contribution of this thesis is thus less the substantiation of a new theory, but rather a demonstration of one way in which concerns surrounding practice, narrative, purpose and identity might be studied together.

Able both to identify discourses within the field and to ask what is at stake in these discursive representations of science and society, there is a clear opportunity for deeper understanding of the field's composition. For instance, where science communication was figured as a space of opportunity for scientists, this narrative furnished forms of practice tailored to ensuring benefit for communicators, potentially at the expense of other groups. This tension was itself generative: within a diverse professional landscape, the apparent conflict between an image of the field predicated on the needs of the 'public' and the science communication gave rise to an increasingly complex discourse of the 'public', through which either focus could be justified, attributed to others as a sign of their unsuitability within in the field, or as a means to construct a desirable image of who the public were. Where the borrowings of this discourse from a more established history of 'public talk' might indicate its misuse, the Figured Worlds approach enables a more nuanced view.

Methodologically, the thesis has demonstrated how ethnographic work might contribute a productive and complementary methodological focus to extant work seeking to trace the meanings of science within science communication and broader understandings of the composition and purpose of the field, by tracing the context and situatedness of more extant representations of science and science communication as they emerge. As a means for investigating the practices through which the discourses of science communication emerge, an ethnographic approach complements previous research, both by opening up new research sites such as the training spaces created by science communicators and the venues for in-group communication, and allowing for a research direction that positions questions of purpose, value and success not simply as

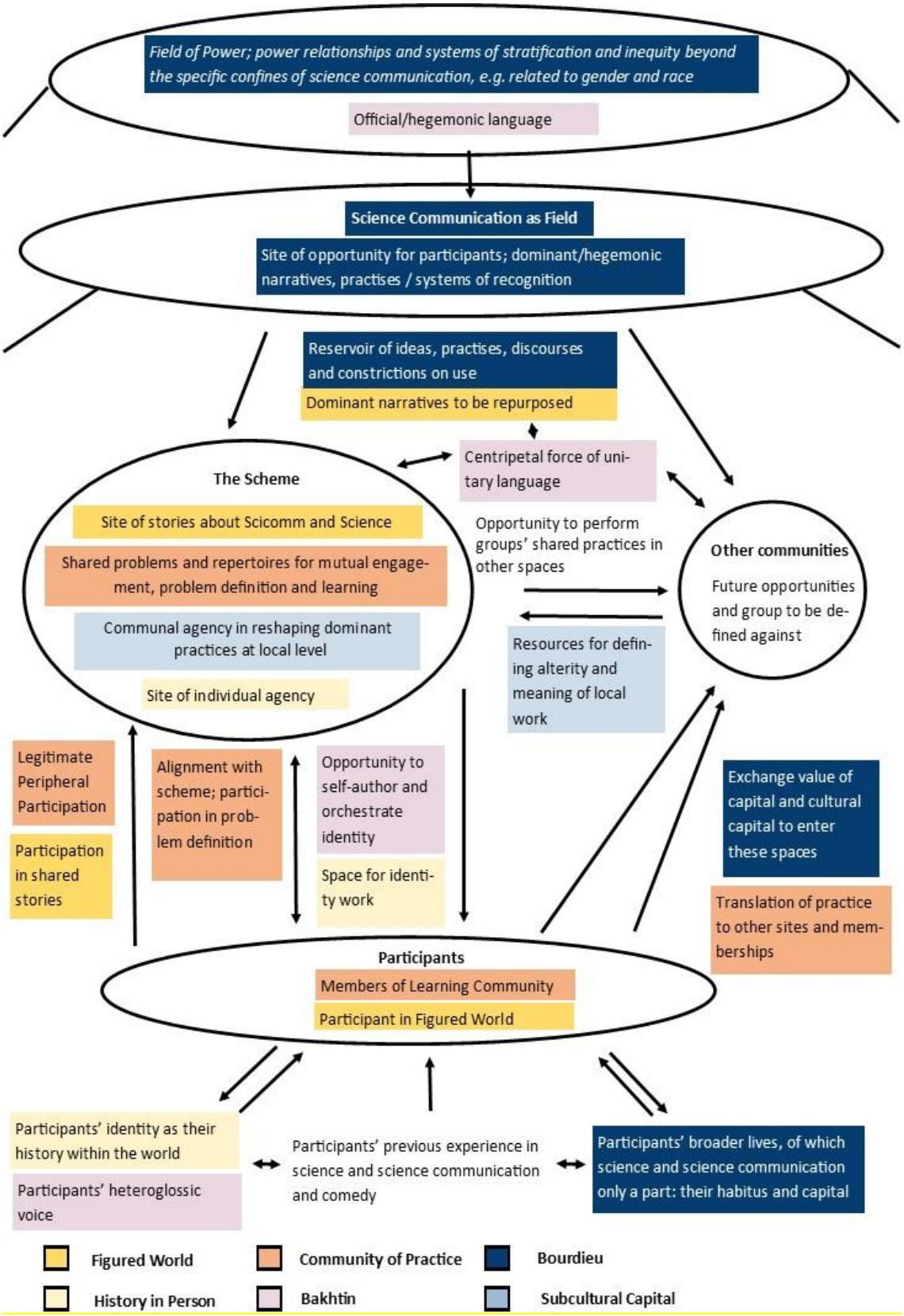

Figure 4: The theoretical framework mapped onto the sites and actors of the scheme

extant features of a world to be measured and evaluated, but as facets of an on-going process of world building.

Enacting this methodology has depended, at least in part, on the ability to remain an outsider, not requiring 'loyalty' to the field (Medvecky and Leach 2019), in needing to endorse the project of science communication and viewing research as offering a substantial opportunity for 'improvement'. In this particular historical moment in which there are concerted efforts to demonstrate and articulate the value and independence of science communication research and practice, there may be fewer opportunities to ask why science communication is at it is, if such questioning might challenging the presumed legitimacy of the enterprise. Yet approaching the field as an outsider has not required its derision, nor the belief that ethnographic analysis offers a unique authoritative vantage point. By seeking to enact Stengers' methodology of humour as an axiological principle of research (Stengers 2001), the methodological choices made within the thesis have sought to resist either reproducing the features of the world uncritically, or presuming the possibility of authoritative critique, but rather to acknowledge the specific achievements of the scheme, as a starting point for extended reflection.

8.5: Limitations

This study sought to provide an exploratory account of science comedy as a lived form of practice, and in doing to provide a broader account of the social world of science communication motivating science comedy's proliferation. By highlighting the particular concerns that emerged within the process of training to enter the field, this local story can serve as a source of orientating concepts for future research. However, in its locality and specificity, this study involved particular pragmatic, theoretical and methodological limitations that ought to be taken into account.

8.5.1: The Generalisability of Case Study Research

As exploratory research, the thesis did not intend to produce findings that could be readily generalisable to the wider field, instead seeking to produce a focused examination of a site that might at once provide a thick description of the case and generate orientating concepts for future research. While questions of generalisability, validity and reliability were addressed in chapter four in reference to the outcomes of case-study research in general, the specific location of this case-study ought to be considered. While any case-study should be explored in part for its specificity, it should be noted that the case-study might not be fully representative of the field. As the scheme emerged without specific institutional affiliations and in many respects sought to stand against the field, defining itself negatively as critique of mainstream science

communication practice, the scheme might well not represent a ‘typical’ case of training and socialisation within the field. Similarly, the particular strength of the community, and the vast amounts of labour that participants committed to building the community – and the support they received in return - may well not be found elsewhere, as training within universities might not encourage participants to develop an identity as a member of a cohort to the same extent.

Facets of the scheme, as well as facets of conducting research, could well be a product of the largely autonomous position that the scheme held within science communication. As a researcher, entry to the field was certainly enabled by not needing to negotiate institutional parameters and there was little prescription on the scope the research could take or expectations on what the research would produce. Similarly, while participants may have needed to negotiate the particular concerns of the community and learn how to belong within the space, they did not need to negotiate a position within an institution, the expectation of matching educational or professional metrics, or indeed financing their training. Given pushes to professionalise and institutionalise science communication, it is likely that training elsewhere would reveal different tensions and priorities for participants, that would similarly require detailed work to disentangle the topology of the field.

8.5.2: The Scale of the Project

The pragmatic conditions of conducting doctoral research limited the scale and scope of the project. While it was possible to conduct a focused ethnographic study for 14 months, the study was nevertheless limited in terms of scale. Financial constraints, the need to finish the project within the funding window and the reliance of a single researcher meant it was not possible to conduct a more longitudinal project. In terms of time, it was not possible to extend the project to follow participants after the scheme had formally ended, and trace how membership of the scheme changed once there was no longer the financial support to ensure dedicated input from the organisers. Similarly, it was not possible to explore what happened when participants entered the field, though as noted in the final section of Chapter 7, they imagined the possibility of retaining membership of the scheme even when career and performance opportunities would reside in the broader field.

Where the spectre of ‘other’ science communicators featured heavily in the empirical work, as a means through which the scheme’s position was articulated, often negatively, the focus on a single ethnographic site precluded the opportunity to include the voices of these ‘other’ science communicators in the study, apart from how they were voiced by participants, particularly the organisers. While the thesis’ focus lay

precisely in the ‘other’ as a local figure of the scheme, the absence of these voices limits the ability of the thesis to comment upon the scheme’s reception. It is probable that the reactions of other science communicators to the scheme might have inflected on the characterisations of science communication found within the scheme.

A similar issue of scale emerges in the sites that were available for analysis. As noted in the methodology, the site for the thesis was prescribed fairly narrowly as the spaces where the group received training and performed, and the communication platform specifically designated as part of the scheme. While these sites produced a wealth of data, it should be noted that these were not the only sites where the scheme was happening. Where participants often spoke about how transformative the scheme had proven in their lives, these claims would suggest that the ethnographic site was potentially much larger, and that understanding what the scheme meant for participants was a much broader story than their explicit interaction with the scheme’s architecture. It would of course have been very difficult to even attempt to attend every performance and event in which every member of the cohort had participated. Though the interviews in part responded to this issue, in allowing participants a space to discuss the meaning of the scheme for them, the study could not claim to have captured the scheme in its entirety.

