# The rise and rise of Science Festivals – an international review of organised events to celebrate science

Karen Bultitude[1], Dominic McDonald[2] and Savita Custead[3]

## Abstract

Recent years have witnessed a dramatic global growth in the development of large-scale public science events. Although usually grouped together under the umbrella term 'Science Festivals', the events differ greatly in size and scope. This paper presents the findings from a 2008/09 international survey of Science Festivals in order to compare and contrast worldwide trends. An online survey was completed by 56 self-identified Science Festivals, supplemented by a content analysis of 94 Festival websites identified internationally. This work identifies for the first time a common international definition for events which identify themselves as 'Science Festivals'. The findings show that Science Festivals are currently particularly common within Europe however their popularity is growing within other regions. There is a large diversity in the scale of Science Festivals, encompassing some small, localised events reaching a few hundred people, up to nationwide events reaching many millions. Precise audience figures are not acquired by many Festivals however there is evidence that over 5.6 million people are reached by Science Festivals annually, with events focused mainly on hands-on activities combined with some talks, lectures, discussion and debates. The funding and operational modes also vary significantly, with the vast majority of Science Festivals obtaining their funding from multiple sources including government support, sponsorship, and funding grants. A considerable number of Science Festivals conduct at least an informal evaluation, with some Festivals making their evaluations publicly available. This work demonstrates that Science Festivals are an increasingly important area of science communication worthy of further research.

***Keywords***: Science Festival, celebration of science, evaluation, international comparison

## Introduction

In many parts of the world a 'Science Festival' is a routine part of the city or region's annual events calendar. Universities, schools, families and members of the public in a number of localities are increasingly aware that at a particular point in the year there is likely to be a focus of activity celebrating scientific endeavours with non-specialist audiences (EUSCEA, 2005). Yet little research has occurred to date to investigate this increasingly global phenomenon. This paper seeks to illuminate this issue, providing a broad overview of existing activity by events identifying themselves as 'Science Festivals'.

[1] (corresponding author) University of the West of England, Bristol UK, karen.bultitude@uwe.ac.uk
[2] Science Oxford, Oxford UK
[3] Bristol Natural History Consortium, Bristol UK


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**Aims and Objectives**

The main aim of this research was to provide a global overview of Science Festival activity, broadly investigating the global reach, scale and operational parameters of such events. Within this broad aim were a number of specific objectives:

- To identify the types of events and/or organisations identifying themselves as 'Science Festivals'
- To provide a map of existing Science Festival activity, covering their geographical location, frequency of operation and year of foundation.
- To compare the operational parameters of existing Science Festivals: what organisations are involved in running them, their funding sources, management models and how much dedicated staff time goes into planning different Festivals.
- To examine the scale and scope of existing Science Festivals: the events they run and the participants involved.

The intention of this article is not to outline the practicalities of setting up or maintaining a recurring large scale science event. This would not be possible on a global scale due to the social and cultural differences between countries, particularly in relation to funding mechanisms. For practical information about Science Festival design and operation see EUSCEA (2005).

**Definitions and distinctions: Science Festivals and science weeks**

There is no one agreed definition to date of a 'Science Festival'. Different authors have approached the issue circumspectly, for example a UK government review in 2004 focused mainly on what a Science Festival is not when articulating their definition:

> 'A science festival is a particular type of science communication event characterised by an ephemeral nature, localised to a specific venue, town or region. In this way they are differentiated from the annual National Science Week where individual events are held in schools, Universities and in towns simultaneously throughout the country, (although festivals are often planned to coincide with this programme). Similarly, there are contrasts with activities based in science centres in that festivals are a short-term, concentrated burst of events, and often utilise neutral ground such as town halls and parks.' (OST, 2004)

Nolin, Bragesjö and Kasperowski (2003) discussed in depth the differences between a 'science week' and a 'science festival' located in the authors' home country (Sweden), and identified contrasting characteristics such as geographical location and 'presentation'. By this second descriptor they meant:

> [In Science Festivals] 'the perspective is much more of a popular science event with an emphasis on science as being fun. In addition, the festivals are often engineered by non-scientists. In comparison, the science week is more university driven, arranged by scientists at the university. The presentation of science is in effect more serious in tone.' (Nolin et al., 2003)

Whilst this may be true for the authors' local events, many science week organisers would strongly disagree with this delineation. Indeed the UK's National Science and Engineering Week describes itself as being:

> '...organised throughout the UK by a large and varied range of organisations and individuals including hospitals, schools, industry and museums. Venues range from shopping centres to science centres.' (NSEW, n.d.)