A theoretical consequence of the issue of scale is that while it has been possible to comment on the world of the scheme, it is more difficult to make substantive observations about how the field works. Where the empirical focus on the thesis predominantly concerned questions of practice and the figured architecture of the scheme, there was less opportunity to position the scheme in the wider field, other in the ways that they were described by participants. Thus while macro-level theories such as Bourdieu’s notions of capital/habitus/field provided useful theoretical tools for examining local forms of value and hierarchy, these observations do not necessarily lend themselves to a macro-level account. While an ethnographic approach has proved useful in moving beyond accounts of training that are heavily tied to skill acquisition, to provide an account of the field would require a much wider study, both in terms of time, space and scope.

While the issues highlighted in the section are potential limitations of the study’s scope and generalisability, they pose empirical questions for future research. Taking the empirical findings as orienting concepts for investigating the broader topology of the field, investigating how far the concerns of the scheme are reflected in the field, and the ways that these concerns are experienced, voiced and understood provides a means

for exploring the social world of science communication in its localities and complexities. I now turn to suggested avenues for future research that emerge from the thesis findings.

8.6: Future Directions for Research

The findings of this study point to the value of close ethnographic work in understanding science communication as a social world and generative site for the production of multiple understandings of science, the 'public' and the social roles of scientists. The research could be developed by attempting a wider study of the field of science communication and public engagement in the United Kingdom, examining how normative concerns of purpose and success emerge across the multiplicities of the field. Doing so would provide the opportunity to examine and composition and relationships of multiple communities in the field, their concerns and practices, and to ask whether there are shared figures and narratives that are constructed within and construct the field and to attempt to characterise broader patterns of structuration, the division of labour and capital, and the identity of the science communicator.

An ethnographic approach might lead to a multi-case study analysis, from which a broader picture might be drawn, though there might be the opportunity for broader field-level analyses, seeking to understanding participants' practices, motivations and understandings of science, their own work and one another. In the tradition of STS, it would be productive to follow science communicators participants back into the laboratory, to explore the relationship between their identities as scientists and science communicators, where they inhabit both social worlds. Certainly, such research is not new, though there might be an opportunity to resist presuming the need for research to have an immediate practical pay-off, instead seeking a broader and more reflexive view of science communication as an active site for the production of representations and knowledge about science.

In seeking to capture the larger picture, there is also the opportunity to explore in greater depth a professional role that has perhaps been neglected in the literature: the administrator. Many participants in the scheme, particularly those wanting to work in public engagement, aspired to have professional roles that were decidedly off-stage, as institutional public engagement managers and coordinators whose responsibilities would consist primarily of organisation and programming, facilitating rather than participating in interactions with the public. While the majority of jobs in the sector seem to be primarily administrative (for instance those advertised on the professional JISC mailing list 'Psci-comm') academic attention has often focused on performers and the skills needed to mediate public performances and interactions, of course with some

exceptions (e.g. Davies et al. 2009). Yet this group is surely crucial for the state of the field, and risks being invisible where academic constructions of science communication position the issues of the field to lie in the recruitment of science and the transmission of scientific knowledge. By working with public engagement professionals in developing a deeper understanding of the topology and complexities of the field, such research could serve as a starting point for a broader discussion and imagination of what science communication and public engagement could be.

In studying science comedy, the thesis has followed Horst and Davies (2016) in using a restrictive definition of science communication as that conducted within the professional confines of the field. Yet, as noted in the introduction, the story of science comedy seems much broader, as science has recurred in both televised and live comedy. Where the thesis has explored the specific uses of comedy within a professional landscape as a means for exploring science communication, foregrounding the wider study of comedy could provide a fruitful lens for examining the role of science in the public sphere. Exploring the themes, narratives and absences that emerge in comedy elsewhere could offer a new site for exploring the construction of science outside the usual confines that dominate attention in STS and science communication, particularly where comedy production is not tied to explicit science communication or education frameworks. Where the thesis has asked how comedy is understood and shaped to provide a suitable format for science communication, we might ask the inverted question of what science needs to look like to furnish comedy. Within the broader field of comedy, where science would be one topic amongst many, exploring the uses of science in comedy could provide a means for exploring the relationship between science and other institutions and forms of knowledge, such as politics and religion, to explore the relationships and boundaries that are drawn as well as the contexts in which science comes to matter.

Sociological work on comedy also suggests that the means of both comedy and science in public could be illuminated through more in-depth work with the audience. Though this thesis has been concerned primarily with producers, Kuipers and Friedman's work on taste and the legitimate consumption of comedy could be applied to science comedy, to explore how audiences discuss consumption, the meta-languages of comedy employed and the 'right' ways to watch comedy. Tracing how audiences consume science content, and how audiences construct legitimate and illegitimate interactions with science might inform analysis of science communication beyond the specific context of comedy. Such work could contribute to research in science education that has documented the highly various and complex ways in which

science content is consumed and thus move away from more event-based research, where interest in the audience is for the most part defined in terms of the activity, almost as a test of whether the particular intervention worked, instead orienting attention to the public's own practices of science.

Finally, the thesis might provide a blueprint for a more reflexive exercise, examining the social world of STS, and the process through which academics become STS scholars. The earlier iterations of STS within the Strong Programme advocated the need for 'reflexivity' in sociological accounts, with one test of the legitimacy of an STS analysis being the ability to offer a recursive explanation of its own emergence. While this principle may have lost favour where the Strong Programme was positioned as advocating a 'science of science' that would take an externalist and adjudicative position, questioning how knowledge is produced within STS could remain a productive route of enquiry, particularly where the concerns of STS frequently intersect with science communication. Both fields are engaged in 'public talk', evoking and making use of a discourse of the public to justify practice, levy critique and draw the boundaries between forms of enquiry. Where STS levers critique upon science communication for misunderstanding or misrepresenting the public, such work relies upon the construction of a public that can be used for this work (Irwin et al. 2013). To ask what the public means for STS, and how this discrete facet of discourse relates to broader questions of purpose and belonging, could well prove productive.

As Stengers notes in relation to irony, the impetus within STS for criticism and analysis might well rest upon an unquestioned ontological commitment to the concerns that are ostensibly the object of critique and resist the opportunity to analyse the field's own social position. Indeed, where a PhD project involves the production of a thesis, it is also a training scheme with learning focused upon becoming an academic. In completing the thesis, many aspects of this process have cohered to the issues documented in the thesis. Becoming an STS scholar surely involves learning the rules of a specific community, learning how to talk and write in ways that at once show membership and articulate potential future positions in the field, and learning how to think and talk about the 'public'. Indeed in this thesis, which like much work in Science Communication and STS has been highly interested in the 'public', such discussion has not necessitated the direct involvement of any public, but rather engagement with an established discourse circulating within the field. Asking what the public means for STS, how scholars are socialised in the discipline, the characteristics of a good STS scholar, and notions or purpose and value might provide a means for thinking about how the social world of STS inflects on the knowledge it produces.

8.7: Implications for Practitioners

As a thesis about science communication, I acknowledge that this research might look little like the tradition of science communication that has emerged particularly in the United Kingdom since the 1980s. This difference might be exacerbated by the fact that while the thesis has ostensibly been concerned with science comedy, there has been little comment upon its form or aesthetic characteristics, its content and representation found within comedy performance, or whether science comedy 'works' as science communication, as other research has sought to do (e.g. Bore and Reid 2014; Pinto et al. 2013). Consequently, I appreciate that the thesis may invite frustration given the lack of a clear 'implication' for practice. However, I would query whether all research on science communication should seek to offer clear and discrete directions for practice, and presume the purpose of research to lie solely in the field's improvement. Such a focus might well inhibit the opportunity to discuss the experience, purpose and meaning of science communication beyond its technical concerns, conversations in which practitioners must surely play a crucial part.

In this sense, the 'implication' of this research for practitioners is perhaps one that would might seem obvious to many, that the practices of science communication are far more complex than the technical concerns of tailoring messages, finding suitable audiences, venues and methods for communicating, and the measurement of outcomes. Indeed, when participants in this project described in interviews what it meant to do science communication, and what made a good science communicator, these were rarely the facets that participants thought important. Becoming a science communication is to enter a social world, to learn the behaviour, languages and demeanours of the field and to identify the multiple roles and relationships that are available. As the research has shown, the wider story does more than set the scene or paint in the background of practice, but instead demonstrate that these practices matter, as they underwrite the project of science communication, making the very existence of the field possible while also making alternatives harder to imagine and enact.

In highlighting the complexity of this world, notions of good practice, value and purpose seem multiple and potentially contradictory, yet also tractable, furnishing the field with discursive and material resources with which to make sense of science communication and the substantial labour committed to ensuring its continuation. Highlighting the tensions that emerge in this work is not to suggest that science communication is somehow meaningless or deceptive, but rather to invite a more reflexive discussion of the contingencies and trade-offs involved in being a science communicator. Such

trade-offs would appear less a sign of the weakness of the field, as science communication and public engagement done well or badly, but rather indicative of the contingencies of a field attempting to professionalise and develop practices that can fulfil its goals. For instance, while readers may challenge or endorse or outright reject the notion of science communication as a space for scientists, designed to welcome certain practitioners and not others, there is the opportunity to discuss communally what is at stake in promoting particular versions of science communication. This is a much deeper question than whether the scheme did science communication 'well', but rather to consider what it means to say that science communication is working well, badly or not at all. There is no 'right' answer here, or easy ways to resolve these tensions, other than to open these problems and tensions out and invite discussion, developing arenas in which to bring these issues to light is crucial in understanding the role and purpose of the field.

8.8: Afterword

The empirical findings and conclusions documented within this thesis are certainly not what I expected to be writing about when I set out to research 'science comedy', perhaps not anticipating how quickly the move to mark comedy as a tool of communication would emmesh a fledging performance format within the highly complex world of British science communication. Yet this surprise is instructive, highlighting the need for fine-grained, close examination of the practices, ideologies, assumptions and achievements of a rapidly maturing sector that has so far proven resistant to such analysis, where the professional world of science communication is either self-evident or self-evidently wrong. As my research has shown, even within a small cohort working largely to effect a highly localised goal of building the community they wanted to exist within the field, the degree of nuance, reflexivity and care with which such a fledging world was built at once urges acknowledge of its achievement, as well as the consideration of how much more might be said about such activity.

As an exploratory study, this research attends to a small niche within a much larger ecology, and offers just one interpretation, though hopefully a valid one. However, the thesis has also shown the validity and fruitfulness of interrogating both the world of science communication, as well as the dominant frames in STS that presume, though might not easily demonstrate, can be used in making sense of an increasingly professionalising and divergent social world that might look less and less like STS might have once imagined it would look. Approaching science communication with humour, whether or not the topic is explicitly that of comedy, might provide a means through an impasse, where competing norms, expectations and understandings of

what science communication is – and should be – hinders the opportunity for research and sincere dialogue between the various niches of the field. STS is surely just one, and perhaps from the outside, looks much like the insider comedian seeking to effect a Bakhtinian turn, cloaked in the discourse of transgression and transformation without needing to articulate its own commitments and alignments through which such critique makes sense. Acknowledging the limits, commitments and desires encoded in this research offers a way forward, a research future in which I hope I will be able to participate.

Appendix One: Cohort Demographic Information

COPY OF DOCUMENT USED TO INTERVIEWS TO COLLECT DEMOGRAPHIC INFORMATION

UCL DEPARTMENT OF
SCIENCE AND TECHNOLOGY STUDIES

'Oh, with a name like "Miss Information," she must know something: exploring the use of comedy in Science Communication.

Any data that emerges from participants will be anonymised. This means that participants will not be personally identified, nor will their participation (or non-participation) be revealed. To aid analysis, participants are invited to declare demographic information that will be used in the study. Participants are requested to choose an alias that will be used in all stages of research: supervision, conference presentations, the production of the PhD Thesis and any subsequent publications.

Participants are invited to declare any demographic information they are willing to share. Participants are also free to declare whatever information they wish in regards to each category. Any declaration of demographic information is entirely voluntary. In declaring this information, participants are aware that demographic information may be used in the publications and presentations related to the project.

The identity of each participant will be known only to the researcher. The researcher will maintain a log that lists participants alongside their aliases, though this will be entirely confidential and will at no point be shared.

Alias/Pseudonym

Research Area

STSUCL STSUCL STSUCL

Institutional Affiliation

Career Stage

Gender **Sexuality**

Race **Ethnicity**

Class Background

Educational Background

Family History of Higher Education

24 participants took part in interviews during the project. For each item, all responses are listed and are organised alphabetically. Where more than one participant answered in the same way, these are indicated by brackets. The number of non-responses are noted at the end of each list.

Research Area

- 3D printing shape changing gels – Engineering/Physics
- Astronomy
- Bowel Cancer
- Chemistry
- Engineering
- Evolutionary Biology
- Genetics
- Geomicrobiology
- History / STS
- Information Security / Crime Science
- Materials Science
- Medicine
- Medieval History / Neuroscience / Personal Training
- N/A
- Neuroscience (2)
- Public Engagement
- Rapid prototyping engineer
- Science Communication
- Wild Cat hybridisation
- Zoology
- ***No response (3)***

Institutional Affiliation

- Charity
- Financial Institution
- None (3)
- Research Institute
- Russell Group University and Freelance
- Russell Group University in London (11)
- Russell Group University outside London (3)
- Science centre
- Veterinary School
- ***No response (1)***

Career Stage

[One participant gave two responses]

- Early
- Early 30s! Is that a career stage?
- Early Career research
- Freelance Writer
- Full time carer
- Has been a director
- Impact and Innovation Office
- Outreach leader
- PhD Candidate
- Planetarium operator / presenter
- Post Masters
- Public Engagement Coordinator
- Registrar
- Research Fellow
- Senior Manager
- ***No response (4)***

Gender

- Cis-woman
- Confused
- Female (16)
- Female / don't say
- Male (3)
- Man
- Non-binary

Sexuality

- Bisexual (7)
- Confused
- Functionally hetero
- Gay (2)
- Gay woman
- Heterosexual
- Heterosexual (2)
- Married to a man
- Queer

- Rather wouldn't say
- Straight (4)
- ***No response (2)***

Race

- Ashkenazi
- Basic White
- British
- Caucasian
- Mixed
- Mixed Black Caribbean and White British
- South Asian
- White (9)
- White British (6)
- ***No response (2)***

Ethnicity

- Anglo-Indian
- British (6)
- London
- WASP
- Welsh
- White
- White Australian (2)
- White British (7)
- White other
- ***No response (3)***

Class Background

- 1%
- Australian
- Don't know
- Lower Middle (2)
- Middle class (8)
- Unsure
- Upper middle – parents owned a house, not a second house. I will never own a house

- Upper middle class (probably)
- Working / Middle Class
- Working class (3)
- Working class (A surprising amount of middle class opportunities)
- Working class (traitor)
- ***No response (2)***

Educational Background

- 4 year MSci Physics. State school and sixth form. 3 years so far of funded PhD
- A-levels: state school; masters and PhD
- Arts and Humanities
- Arts Grad
- Australian
- BA Natural Sciences and Management
- Bachelor of Science with Honours; Masters in Science Communication Outreach
- BSc
- BSc
- BSc and MSc in Landscape Architecture
- BSc and MSc; 1 year of PhD then quit (!)
- Chemistry MSci (1st class honours), Chemistry PhD – writing up
- MSc and PhD. Evolution and behavioural ecology
- MSci and MRES
- PhD
- PhD, 2 masters
- Private school (day); Russell Group MA and PhD
- Public School UK
- Scholarship private school
- State comprehensive and further college; University undergrad and masters
- State school (partially selective)
- State school / sixth form; Russell Group University (MA); Russel Group University / Research Institute PhD
- Undergraduate and Masters in Archaeology
- University MEng; A-Levels; GCSEs

Family History of Higher Education

- 1st in family to have degree
- Both parents were first in their families to have degrees
- Dad – masters (Business), MBA
- Dad had degree in physics

- Dad has masters
- Diplomas
- Father has PhD, Mother has BSc, is teacher; but both parents started as working class. Dad lived in council house as child, mum was asylum seeker refugee
- First with a degree
- Grandfather PhD; Grandmother and Father BA
- Grandfather studied History at Cambridge; no one else in my family went to Uni
- Lots – mum pharmacy degree; dad musical degree, lots of medical allied professions (eg. dentist)
- Mother and Father BSc
- Mother studied for part-time degree and masters; but apart from that my sister and I are first generation university ed.
- Mother's side: one person with university degree before my generation; dad's side: two people. Technically neither of my parents went to uni but my mum is a nurse and dad went to a poly so they would both have degrees now
- Neither parent went to university
- None
- None
- Parents and Grandparents all attended Uni
- Parents both have science degrees
- Parents both PhD
- Parents both university; 1 grandparent university
- Parents don't have uni education; mixed in wider family
- Parents went to university. Maternal grandparents went to university.
- Step dad has a degree in geology

Appendix Two: Ethical Approval for Research

DOCUMENT ONE: ETHICAL APPROVAL FOR RESEARCH, JULY 2017-AUGUST 2018

DEPARTMENT OF
SCIENCE AND TECHNOLOGY STUDIES

UCL

This document certifies that

Edward Bankes

has received ethical approval for their project entitled

Exploring the relationship between science and comedy

in accordance with the UCL Department of Science and Technology Ethical Research policies and procedures.

Application reference number: STSEth120

[redacted]

Signed: Director of Research

Date of Approval: 5 July 2017

DOCUMENT TWO: ADDITIONAL ETHICAL APPROVAL TO EXTEND DATA COLLECTION TO DECEMBER 2018

DEPARTMENT OF
SCIENCE AND TECHNOLOGY STUDIES

UCL

This document certifies that

Edd Bankes

has received ethical approval for their project entitled

Exploring the relationship between science and comedy

in accordance with the UCL Department of Science and Technology Ethical Research policies and procedures.

Application reference number: STSEth126

[redacted]

Signed: Director of Research

Date of Approval: 2 January 2018

Appendix Three: Interview Documents

DOCUMENT ONE: PARTICIPANT INFORMATION SHEET

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"Oh, with a name like 'Miss Communication', she must know something: exploring the use of comedy in Science Communication

This information sheet has been written to outline the scope of my PhD project, to indicate my intentions for using interview data, and to state how the data will be stored and used. I hope to be able to conduct interviews with practitioners of science comedy, though participation is entirely voluntary, and participations are free to withdraw their data up to 20 days after the interview is conducted by contacting the researcher: Edward Thomas Bankes (edward.bankes.09@ucl.ac.uk). If you have any questions regarding the scope of the project or the use of interview data, please feel free to contact the researcher.

Who am I?

I am PhD candidate in the Department of Science and Technology Studies (STS), University College London. My work is focused on qualitative analysis on the practices of science comedy, and the experiences of scientists, science communicators and comedians who perform science comedy in the United Kingdom. My work also explores whether, and if so how, science comedians understand science comedy as part of science communication and public engagement with science. The project draws from theoretical work in Science and Technology Studies, Science Education and the sociology of humour. Overall, my project employs a number of qualitative methods, including ethnography, interview, narrative analysis and documentary analysis.

What am I researching?

My research is interested in the experiences and attitudes of science comedians, performers of comedy the content of which can be seen as being 'about' science. The primary research questions ask how science is represented within science comedy, and how science comedians experience and understand doing comedy, the relationship between science and comedy, and how comedy serves as a way of talking about science. Given the growth of science comedy within professional Science Communication and Public Engagement with Science in the United Kingdom, my research also asks whether, and if so how, science comedy practitioners understand their performance as a part of these social programmes. My research is multi-sited, meaning that a number of case-studies in different contexts are explored, to begin mapping the field of science comedy, including the use of science in mainstream comedy, scientists using comedy in their work or performing

their research on stage, comedians who draw on scientific ideas and imagery, and the use of comedy within professional communication and engagement activities.

What does participation involve?

As part of my project, I am interviewing science communicators, scientists, performers and comedians who perform science comedy in the United Kingdom to build a picture of the field of science comedy in the United Kingdom. Participants will be invited to take part in semi-structured interviews, where they will be invited to speak about their experiences of performing science comedy, their experiences as scientists, science communication and comedy, and their attitudes towards science communication and public engagement with science in the United Kingdom.

All data will be anonymised at the point of transcription, and any identifying information deleted. Involvement in the project will be kept confidential.

How will the data be stored and used?

After the completion of the interview, recording of each interview will be transferred onto an off-line encrypted hard-drive. Participants will have a period of 20 days to withdraw their consent for data to be used as part of the project. Only after this period will interviews be transcribed and will be stored using a pseudonym chosen by the participant. Only the researcher will be aware of the identity of each participant.