According to the definition by Nolin et al. (2003) this 'science week' would in fact come under the definition of 'Science Festival'. Aside from these cultural comparisons there are also language issues which mean that a direct translation of the words 'Science Festival' into another language may miss the important sense, implicit in the English, that this is a 'celebration' of science. As a result, the term 'Science Festival' could take on a variety of meanings in other languages; the question of whether this is the case is not something that this study has attempted to answer. Within English speaking organisations the choice of the word 'Festival' is in many cases very deliberate – for example during the foundation of the Edinburgh International Science Festival: 'It was a 'festival' not a meeting, conference or centre, this gave it an energy that was higher than you could find elsewhere' (Gage, 1997).

One underlying aspect within all of the associated uses of the term appears to be the intention of bringing public audiences and scientific concepts together. As Neresini, Dimopoulos, Kallfass and Peter (2009) describe, one of the key aims of events such as Science Festivals is to 'improve relations and communications between science and society'.

Part of the intention of this work, therefore, is to identify the characteristics of the existing activities that identify themselves as 'Science Festivals'. For the purposes of this research a 'Science Festival' is defined by the following characteristics:

- The main focus is a 'celebration' of science, technology, engineering and related aspects[4].
- The intention is to engage non-specialists with the scientific content.
- The event is time-limited and recurring, usually on an annual or biennial frequency.
- There is a common theme and/or branding to component activities.

**Science Festivals in the literature.**

The first recognisable example of a 'Science Festival' by this definition was set up by the British Association for the Advancement of Science in 1831 (Gregory and Miller, 1998). From their foundation, the intention was that 'leading scientists gave public lectures to ensure that the latest research had the broadest possible audience' (OST, 2004). These meetings, which are still ongoing under the current name of the British Science Festival, travel to different parts of the UK for a week-long event in September each year. Very few other

[4] Following recent international trends, the definition of 'science' will be taken to include 'research and practice in the physical, biological, engineering, mathematical, health and medical, natural and social disciplines, and research in the arts and humanities' (Science for All, 2010; and the German concept of 'Wissenschaft' described in the context of Science Festivals by Nolin et al., 2003). For simplicity this will be simplified to 'science' only in future descriptions here however all such subjects are acknowledged as relevant.


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similar Science Festivals appear in the literature, whether within the UK or internationally, until towards the end of the 20th Century, when such activities proliferated according to Cassidy (2006):

> '…such events achieved a new frequency and popularity in the 1990s, with the Edinburgh International Science Festival and many other smaller events appearing at this time.' (Cassidy, 2006)

To the authors' knowledge the quantitative growth trajectory of Science Festivals internationally has not been reported in detail to date; however this general timing as described by Cassidy (2006) concurs with growth in other types of Festival events, most notably Arts Festivals and other cultural events, during the 1990s (British Arts Festival Association, 2008; Yeoman, Robertson, Ali-Knight, Drummond & McMahon-Beattie, 2004). Work investigating these broader Festival types has identified that the motivations for starting a Festival tend to be wide ranging:

> 'On a global basis there is unprecedented interest in festivals and events – at international and national level, in cities and towns, villages and hamlets, and in rural and coastal areas. Everyone wants to celebrate their particular form of culture, tradition, difference or similarity with others. Festivals and events can help promote their destination and attract tourists' (Yeoman et al., 2004)

In a similar manner, the success of Science Festivals frequently transcends a local or regional scale, with the activities being used as a vehicle for international focus and exposure for science communication activities. For example in the case of Sasol SciFest in South Africa:

> 'Since the first festival in 1997, it has attracted some forty thousand visitors a year, drawing prominent scientists from around the globe as key speakers, and securing participation and support from abroad' (Joubert, 2001).

In addition to benefits associated with profile raising, the economic advantages of Science Festivals have also been recognised, for example the 'primary motive' in founding the Edinburgh International Science Festival was to 'create an event that would boost Edinburgh's tourist numbers over the two week Easter holidays' (Gage, 1997). Whilst attracting tourists may not be the main incentive for most Science Festivals, it is well recognised by regional and governmental communities as a potential outcome for larger Festivals. For example a single arts Festival held in Brighton (UK) is recognised as adding £20 million to the local economy annually (SEEDA, 2009).

Looking more closely at their impact on the science – society interface, Science Festivals have previously been recognised as a 'prevailing mode of science communication' (Kim, 2007) and a 'vital instrument for intervention' within the 'dimension of the scientific culture' (Quaranta, 2007). Along with bars, streets, fairs and schools, Science Festivals were identified by Brito (2008) as suitable places for a direct interaction between science and the public: '…environments that allow for greater and more explicit interaction with society' (Brito, 2008). This use of unusual environments and formats is crucial to the success of many Festivals (EUSCEA, 2005; OST, 2004) and in their attempt to refine the various definitions

of 'science communication', Burns, O'Connor and Stocklmayer (2003) listed 'festivals' as an example of informal science communication.

Research into other forms of informal venues has been prolific, led by key advocates such as Falk and Dierking and the Center for Advancement of Informal Science Education (CAISE) in the USA (see for example Bell, Lewenstein, Shouse and Feder, 2009; Falk & Dierking, 2007; McCallie et al., 2009). Yet there has been little academic research investigating Science Festivals, in particular comparing more than one Festival. From the non-academic literature there have been two previous reviews of Science Festivals and similar public events, published by the UK government and the European Science Events Association (EUSCEA) in the mid-2000s. These reports reviewed the status at the time of UK and European events respectively. The focus of the UK government report (OST, 2004) was an investigation as to whether UK-based Science Festivals succeeded in engaging public audiences with science and technology, rather than a more one-way communication model focused purely on education (Miller, 2001). Elsewhere the potential for Science Festivals to play a role in engaging public audiences with controversial issues had already been recognised:

> '…it is also worthwhile considering the less-formal mechanisms that can offer opportunities to create ethical engagement with science, perhaps through the programming of science festivals, which can encompass the broader community of cultural industries in the processing of science.' (Miah, 2005).

Indeed, from the beginning the Edinburgh International Science Festival focused on two-way communication:

> 'From the outset the organisers were determined that the Festival should be a place for discussion and debate; everybody was regarded as a participant, especially those in the audience.' (Gage, 2001)

However the findings from the OST report were mixed: some Science Festivals provided good evidence of incorporating a strategic approach, with clearly defined target audiences and detailed evaluation mechanisms. Yet the report was generally scathing about Science Festivals' handling of '...media involvement, engagement of otherwise excluded audiences and in evaluation' (OST, 2004).

Around the same time the European Science Events Association (EUSCEA) conducted a review '...to put together ideas, guidelines, recommendations on how to organise such 'Science Communication Events (SCE)', as these events were called' (EUSCEA, 2005). This handbook was aimed primarily at event organisers and contains a great deal of practical information based on the learning from successful existing European Science Festivals.

Despite evidence of significant activity by 2005, Science Festivals are frequently under-represented in the existing literature. Evidence is now growing of the increasing importance of these activities, especially in their ability to reach new audiences and create a centre point for focusing science communication efforts within a city or region (EUSCEA, 2005). The

intention of this work is to build on these initial national and European perspectives to produce a global picture of Science Festivals.

**Methods**

Data collection was achieved through two main approaches. Firstly, a content analysis to investigate basic operational information was conducted using website data from internationally identifiable Science Festivals. Existing international networks with an interest in Science Festivals, such as EUSCEA (Europe), Red-POP (Latin America), ASTC (Association of Science-Technology Centers, North America) and the British Council were contacted in order to maximise the number of Festivals identified for inclusion in the content analysis. An additional Internet search was performed to identify additional Science Festival websites using the terms 'science festival' and 'science week'. This approach resulted in a total sample of 76 Festivals internationally. The investigation was however limited by the amount of data made publicly available by the Festivals themselves. Science Festivals differed in the amount of information they provided online, especially with regards to their organisational structures and evaluation methodologies. For a more in-depth comparison between Festivals an additional electronic questionnaire was therefore distributed to Science Festival organisers via various international mailing lists (PSCI-Com[5], PCST[6], ASTC[7] and BIG-chat[8]) as well as personal email using the contact details and networks identified in the content analysis. New Science Festivals self-nominated by the online survey respondents, as well as snowball sampling (David and Sutton, 2004) with respondents from particular geographic areas (notably Central & Southern America and certain parts of Europe) led to a total of 94 Science Festivals being identified globally. The content analysis was also performed on the 18 newly identified Festivals in order to produce consistent data between the two methods.