Anonymised extracts or summaries of interviews will be used in my PhD project and academics publications emerging from the final thesis. Participants' contributions to the project will be kept anonymous in accordance to the British Sociological Society Ethical Practice: https://www.britsoc.co.uk/ethics

The research is being conducted in accordance with the ethical procedures of the UCL Department of Science and Technology Studies, and has gained ethical approval. If you have any questions of concerns regarding how the research is being conducted, please contact the supervisors of the project: Professor Brian Balmer (brian.balmer@ucl.ac.uk) or Dr Emily Dawson (emily.dawson@ucl.ac.uk).

Thank you and please do not hesitate to contact me at any stage of the project.

DOCUMENT TWO: CONSENT FORM FOR INTERVIEWS

UCL DEPARTMENT OF
SCIENCE AND TECHNOLOGY STUDIES

'Oh, with a name like "Miss Information," she must know something: exploring the use of comedy in Science Communication.

I agree to take part in the above research project. I have had the project explained to me and I have read and understood that agreeing to take part means that I am willing to:

- Engage in an interview with the researcher
- Be audio recorded by the researcher, with permission
- Have extracts from the interview used in the production of a PhD Thesis and academic papers related to the research

I understand that my contributions to the project will be kept anonymous.

I understand that my participation is voluntary, and that I can withdraw my interview, without reason, up until 20 days after the date of the interview, by contacting the researcher at: edward.bankes.09@ucl.ac.uk.

I consent to the processing of my personal information for the purpose of this research study. I understand that such information will be treated as strictly confidential and handled in accordance with the Data Protection Act 1998. (http://legislation.gov.uk/ukpga/1998/29/contents)

I consent to the demographic information I declare being used in the research study, and publications emerging from it. I understand that only information that I explicitly declare will be used.

Name: _____

Date: _____

Signature: _____

STSUCL STSUCL STSUCL

I give my consent to transcripts of my interview to be made available to other researchers. I understand that in this instance, a transcription of my interview along with my declared demographic data will be shared with other researchers requesting to use it. I understand that I can withdraw my consent for the sharing of my interview at any time, but that my data may be shared prior to the withdrawal of my consent.

Name: _____

Date: _____

Signature: _____

--

Researcher's Name: _____

Researcher's Signature: _____

DOCUMENT THREE: ADAPTED INTERVIEW CONSENT FORM FOLLOWING IMPLEMENTATION OF GENERAL DATA PROTECTION REGULATION (GDPR)

DEPARTMENT OF
SCIENCE AND TECHNOLOGY STUDIES

UCL

"Oh, with a name like 'Miss Communication', she must know something: exploring the use of comedy in Science Communication

Before Interview

I agree to take part in the above research project. I have had the project explained to me and I have read and understood that agreeing to take part means that I am willing to:

- Engage in an interview with the researcher
- Be audio recorded by the researcher, with permission

Name: _____

Date: _____

Signature: _____

Researcher Name: _____

Researcher Signature: _____

STSUCL STSUCL STSUCL

After Interview

- I consent to the audio-recording of my interview being transcribed and used in the production of a PhD Thesis and academic papers related to the research.
- I understand that my interview data will be anonymised at the point of transcription and that no identifying information will transcribed. I understand that all audio-recordings will be permanently deleted once they have been transcribed
- I understand that my participation in the project will remain confidential.
- I consent to anonymised demographic information I declare being used in the research study, and publications emerging from it. I understand that only information that I explicitly declare will be used.
- I understand that I may withdraw my interview and any demographic information I declare, without reason, up until 20 days after the date of the interview, by contacting the researcher at: edward.bankes.09@ucl.ac.uk
- I understand that all data will be processed and stored in accordance with General Data Protection Regulation (https://www.ucl.ac.uk/legal-services/ucl-general-data-protection-regulation-gdpr).

Name: _____

Date: _____

Signature: _____

Researcher Name: _____

Researcher Signature: _____

Appendix Four: Coding Frames

DOCUMENT ONE: INDUCTIVE CODING USED IN ANALYSIS OF COMMUNICATION DATA FROM SLACK

Name	Sources	References
Being the Right Sort of Person	37	53
Comedians	0	0
Bad Comedians	11	13
Good Comedians	3	4
Rules of comedy	41	62
Intersections	1	1
Class Background	7	8
Diversity as discourse	19	23
Gender	36	44
Privilege	5	5
Race and Ethnicity	24	28
Science Background	5	5
Sexuality	6	13
Rules of Scicomm	6	10
Bad practice in Scicomm	53	114
Good practice in Scicomm	20	20
Money	11	15
Role of Scicommer	6	7
Rules of the scheme	16	18
Scientists	0	0
Being Bad Scientist	18	28
Being Good Scientist	3	3
Being Non-Scientist	15	20
Being Scientist	27	38
Sharing Opportunities within the scheme	31	40
Types of Scicommer	1	1
Right Type of Scicommer	15	15
Wrong Type of Scicommer	28	39
Scheme as Practice Space	0	0
Doing it for real	32	38
Features of scheme	2	2
Being Good at the scheme	6	6
Being Left Out	2	2
Collaboration	17	22
Community not working together	16	16
Community working together	24	29
Creating Events	57	91

Expectation of participation	28	42
External value of the scheme	8	9
Internal Value of the scheme	5	6
Justifying non-participation	38	45
Leaders	3	4
Learning comedy	38	69
Letting People Down	4	6
Not Acting	3	3
Overloading	7	11
Personal Development	27	47
Respect for Expertise	17	19
Slack	3	4
Taking too much	2	3
The Audience	22	28
Working for the community	24	36
Future Plans	2	2
Branding	22	29
Changing science and scicomm	2	2
Entering World of Scicomm	23	29
Extending scheme into Scicomm	7	9
Future Plans for participants	1	1
Suitability to enter Scicomm	7	8
Playspace	13	14
Relation of scheme to other fields	0	0
Comedy	48	68
Real Comedy	10	11
Scicomm	37	48
Science	12	12
Science comedy vs Comedy	4	13
Scheme as Safe Space	11	12
Scheme as Subculture	18	22
Success	0	0
Celebration of success	12	14
Definitions of success	14	17
Recognition of success	8	8
Success not recognised	0	0
Understandings of Scicomm	0	0
Purpose of Scicomm	44	68
Purpose of Scihaha	31	44
Understanding of scicomm	39	57
Understanding of science	5	6
Understanding of scihaha	19	26
Support	0	0
Career Support	7	10
Professional networks	2	2

Sharing contacts	2	2
Confidence	36	46
Ability to enter world of scicomm	2	2
Imposter Syndrome	10	10
Passing as good scientist	7	11
Personal Success as Group success	1	2
Negative experiences of science	25	31
Scheme as Support Network	14	17
Scheme Organiser as source of support	34	43
Seeing the world comedically	28	32
Support as form of labour	10	10
Demonstrating support	18	22
Expectations for support	28	34
Failing to demonstrate support	1	1
Types of Support	0	0
Being Supported	26	31
Being Supportive	34	36
Humour as form of support	9	16
Non-support	6	6
Not wanting support	2	2
Support from Previous Cohort	8	8

DOCUMENT TWO: INDUCTIVE CODING USED IN ANALYSIS OF COMMUNICATION DATA FROM SLACK

CODING FRAME USED IN INTERVIEW ANALYSIS

CODE	Name	Sources	REF
A	PURPOSE OF SCIENCE COMEDY	0	0
A1	New way to be scientist	0	0
A1a	Bad scientists	22	31
A1b	Defs of science	23	35
A1c	Good scientists	8	9
A1d	Negative experiences of scientific training	21	37
A1e	Non-scientists	24	48
A1f	Scicomm as way to be scientist	29	75
A2	Personal Benefit	0	0
A2a	Confidence	34	74
A2b	Passing as Scientist	26	36
A2c	Seeing world comedically	18	24
A3	Science Comedy as form of Scicomm	0	0
A3a	Discussion of Scicomm	0	0
A3a1	Bad scicomm	33	96
A3a2	Characteristics of scicommers	14	21
A3a3	Good scicomm	26	44
A3a4	Need for scicomm	12	15
A3a5	Purpose of scicomm	42	136
A3a6	Scicomm in Universities	8	21
A3b	Discussion of science comedy	0	0
A3b1	Bad science comedy	26	47
A3b2	Good science comedy	27	59
A3b3	Purpose	39	101
B	SCHEME vs FIELD	0	0
B1	Comedy	37	117
B1a	Learning comedy	35	69
B1b	Rules of comedy	15	19
	Reputation of the Scheme	5	12
B2	Scicomm	41	141
B3	Science	27	58
B4	Trajectories	30	51
C	THE SCHEME	0	0

C1	Characterisations of	0	0
C1a	Bad at the scheme	21	45
C1b	Experimentation	32	80
C1c	Good at the scheme	18	39
C1d	Purpose of scheme	29	69
C1e	Scheme as Own world	21	50
C1f	Scheme as Safe Space	24	42
C1g	Scheme as Scicomm Elite	32	88
C1h	Scheme as Support network	28	57
C1i	Success	0	0
C1i1	Definitions	14	25
C1i2	Learning as outcome	30	74
C1i3	Within the group	20	33
C2	Events	0	0
C2a	As logistics	30	58
C2b	Collaboration	33	53
C2c	Expectations	37	86
C2d	Justifying NP	24	37
C3	Good and Bad Scicommers	0	0
C3a	Bad scicommer	21	32
C3b	Good scicommer	20	35
C4	Support	0	0
C4a	Being supported	39	70
C4b	Demonstrating support	25	33
C4c	Expectations of support	32	63
C4d	Failures	25	46