The electronic survey was distributed via Bristol Online Surveys[9] and consisted of 20 questions broken into three sections: Your Festival, Your Audience, and Your Organisation. The majority of the questions were in the form of open responses in order to remove any bias or assumptions made by the researchers, and to allow the respondents to answer in their own words (Cohen and Manion, 1994). Some closed questions were also included in order to elicit a more direct comparison between Festivals (David and Sutton, 2004). To encourage candid responses and increase the participation rate it was necessary to assure contributors that all data would be reported anonymously. All data were handled and stored according to standard ethical research procedures.

[5] http://www.jiscmail.ac.uk/lists/psci-com.html is a mainly UK-based discussion list

[6] http://mailmanlist.net/cgi-bin/mailman/listinfo/pcst is the mailing list for the International Network on Public Communication of Science and Technology

[7] US-based Association of Science-Technology Centers

[8] http://www.big.uk.com/chat/index.htm is an informal discussion forum for members of the British Interactive Group

[9] http://survey.bris.ac.uk/

The definition of a 'Science Festival' was deliberately left very broad within the survey invitation in order to allow Festival organisers to self-identify their relevance. In accordance with the first objective of this research this approach solicited an unbiased perspective from Science Festivals themselves as to what constitutes a 'Science Festival'. 56 respondents contributed to the survey in total, representing 60% of the Festivals identified during the desk research/content analysis. All data collection was conducted during the northern hemisphere winter of 2008/09, with a condition of participation in the survey being the preservation of participant anonymity in all reporting.

**Analysis Methods**

For the content analysis a coding framework was developed, focusing on those dimensions that were expected to yield information relevant to the research questions (David and Sutton, 2004). Website data from the 94 identified Science Festivals were categorised according to geographical location, Festival frequency, organisation(s) involved in managing the Science Festival and indicative annual visitor numbers. To investigate any potential English-language bias within the sample a further analysis was also performed to identify whether the region or country in which the Science Festival was located spoke English as an official language.

For the online survey, data reduction of the open-form responses was achieved through manual content analysis, thereby allowing ease of comparison between the responses from different Festivals (David and Sutton, 2004). For example, responses to the question 'What date did your festival first happen?' were used to categorise the Science Festivals according to their year of foundation. In this case, the responses were separated into four categories: Festivals founded before 1995, those founded 1996 - 2000, those founded 2001 - 2005, and those founded after 2006. Quantitative data from the online survey that had been entered in free-form text (for example audience sizes and demographics, staff time committed and budgeting aspects) were also manually coded after generating a frequency tally of the range of responses (Cohen and Manion, 1994).

An iterative approach was taken to all coding analysis (including both the website content analysis and the questionnaire data), involving multiple researchers in developing and applying the coding framework in order to optimise its final viability (David and Sutton, 2004). Due to the relatively low sample sizes and use of multiple coding categories it was not possible to apply statistical tests (such as correlation analysis or Pearson Chi-square tests) between categories (David & Sutton, 2004; Gaur & Gaur, 2009). However broader trends observed within the data have been reported here. All data were manually coded and analysed using MSExcel.

**Results and Discussion**

The results will be described in two sections: firstly, the findings from the website content analysis (n=94) will be presented in order to provide a broad overview of global Science Festivals in 2008/09. Due to the extended length of the global Science Festivals list the full details are not included here however are available separately from the corresponding author. Wikipedia also contains a publicly-available listing of current Science Festivals. After the


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desk research overview a more detailed analysis is presented, based on Festival organisers' responses to the online questionnaire (n=56) . Due to the necessity of anonymously reporting the online survey data, individual Festivals are not named however broad trends are outlined.

**Science Festivals: the Global Picture**

Findings from the website content analysis phase identified a broad range of Science Festivals around the world, with existing events identified in all of the major continents. There was a strong European presence, with 68 of the 94 identified Festivals originating in Europe, and a further 10 in North America. Asia (n=5: two in Japan, two in China and one in Thailand), South America (n=4: one in each of Brazil, Venezuela, Guatemala, Trinidad & Tobago), Australasia (n=4: three in Australia and one in New Zealand) and Africa (n=3: one in each of Mauritius, Egypt and South Africa) were also represented. Within Europe the most common locations were Great Britain (with over 25 Festivals in the UK alone), Italy (n=5) and Spain (n=4). There was at least one Science Festival in each of the member states of the European Union, with three Science Festivals in Canada and a further seven in the USA. Note that it is possible that other Science Festivals may have existed at the time but were not picked up during the website content analysis phase, especially smaller scale activities in Asia, South America, Australasia and Africa.

**Organisations involved in delivering Science Festivals.**

There were a diverse range of organisations involved in managing the delivery of the Science Festivals sampled, including national government ministries and/or research councils (n=18), university-based organisations (n=16) and non-profit organisations (such as science centres and museums, learned societies or membership organisations, or bespoke charities set up for the purpose; n=22). The proportion of local governments who oversee Science Festivals was relatively low (n=6), whilst there were no Science Festivals identified within this research who are managed primarily by industrial groups. This lack of central management of events by industrial groups is historically unsurprising; the UK's national 'SET' (science, engineering and technology) week was previously described as having

> 'feeble financial support... proffered by the engineering and industrial community... perhaps because they [Science Festivals] do not fit comfortably with the public relations campaigns mounted by industry' (Farmelo, 1997).

However, more recent work in mapping the breadth of public engagement provision within the UK has identified that '...industry utilises umbrella organisations and support networks to deliver public engagement' (Featherstone, Wilkinson and Bultitude, 2009), rather than leading or managing the interactions themselves. Therefore industrial organisations may well be involved in the Festivals, but not managing the overall operation directly.

The involvement of academic researchers in Science Festival events has been recognised as crucial from the beginning, therefore the relatively low involvement observed here of academic institutions leading the management of Science Festivals is somewhat surprising. As described by Pearson (2001) a decade ago in relation to what was then the UK's SET week:

> 'The higher education sector has steadily increased its participation to become the mainstay of *set* week, with scientists from more than 100 universities and colleges contributing. In 1998, it was estimated that universities now support more than half the week's events (total 1,800+) and attract two-thirds of its audience (total 1.2 million)' (Pearson, 2001)

As with the industrial organisations, the reduction in Universities leading the management of Science Festivals does not however necessarily mean that academics and universities are no longer involved in the delivery aspects of a Science Festival. The high proportion of 'non-profit organisations' now running Science Festivals suggests the emergence of an 'intermediary' group who facilitate the interaction between scientists and publics. Such groups were described by Bauer (2009) in the context of a variety of science communication events (including Festivals) somewhat glamorously as 'angels':

> 'As these events are costly and require know-how to organise, they become the remit of private 'angels' rather than civil servants or academics. 'Angels' are age-old go-betweens, however, here they [are] not between heaven and earth, but between a disenchanted public and the institutions of science, industry and policy making.' Bauer (2009)

Non-academic and non-governmental organisations taking on such an intermediary role were observed across a broad spectrum of the Science Festivals sampled; there did not appear to be any noticeable trend in terms of the geographical location of the Science Festival and the type of organisation involved in managing it. It is notable that in the case of 14 separate Science Festivals the delivery organisations were identified as 'others / mixed', whilst for a further 17 Science Festivals the type of delivery organisation was noted as 'unidentifiable', meaning that from the website data collected there was a lack of clarity as to who was involved. These two categories represent almost one third of the data sample, and signify the frequent lack of information that is available publicly for many Science Festivals. Similarly, of the 94 Science Festivals identified, 46 (49%) did not make their visitor numbers available publicly on their website, and for 20 Festivals it was impossible to determine how frequently they ran (e.g. annual or biennial).

## Questionnaire Results

*Types of events that self-identified as 'Science Festivals'*

As discussed in the Methodology section, the lack of publicly available data on many Science Festivals led the researchers to conduct an international online survey. One aspect that became immediately apparent during the questionnaire distribution was that 'Science Festival' as currently used is a very broad term, encompassing a wide range of public engagement activity. This characteristic of each Festival being 'unique' has been recognised previously in the context of Science Festivals:

> 'Each [Science Festival] is organised differently with different budgets, objectives, audience levels, media interest, target audiences, and perceived 'success'.' (OST, 2004)

Within the respondents to the online questionnaire, the diversity of approaches was one of the main findings across all of the characteristics investigated. All of the 56 self-identified Science Festivals who participated in the survey fulfilled the four criteria in the proposed definition of 'Science Festival' included above. In addition, it is worth noting that the term 'Science Festival' was thought by Festival organisers themselves to encompass broader 'science weeks' – celebrations of 'science', 'science and technology', 'science and engineering', or in one case 'social science' on usually a national but occasionally large regional scale. Ten such 'science weeks' contributed to the present research; the remaining 46 events were each focused in a particular smaller geographical location (whether that is a single venue or a city-wide area). Due to their different structures and scope the data were investigated for any variation in trends for the 'science weeks' in comparison to the other Science Festivals – any key differences are noted in the discussion points below. It is however important to note that the 'science week' organisers themselves certainly saw their events as being under the broader umbrella of 'Science Festival'.