DESCRIPTIONS OF CODES AND EXEMPLA

CODE	NAME	DESCRIPTION
A	Purpose of Science Comedy	
A1	New way to be a scientist	[Arch] – Specific references to science communication as space in which you are a scientist
A1a	Bad Scientists	Negative identification / characterisation of scientists in science and science communication
Ooh,,,that's an interesting point. I mean I think I hear a lot more about sexual harassment now [laugh] in science, because like I've always had female supervisors, so it's, apart from when I had a job, but like in academia I've only ever had female supervisors, so I've never been exposed to anything, but like now I seem to constantly hear about how science is full of creepy men, from that point of view [laugh] my opinion of it has changed. I don't know, I mean it's exposed me to a lot		

more area of sciences, areas of science that I'd previously had, like I came up from, I mean I didn't do science A-Levels and I didn't – I took single science GCSE and, I only did a kind of, you know, I did an environmental science degree which is like, it's got some science in it but it's quite soft science, and it, a lot of it does border does border on social science, so for that reason I wasn't really aware of a lot of things to do with a lot of other areas of science, and I think I've learnt a lot more about different things I would never have known about material sciences before [laugh] for example. Yeah, it's expanded my view of science.		
A1b	Defs of science	Participants discussing / articulating notions of what makes a scientist; dispositions, symbolic capital etc
Do you feel comfortable calling yourself a zoologist? Not 100%, but I feel 100% comfortable wihth someone else with my level of experience of doing what I do, calling themselves a zoologist, but I feel weird calling myself one, and like I've been called up by some people for calling myself a scientist, calling myself a zoologist. It's something I always find weird, because it's that, I haven't, I literally haven't been taught art since I was like 13, but no one will ever tell me I can't call myself an artist, and yet I have a degree in zoology and I will be challenged about calling myself a scientist or zoologist. ***I mean who, do you get a sense of who these people are that are challenging you?*** They tend to be, tend to be scientists, the odd science communicator who I think probably have the same identity issues themselves, full time science communicator. With scientists, I think it tends to be like, older, erm, generations, erm…I quite often when it is science people who don't see the value in communication as much as the other people as well. Erm…[laugh]		
A1c	Good Scientists	Positive identification / characterisation of scientists in science and science communication
Um, yeah, definitely, like people have definitely read me and someone who's like very controlling or [inaud] someone who doesn't, some fellow PhD students have read me as someone who doesn't take, doesn't take his PhD seriously enough, kind of thing, and some people definitely see me as someone who is not as committed, as one should be, but then again that's a disagreement between me and them on how I view the PhD life, for instance I've, when I started my PhD, I'd had – I did a research masters, I worked as a technician, I volunteered in labs, so I had a bit more of a background than those who came straight from undergraduate, and so at the beginning of the programme you know there's all these training things available, I had the confidence to be like, I don't need to go to all of these, I know what project I'm going to go into, and I think these are going to be the most useful to me, whereas those other ones like, I can safely say, not interested and also I don't think they're going to be relevant to my work at all, and other would look at me like, I'm sort of, not, not playing along with the system because like, oh he's only going, picking and choosing things he goes to, but I don't know, yeah people model – identify me in ways like that which I don't really like but I mean, I'm not mad about it, they don't really know me that well, so I don't get mad about it.		

A1d	Negative experiences of scientific training	Participants accounts of training (PhD etc); descriptions of negative experiences viz participants' own identity, including sexuality, gender, class, race and ethnicity
I think that the science that I'm…that I participate in, the sort of general ethos is like, because we're all like academics, obviously we're all like cool, like, gay thing or the people of colour thing and we're not like racist or homophobic or sexist, um…which means that there isn't really a self-awareness of when those kinds of things happen, so like there is a disproportionate number of men, there is a disproportionate number of white people, there's a disproportionate number of straight people in our department and in the field more generally but…I guess, partially, because see those characteristics as being irrelevant to the specific field that we're looking and partially because, erm…from my experience and this is purely anecdotal, erm…when people seem to think that they're cool with those things, they just presume that…like it's not, noone's active, noone's being actively discriminatory, so, there isn't very much there.		
A1e	Non-scientists	Descriptions of 'non-scientists' working in science communication; participants' without scientific training making explicit reference to not being a scientist. References to professional field (i.e. not the 'public')
Yeah, I think like…yeah I think people are nervous about hiring someone to do science communicators, if an audience member could say, hey they're not even a scientist. I think it's more, covering your own arse sort of thing, oh I definitely know what I'm talking about, because I have a degree in it. But actually I think, in my experience as a PhD student, I felt so ignorant about my subject, even though I was reading papers every day, because I knew, if people read a book, they could have a piece of knowledge that I didn't have, and therefore kind of make me look silly, and show that I didn't know everything. I mean you can never know everything, and now it's fine I'm more comfortable with that, but yeah, it's easier to lend…er, credibility to yourself when you have a degree in something, obviously.		
A1f	Scicomm as way to be a scientist	Explicit references to science communication as site where you are a scientist; claims of continuity viz professional identity/ recognition etc
Well if I was to stay in a university, I'd rather be a scientist, I'd rather be doing science. And that's what I always wanted to do anyway, to be a scientist, it's just that being an academic comes with so many headaches [laughs], that's the only off-putting part, like otherwise I'd happily be like, say, yeah I'll be in a university in academia for the rest of my life, but…university administration doesn't make it easy. They make it hard, it's almost – I want to believe that they're not making it hard on purpose but it's almost like they're making it hard on purpose, so it's very hard to exist within the academic environment. That's the reason I don't want to be in it. And that's the reason a lot of people don't want to be in it, but it doesn't seem like that message is being heard enough, and so, if I can be not associated with academia, because of the headache, then I'd love to not be attached to academia, but yeah I want to be a scientist for sure.		

A2	Personal Benefit	[Arch] – Science Communication as a site offering personal benefit to scientists and science communicators
A2a	Confidence	Science comedy making participants more confident
I…feel like it's easier to deal with stressful situations, or like, when people are involved you can be a bit more relaxed around them, and say funnier things that don't piss people off, don't- a bit less passive aggressive I guess, but that's, yeah, still working on that [laugh] because I'll, my – people around me always say you're so passive aggressive when you're stressed, so I think that's better. What else? I think, because I have to talk to a lot of people in my job, it helps with that, just not being scared of doing that, but I still know that it's better to prepare, like it is better to prepare with comedy stuff if you are going to have a little speech to do, that has, yeah.		
A2b	Passing as scientist	Science comedy giving skills that make participants know how to act like scientists / play the part expected of them
Oh when I was doing this comedy gig, but if it's all that's in your life, you can only really talk about what you've done in the last week, and then other people it's been good, like other people have been like, oh I didn't know you were funny, and I'm like what am I normally like? [laugh], um, and for my supervisor as well, like, I don't know if I said this in my interview with you, which is like, that…someone from our department had seen me do a gig at, I think the medical place and she knew my supervisor and then told my supervisor that, that I was good at comedy, and it like, it clearly changed my supervisor's opinion, like positively towards me, because I think before my supervisor just thought I was incompetent at everything [laugh], I think the fact that like, a well respected person then said to her that she was impressed with me, even if it wasn't a scientific thing, I think that helped, also it's, my parents understand comedy a lot more than they understand comedy, so I think for my dad, my dad's a bit like oh, yeah I'm proud of you for doing this, whereas he's a bit like what is…what is bacteria [laugh]		
A2c	Seeing world comedically	Using comedy in everyday life – making jokes about negative experiences; participants' sense they see the world differently
No, so I, the sort of backdrop of my, of me as an act, was that I'm a scientist who's doing comedy, and…so…it was mostly, I think generally even the comedy that I do within the science gigs that, [the scheme] put on or non-science gigs, is that I – the science part of me only comes as I am a scientist and then I talk about, just experiences of, either being a scientist or just being me, and being a scientist just happens to be part of me. And how that, how like your science brain can bring a lot of comedy into everyday situations, just because of the way you think and stuff like that, and social awkwardness and all of that jazz…So I think that's how I pitched that and I was talking very, like everyday, like, situations that were funny.		
A3	Science Comedy as form of Science Communication	[Arch] Discussion of purpose, explicitly framed as referring the broader world of science communication

A3a	Discussion of science communication	[Arch] The goals, purpose, justification, rationale etc of science communication
A3a1	Bad scicomm	Identification and description of bad practice outside the scheme
Yeah, yeah yeah yeah, well standard scicomm is erm, well partly OK, there's two reasons I use the word scicomm perjoratively, one is scicomm as opposed to public engagement, so public engagement being about actually having defined outcomes for what you want, having a sense that you work with communities on an equal footing and scicomm being that kind of 1980s erm, Tomorrow's World style here's some amazing things about science, or what I often joke is tricking children into studying chemistry, just the relentlessly positive science is great, but with no critical analysis of what science is, but people use the word science to mean loads of different things, I can never line with a version of I'm doing this for science where science includes weapons manufacturers for instance, which it usually does. So that's one pejorative is scicomm versus public engagement, and the other one is scicomm as the same old thing we've always done, and partly that's driven by how you make a living as a scicommer is that you do things for people with lots of money who already love science, um, and I do bits of that, I do after dinner speeches for science, er, conferences and that sort of thing, erm…but it's not very challenging or interesting, it's just literally providing a product for money and I think a lot of scicomm is that, it's very simple, it's very you know wave the flag for science, so yeah that's the other sense I use it pejoratively. If it could be a talk on The March for Science I'm not really interesting in it as a piece of scicomm		
A3a2	Characteristics of scicommers	Experience, training, attitudes attributed to science communicators – who do you need to be to be a science communicator
Participant: I hope so. Um…I'd like to, remain in it, and try and break into it I guess [laughs], um, but I don't know, I think to, to the idea – the impression I'm getting is to be a reliable and successful scicommer, particularly to get bigger gigs booked, you need to still be attached to an academic institution. Which means that, I'd have to be an academic [laughing] as well if I want to be a scicommer, but I'd really like that to change actually, I know, it's very unfair on so many good scicommers, but still the impression I get, and so I think doing a PhD's part of that, but again, it doesn't end with the PhD I think, sometime there are still these barriers…and yeah, being attached to a certain, university or institution makes you more reliable? I don't think that's fair but, if that's how you got to play, that's how you've got to play the game.		
A3a3	Good scicomm	Identification and description of good practice
I think so, yeah, I think…it massively distils within you like, if you're, if anybody in the scheme is going to go away and create a forum or a panel for anything they would definitely have certain ideals, and I think that people who aren't in the scheme wouldn't, because of the amount of times it's been said, you know don't have it all men, don't have an all white, anybody, consider different types of voices in all areas, and it was something, I think it's something that everybody in the group was thinking about before but it's now like really, really obvious, yeah just like different types of voices and also not trying to do the exact same thing over and over again, you know…it's a funny podcast about things you've never heard of because I'm smarter		

than you – yeah it's, not seeming elitist, I think it is, which other unknown, unnamed science communication organisations can be quite elitist		
A3a4	Need for scicomm	Participants presuming the need for science communication; science communication as unquestioned good
Ummm….I think, yeah those, those big…yeah those big questions about like…why they're doing what they're doing, what science is and who it's for, I think, maybe they haven't thought about so much, I think that they seem, and again – I haven't got to know any of them super well, so I'm kind of, I don't know how much this is grounded in anything, but they seem to be concerned about like, specific stuff, you know how their set is presented, how they can sell their topic, how they can make it in scicomm, not, I don't see that much discussion about, like who is scicomm for, what is scicomm for, yeah. ***Is that a conversation you feel you could have?*** Um…[long pause] I, I…I feel like a lot of, or a kind of core of the [the scheme] at the moment are in a point in their kind of career and career development in terms of PhDs, where there's a lot of insecurity, and I don't know that they're at a stage where they're ready to think about, I guess what the, what the purpose of their work is, yeah. Because that, that's a bit confronting.		
A3a5	Purpose of science communication	Specific discussion of the purpose of science communication – claims about outcomes, future practice etc
Just having a more appreciation and increasing science capital, I guess, if you want to talk about it in that regard, because, I guess scientists always think about we want more scientists, but there's lots of scientists in the world. I would like to change public perception of science and, and change how people engage with science and see it as a positive thing that needs to be continued, and needs to be fostered, and not only needs to be funded, yeah, so one of the biggest things that I would like to change is, um…I would like science to be regarded in the same light as say education. When budget cuts happen to education, every single person is like, no that's ridiculous. Budget cuts are happening to science every single quarter but, no one really, like it, it's talked about but no way near to the same gravitas as education, yet I see these two as quite similar		
A3a6	Scicomm in Universities	Specific reference to doing science communication in Universities
I'm OK, honestly, I, find the whole like, the us and them switching sides like I roll my eyes at it, I can't, I can't deal with such semantics, and I think it's total crap. But, so yeah, I wouldn't mind, like I don't see it as an issue if I start going to work for professional services, doesn't make a difference to me like it's more like the actual work I'm going to do, but when, you are trying to, because I find that academic work normally has a collaborative, altruistic vibe to it, not at all saying that all academics are like very giving, some of them are hugely selfish, but, again it's a sort of like, the difference in ego and people being able to accept critique on things and…the way people's processes, the two halves processes go about it so, yeah if I was to go into that environment but then, like when I go to people and say, OK I'm doing this because it's not, I want to do this because it hasn't really been done before, so, and I know you have this particular skill set to help me, how do I do this? You know, from		

an academic side of things, this seems completely reasonable, right, acknowledging when you don't have that little bit of expertise for this one that you're doing, even though you generally know how to do the rest of it, that's seen as an acceptable thing and professional services side, with a lot of people having like, PR marketing backgrounds I found that, when you go to them and say right, this is what I'm working on, I know what I'm doing, but there's this little thing which I think your expertise is better for and it's under your remit, can you help me?, it's sort of, viewed more negatively as like, you don't know what you're doing, kind of thing, so it's, it's those things which I think would make crossing over difficult and I would be reluctant to do it.		
A3b	Discussion of science comedy	[Arch] The goals, purpose, justification, rationale etc of science comedy within science communication
A3b1	Bad scihaha	Bad science comedy – comedy that is aesthetically deficient or doesn't meet goals of science communication
So, I mean, yeah, as a – I was a [comedy night] organiser in Bristol before [Organiser 1] stopped coming to Bristol and we had to rebrand and develop into something else, and my constant battle was trying to get people to do something that was actually different from a lecture, because people would do a borderline funny lecture with slides and stuff, and I'd be like you can push this a lot further, in terms of science performance and it's what – another reason why I was trying to do some outthere stuff, just as a way of pushing the window of what was possible, in the hope that somebody would do something that wasn't, you know, a pun about their stuff, and some powerpoint. Honestly, things can be done without powerpoint. So…I actually don't particularly want more comedy, what I just want is more people going full throttle for it. I really love it when people have got their own niche thing that they're totally into,		
A3b2	Good scihaha	Identification and description of good examples of science comedy 'doing' science communication
OK cool, so…he straight away established a character, and then he responded to everything sort of in that character, and afterwards some of the feedback to the group as whole, it might be good if you kind of do what [] did and establish a character because then you're not thinking, what's a fun joke, but you're thinking, how would that character respond [clicks] and it can sometimes make it snappier when you're stressed, but the idea of establishing a character is harder for me than it is just kind of…doing my self but kind of, more. OK, just doing a deeper, a hyper [] I guess, rather than kind of, I mean he did himself too, but he made it – he made it a caricature, he was kind of, the doctor who will do anything for money, which is obviously not him, but he is a doctor, so it – it felt like it was his character, but obviously he was doing it in a way that was very, very funny. And I think, because of my style if I did a caricature, it would feel unnatural.		
A3b3	Purpose of science comedy	Specific discussion of the purpose of science comedy – claims about outcomes, future practice etc

Yeah, definitely, it…not even necessarily as science comedy, but, I think it's very..I mean for people like me who are interested in science or it's piqued our interest for whatever reason without ever needing much of a push…er, it's…by that I mean er..the, the way science is at the moment in terms of how academia is, erm…it appealed to that very academic setting it appealed to me and even though that scientific content will appeal to a lot of other people, umm it's still framed in the very sort of intellectualist, almost elitist setting and I think reframe – taking the same knowledge and reframing it to show that it does have appeal to different audiences is very important because, you know, science is very critical to, sort of, progress and human culture, but..reframing it and sometimes removing the word science entirely to show people who may be very, anti…you name it, anti - a thing, to show them actually there's a lot of, you know, science in..their everyday lives or even stuff they're interested in		
B	Scheme vs Field	[Arch] – Participants locating the scheme; discussion of similarities and difference between the scheme and different fields; trajectories from the scheme into the field
B1	Comedy	Science Comedy as Comedy: comparisons between science comedy and mainstream comedy; identification of different purposes, standards
Because, in a way, it's served like the fulfilment of my childhood dream to be a comedian to go and tell jokes in Edinburgh, but it was so challenging, and I was in a really bad place personally when it happened, like I don't want to be standing in the rain [laugh] handing leaflets out to people to try to get them come see me in a show that they're not going to find funny, and they just, yeah, so it was very very stressful, but it was like such a good learning experience as well, in terms of, by day 2, I'd already become vastly more comfortable with talking into silence, because anytime before I've done a gig and it hasn't gone great and the audience has been quiet, I've started to panic and get faster and faster and just get off the stage, whereas there I learnt that it wasn't necessarily that they weren't enjoying, it's just that it's a small crowd, or maybe they're just a bit sciency and they're a bit, they don't know that they're meant to laugh, they're a bit quieter for that reason. But there were two very very good nights, and they were really, what's the word like, soul restoring? [laugh] The very last night was very good, it was the best night, and that was, that meant I could leave on a high and then the kind of stress of it was over, but yeah, so there's – I don't know what the lowlights are. I've been stressed out a lot with people not working hard enough [laugh]		
B1a	Learning Comedy	Participants' descriptions of learning comedy skills
Umm…sometimes? I find like, I get more laughs about stuff which is just more personal, generic, comedy because, my, from what I've learnt from the scheme is a lot of stuff people find funny is humanly relatable and so it's, when you put that in the context of like, I'm telling you a story about this scientific concept like, even though it would have mostly been, irrelevant personal jokes, like about my experiences or about something I know everyone else has experienced and then me trying to make it funny. Maybe once or twice I've got like a good science, like a joke about the		

actual science, but I find most of the time I craft, when I craft the, the story of the jokes around a science subject that's how I get more sciency.		
B1b	Rules of comedy	Meta-language of comedy – how to be good, the moral rules of doing comedy
So do you have a sense that you're allowed to tell, or jokes that you can't tell? Oh yeah definitely, like I'm never going to make a joke about a black person, [] could say them, I'm not going to. Yeah, definitely there, I hate the idea that there are like, topics should be universal, that like language is a universal thing, because that ignores the fact that actually we live in a society where context matters, you know. ***OK, you said before that comedy legitimising certain things, do you see that more generally as what comedy does?*** Oh yeah definitely, a lot of people use that specifically, where they use it to talk about difficult subjects and how you talk about a difficult subject like abortion, for example, you see the late night comedians doing it, like the Daily Show and stuff, they use comedy to talk about politics, I'm sure they would just like to talk about politics, but then they'd just be a news anchor, but how do you talk about things like abortion and not have people switch off, use comedy. John Oliver is the best of it, he's like the ultimate example of using comedy to get across difficult subjects.		
B2	Scicomm	The scheme versus the rest of the field; audience for events
Are you surprised it didn't get funding for another year? No. Because I don't think it's the kind of project that anyone is looking to fund. I think funders are looking to fund projects and it's difficult to get your head around the idea of funding a training cohort. It's more of a thing, I think if it was based inside a university, so if it was at QMUL and it was QMUL people, it would have been funded the next year and the next year and the next year, because the results we got in Year 1 were so convincing, this was definitely a brilliant way of training people. I am sad it didn't get funded, I was genuinely hopeful that people would pick it up and see the benefit in it, because I've seen incredible change for the people involved in the project, but I, I'm not surprised it didn't, I think it would always have been a bit, a little bit of a punt, because I don't think people are looking for funding training and development programmes, which is still how I see [the scheme] more, I don't see it as a…what's the word like a troupe [laugh] of performers, or like you know a company in that theatre sense, I see it as a training and development programme for lots of early career people who want to go into scicomm or some aspect and so, that's quite hard to fund externally.		
B3	Science	The scheme versus science; being a science communicator and a scientist; different standards and expectations
Umm, I guess, yeah. I feel like it has, but I feel I don't have a solid answer for that, I feel, it's…my view on what it means to be a scientist has probably evolved from taking part because I met people with such varied experience, learnt from them, and how they do what they do, in – with a lot of being scientists or having worked as scientists…and able to sort of develop what I think (?)…of, the way it's informed how I view science, as being a scientist is, changed in that I would, I view scientist now being more as like, something, my scientist aspects to myself which I would attribute less to a job and more to, outlook and personality, if I was to say the one sort of		

definite – concrete things that it changed, the value I put on those and the value I present to other people of that, so one thing [the scheme] has taught me is like, value your time and effort more to these things, even if it's not necessarily taken as seriously in wider professional contexts,		
B4	Trajectories	Future trajectories for participants – discussion of the applicability of skills in the scheme in the wider field; professional opportunities to be a science communicator
I don't know if everyone wanted different things, I think a lot of people wanted to forge a career in comedy, like certainly one or two people in the group wanted to be a comedian full time, I sometimes get the impression that like, the people, or person running the group kind of wants to move in that direction, and my direction's more towards the like, scientific communication, and like the comedy side, that's just a, one of several tools. So I think there was quite a large focus on that, which wasn't necessarily what I wanted to do, and, yeah there's a lot of focus on live stand up performance, and I think that's a little bit restrictive if people don't necessarily want to focus on that, so…yeah I think maybe my, way of communicating is slightly different, I suppose.		
C	THE SCHEME	[Arch] Discussion of the scheme's architecture, moral economy
C1	Characterisations of	[Arch] Participants discussing how the scheme works, what they contribute, expectations on membership
C1a	Bad at the scheme	Negative evaluations of other participants' contributions – what they're doing wrong, what they're not doing enough of
Yeah, so there are a couple of people that I don't think have ever posted on Slack…and I've never seen them at any of the training events, um…so you know, I notice, I go on the [the scheme] website, and you're like, oh that person I haven't seen since November or whatever, um…but than there's the kind of core group of people who are on Slack like, all the time, um, but it's hard to keep up with like, I'm, because I'm freelance and I work from home a lot it's fairly easy for me to be on Slack during the day, but I imagine if I was in an office and I couldn't do it, coming home to 100 messages, I'm not going to read them all. And you know, when I went to California, I came back and it was like…such a nightmare to catch up so		
C1b	Experimentation	Descriptions of the scheme allowing experimentation and play; Experimentation as goal in own right
Surprised? Like, what were my expectations at the start, yeah, OK…I don't know, like it's nice, I feel very proud of what we've all done together, I don't think I'm surprised, I don't know I feel like it is a bit peculiar doing like some gigs to random, 30 people in the basement of a pub, so I guess that is a bit funny, but I've kind of got used to it after a while, it's just more of a safe, experimental area for us to do our stuff, so yeah I guess if you talked me two years, I'd never be like, oh yeah I'm going to do stand up comedy in the weekend or whatever, so I guess that is a bit surprising, and people think that I'm a bit mad for doing it, but, I feel like comfortable		

with it, that we've done it, so I'm not like surprised I guess, but pleasantly pleased I think, the random experiences.		
C1c	Good at the scheme	Positive evaluations of other participants' contributions – what they're doing well, how they're meeting expectations
I don't know, I think it- it means that more opportunities comes your way, and it allows you, like I think it's sort, and I apply this to my writing as well, if you're the person that's there in a pinch, then people will naturally come back to you, they'll know that they can rely on you and so if you are that spontaneous person who jumps at, you know, an opportunity that day, it's inevitable that then, you know, people are going to think of you as the person to go to, and the person who says, oh I can do a gig next week is, I think that's just, inevitable to an extent. I don't think that you have to be spontaneous to be in the scheme, or to do well at it, I mean I don't think I've done badly, so, but I think if you want to be in that top – then – that's what to do.		
C1d	Purpose of the scheme	Specific characterisation of goals and ethos of the scheme
I think so, it's one of the reasons why it's so useful to have a team, because you can turn your chair around in the office and go ooh, what do we think about this, is this right. Whereas if you're the only person in public engagement in your university, it's really hard, it's painful, to sit there going, I'm not even sure I know what public engagement is anymore, after like this, you know, this morning. Erm, and that's why the London PEN exists, as a chance to have some other people to talk to, to recalibrate your thinking, because if you spent an hour in a room with a very angry physics professor, telling you that no, engagement is actually doing schools workshops for kids, erm, just to encourage them to think about studying physics and you spent an hour going, no actually, I think for our university I think we're interested in other kinds of outcomes as well as that, we've got outreach teams who do that, what I'm interested in is this. You come back to your office and you're like, actually I'm not even sure what engagement is anymore, maybe it is physics outreach [laughs] you know you get ground down, so yeah we're constantly having to go back to questioning what we do		
C1e	Scheme as own world	Specific reference to autonomy of the scheme; scheme not needing to play by the rules
No, no I don't think it's easy to show the value of it because I think it's very, it's very subjective. It's very personal, when you're within it, so I think people who are, who are on the Slack and people who take part, would probably say that it's something very different to people externally saying, oh you're a group of people who do shows [laugh], so maybe the amount of the shows that we do and the breadth of them might, you know, from doing Flamingo Bingo to doing a show all about death, and various other ridiculous things, that might be easy-ish to show, but because of, you know, often funders or particularly things within academia, they want like numbers, they want audience participation, they want follow ups, they want evaluations, is not really what is done, so, no maybe it's not as easy to quantify.		
C1f	Scheme as safe space	Specific reference to safety and security; scheme as form of refuge
It's very clear that the most active participants of the group who are, are gaining a lot but also giving back a lot, and they're also forming these friendships, outside of the		

group itself, and it's easier to have those conversation with those core people. And sometimes because you only want, you want that double safety net, I mean the scheme itself is a big safety net, in terms of saying stuff like that, but sometimes you want that real real, this is not going to go outside and be damaging to anyone, then you do have those conversations in private sometimes, in smaller groups, sometimes in the Slack sometimes outside the Slack, in Whatsapp or in person. But again, it's definitely, like it's easier to have those conversation because you know that they're a group of people that will understand why you're having an issue with a certain thing, or, a certain situation, or a certain person, and…it's easier therefore because they're, we're all in it together almost.		
C1g	Scheme as scicomm elite	References to scheme being better than other facets of the field (including ironic/humorous); participants' responses to idea that scheme is the elite
If you want to go beyond science journalism there's not a lot, and I've found the same actually, I went to the [] conference and was horrendously disappointed, to the point that I'm just screaming at [Organiser 1] that we need to build our own conference because it's shit, but you know like, and so, [Organiser 1] developed this programme to help people that are likeminded achieve what they want to achieve rather than having to fight against the current networks that just aren't, they're so archaic, they haven't updated themselves, they haven't moved with the times, and I think it's moved amazingly. It's not for everyone, it's, I don't even know half of the first cohort because they've dropped off the radar, and the second cohort we've lost a few and others barely have anything to do with it, but the, the ones that come out on top have really shown, so, yeah.		
C1h	Scheme as support network	References to support as predominant feature of the scheme
Yeah, I think so. I think that, the combination of trying to do communication, which can fuel very very complicated, because of the amount of things you've got to think about and then you've got to actually deliver it to an audience, and the – that, that combined with academia means that a lot of the people in the group felt very confused previously, and might have felt quite alone in what they were doing, so I think the fact that we literally have the support thread and the help needed threads on our Slack, it's – I think it's very important, and it's shown throughout the year because a lot of people at times have just said, look I'm doing really badly, how – and it can be nothing to do with science communication, it's to do their emotional state, and so it's a little bit like the mental health stuff that universities should be providing but they're not, like at all, so, yeah we've found it elsewhere [laugh]		
C1i	Success	[Arch] Discussion of the scheme working; what constitutes success
C1i1	Definitions	Participants' descriptions of what counts as success within the scheme; successfully making use of the scheme
Yeah I think it's ended up being, it's weird, I think the description of what the scheme is, is not, comedy based I don't think, but most of the gig opportunities are, comedy, or improv which is still just comedy isn't it? [laugh] It's just a different form of comedy, so yeah I think it's an integral part of it, although it's not necessarily the only way you		

can be successful in it, like [] has obviously done a bit of comedy but she's also like really forged ahead in being a producer, and then I think other people have learnt comedy skills that have made them better public speakers in a general sense, so…I don't think it's essential, but I think it's…I think the scheme would be very different if there were no comedians in it		
C1i2	Learning as outcome	Individual learning as sign of success within the scheme; personal growth as success in own right
Yes, I think comedy gave you a goal, it was something for everyone to bond over, like encouraging each other, supporting each other, the events gave you a goal to be better, you wanted to be better than your first show and in your next, everytime you perform you want to be better than the last time you were on. If you didn't have that where are your benchmarks, what are your goals? There's nothing to work towards you could go and do training and then walk away and forget everything you've learnt, and yet having show, or having whatever the event is, gives you that ability to develop the skills and actually tailor them, yeah.		
C1i3	Within the group	Comparative success within the group and explanations
Yeah, maybe only in hindsight. I think I just felt like some people got a lot of opportunities thrown at them, that were never even on my radar, and suddenly they were doing all these things, and maybe they went and got them themselves, and I'm just lazy, but it, it felt like, I don't know, it felt like very very early on there was kind of a divide between the like, the stars of the programme and everyone else, and not that everyone was bad, but we just, weren't amazing. That's not the right word, but you know what I mean, I think. ***I mean do you, do you get a sense of what made them amazing?*** Um, I don't know, I mean, I guess in part maybe they were people who'd just started it, and, whereas I – I'd been doing comedy for a little while before I joined the scheme, I don't know. I mean, objectively they are good, they're amazing and I'm not denying that and I'm not saying they don't deserve the opportunities but I felt like, I felt like maybe I lagged behind from the beginning and I was never able to catch up, in terms of being seen as the go to person for things, for special, you know, extra stuff. But it is what it is.		
C2	Events	[Arch] – Descriptions of participating in and running events
C2a	As Logistics	Events as logistical tasks; descriptions of the skills/work involved
I got [Organiser 1] to tell me their email and then email them, and they were really receptive, they were really nice about it, and they gave me a couple of dates, and then, since then I've been totally out on my own, because once it wasn't at the pub anymore, there's no connection to anyone and so I've had to work out how to email other pubs, and that's a weird thing because they don't advertise on websites, they advertise for punters, they don't advertise for how to put on something at their pub. So that's been quite an interesting challenge to try and work out where it is I'm looking, even to get contacts, and yeah.		
C2b	Collaboration	Discussion of collaborating within the scheme; moral need to collaborate

I think so yeah, I think everybody is, everybody's like tested the water a little bit, so I think people will go off and start doing their own things, and like there's stuff that I want to do now, is possible but it'll be less collaborative, but it will still be really really useful to have like the soundboard of people, essentially I want to, I really want to make a roving museum, like a roving natural history museum, that I can like take around, a like anarchist museum essentially, because I've got so many specimens, and because of the number of kids who can't go to museums on the weekend, so that kind of thing, like won't be as collaborative, but I think that with me, like a group of people that can be soundboards, they can be collaborators, they can be people to be like, you know, this is a really crap idea, yeah. Yeah, I think it will probably change a little bit, and people will go off in their own directions, but I think it hopefully, the Slack will stay the same [laugh]		
C2c	Expectations	Participants' descriptions on how much they are expected to participate, the forms of participation expected
I feel that, because – yeah, because I feel like if you're in the scheme but you're doing the shows, you're not coming to the training sessions, you're not coming to the casual meet ups, you might as well not be in the scheme but, especially when [Organiser 1] was using it as like, you know, those are the first people I'm going to ask to do my shows or do various things, or put forward for things that I hear about, I feel that I can just be a one way street, it's not fair, particularly for him, because he does a lot of work, and he also, you know his shows they make a lot of money for charity, so, I don't know, you should just…try [laugh]		
C2d	Justifying NP	Explicit justifications for not taking part in events
Yeah, hard. I think that's the other thing, there's, there's quite a lot of PhD students, who, I appreciate that's like full time, but with things like the Slack chat and whatever, there's a lot of chat on there, I just can't keep up. So I think it is quite hard to…I think they can, why I get the impression, this is a sweeping generalisation I'm sure it's not the case, but they can be a lot more flexible with their time, whereas, you know, I can't, I just literally can't, and, so yeah, it's, it's hard, but, yeah, it just means that I can't do, it just feels like I can't do as many gigs as the others but, oh well.		
C3	Good and Bad Scicommers	[Arch] Descriptions of good and bad scicommers as discrete types of people
C3a	Bad scicommers	Bad science communicators as discrete type of person
Hmm…basically like, so science communication beforehand felt like a very, very erm…like, what's it called, like not dog eat not, but you know what's it called where you have to like, all for yourself, too tired to think of these words ***Like a zero sum thing?*** Yeah, like, kind of you're going to be doing it yourself, you're going to be working everything out yourself because if you collaborate with people they'll take the work from you, that's what it felt like before, and especially the stuff that I want to get into, eventually the – the media stuff, it's heavy with nepotism, so it felt a little bit like, if you tried then people would be like, oh no I already know somebody who can do that better than you, and so I think it's quite an interesting collaborative group that		

are…slightly trying to test the boundaries of science boundaries while still you know doing fun stuff and stuff that everybody knows works, like science showoff and you know, funny things about animals and, you know…physics, but still trying to make it a little bit more inclusive, a little bit more different, newer voices I would say, and less nepotism, which is very useful. But yeah.		
C3b	Good scicommers	Absence of bad qualities; good science communicator as discrete type of person or rejection of bad science communicator
I do think you need to, always be willing to…just be, just be like, really gracious with your time, and you energy, I think like it's really, it's just really nice to know that someone will make the time for you and you can't expect that if you don't do it yourself, so I think that's really important. Also just being there as a form of support, the amounts of time, people are I'm having a shit day because of XYZ, and you've just got like 10 being like, or I feel terrible, am I a horrible person, and you've just got 10 people just being like you're brilliant, this is why, or just you're brilliant, or everyone feels like this some times, and that feels incredible, because it gives this space that, because they're not a group of friends that you've already got, so they know everything,		
C4	Support	[Arch] Discussion of support as form of labour within the scheme
C4a	Being supported	Acknowledge and experience of being support
Yeah, everything, everything from helping me with specific issues or just being there, being like, you know, if you want to go and get cake, like [] did when I was really having a terrible day and I put in slack like everything's going wrong, []was like let's go and get a tea right now, and we went and got a drink and had a walk around and just chatted it through, and chatted through options for where I could go next and stuff, so like there's always somebody knocking around central London that's willing to meet up straight away if you need like a crisis talk, but then yeah, in terms, the more difficult one is people will say, I'll take stuff off your plate, but they also have their plates full, not always true, but yeah there's definitely a…there's a great bunch of people who'll be like, like []bought me a plant to cheer me up, she just bought me a plant to the summer party to be like, I just thought you'd like a plant, and as yet I haven't killed it [laugh], so yeah so it's a lot of thoughtfulness like that, it feels nice to…		
C4b	Demonstrating support	Support as explicit form of labour – how to do it
No I think that's it, I think that's the reason I don't have one, I don't necessarily need a well-defined role, erm…yeah I mean I'm quite active on like the slack channels and stuff, not as active as some, I think I take a kind of middle ground, but I'm not inactive, erm…well I'd say I'm the upper end of active, of mid – medium. Erm, so I'm constantly kind of, I'm there to kind of like…say ah that's a good idea, these are ideas, or that's really shit, you deserve better, all that sort of stuff, but do I have an individual role? Probably not, because we're all quite good at the same things, erm…and I mean I'll look over scripts and say these are – you know, things I think will make it better, but other people are just slightly more experienced at doing that than me, because they're someone who would self-define themselves as a comedian, but…yeah		

C4c	Expectations of support	What it means to be supportive; expectation that participants be supportive
Is there anything that's disappointed you about [the scheme]? My gut answer is no, but if I had to find something, I guess it would be the fact that, like some people just seem completely absent, from like, there are people we know are in [the scheme]?, but don't really participate in conversations, don't show up…and I think someone else mentioned recently about how it's weird that, to know that there are certain people in Slack that can see everything that we talk about but actually never participate, and that they're gaining quite a lot if they are reading everything, or gaining a lot of insight, which, you know I'm, part of me is like fine, you know, it's no skin off my nose if you see everything I say about science festivals or websites, or anything else…but I guess there is that thing of you know they're not bringing anything to the table, but largely, like I…I didn't have like massive expectations, because I feel like, I feel lucky to be involved in it, I feel lucky to get everything we've got without paying a cent, you know.		
C4d	Failures	Support labour breaking down; participants who don't offer support, or support not working
Yeah, so I absolutely, and I really try to be as honest as possible. I don't, I think within [the scheme] there's too much like, obviously like positive…positive feedback is good but I don't think there's enough criticism and I try to be quite critical. I don't want to come across as a bitch, that's the other thing like…um, so I try and, say something amazing about them and then say like, oh maybe you could do this next time. Um…I also like, if I see an opportunity for someone else, I put them in touch straight away, which is something I like to do, like if I think there's a talk that, like [] would be incredible for, I'll put them in touch, and I try and like hook them up with as many people as possible, yeah, because I don't like, I don't like being the weak link in a chain, it's nice to be a really strong team where everyone contributes and everyone pulls each other up		

Appendix Five: The Triangle of Public Engagement

As part of participants' formal training in evaluation techniques, the organisers a set of definitions for work in science communication and public, a grid for recording impact, and the 'public engagement triangle' which visualised the relationship between different aspects of public engagement programming.

Definitions:

Aims – are the change or benefit you hope to achieve as a result of your work

to increase, to enable, to improve, to reduce

Objectives – are the areas of activity you will undertake to make your aims happen.

to run, to produce, to support, to offer

Outputs – are all the products/services you deliver as part of your work

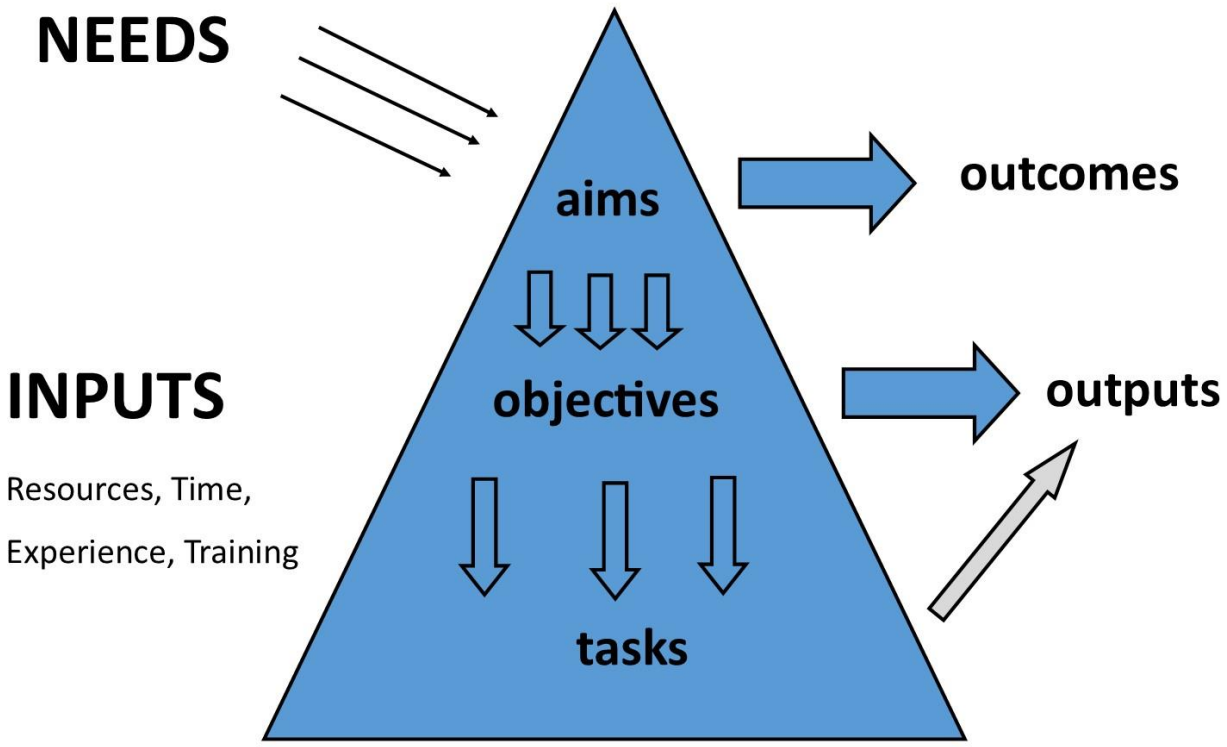
5 training sessions, 10 researchers involved, 100 people attended an event

Outcomes – are the changes that happen as a result of your work, they can be wanted or unwanted, expected or unexpected

Increased awareness of University's research, improved relationships between academics

Monitoring - The collection of data or information, in systematic and organised way, to capture and assess what is being done (for example, an event, project, activity, programme).

Evaluation - Using monitoring data and other information to reflect upon and make judgement about what is being done, and/or using monitoring data and other information to make changes and improvements.


NEEDS
INPUTS
Resources, Time,
Experience, Training
aims
objectives
tasks
outcomes
outputs

	Participants (researchers and partners)	Audience / community
Knowledge and awareness		
Attitudes		
Skills		
Empowerment		

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