*Geographical distribution*

The survey respondents came from all six geographical areas identified in the website content analysis phase. European Science Festivals constituted 73% (n=41) of the sample, with five from North America, four from South & Central America, and two each from Asia, Australasia and Africa. These proportions are very much in line with the geographical distributions identified in the website content analysis phase therefore the data is taken to be approximately representative. There was no discernible bias towards respondents from countries where English is an official language, meaning that language bias is not likely to be a predominant effect in any results reported here.

*Frequency of operation*

The vast majority (n=49, 88%) of Science Festivals which responded to the survey run on an annual basis. Six of the seven exceptions to this rule began after 2006, indicating that newer Festivals may be exploring more unusual formats. It may also suggest that only annual Festivals survive for more than 2 or 3 years: only one Festival that began before 2006 runs less than annually. However within the current data it is not possible to identify the reasons behind this trend; further qualitative work in this area would be beneficial to identify the underlying reasons for this trend.

All ten of the 'science weeks' run on an annual basis. The annual frequency of most Festivals is understandable in the context of maintaining momentum and 'brand' profile in the eyes of sponsors, partners and audience members alike. As Edwards (2004) identified, the goals of events such as Science Festivals '…could be concerned with raising the morale, energy, or productivity of an organization' in addition to the more usual aims of educating and engaging the public audiences involved. Creating a regular point on the calendar when such focus occurs arguably enhances the likelihood of its continuity and embeds the event as a 'natural' part of the local (or regional, or national) cycle.

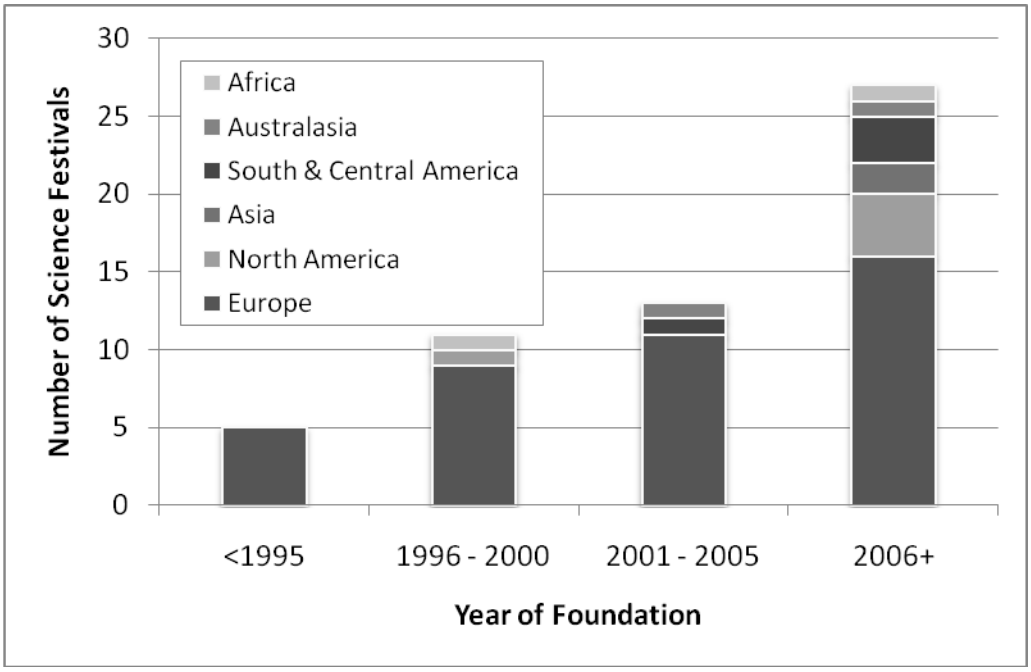


**Figure 1 – Global growth in the number of Science Festivals. Note that the data sample was collected in 2008/09 (n=56)**

*Chronological development*

The year of Festival foundation as captured within the online survey provides a historical record relating to the chronological development of different Science Festivals. Figure 1 shows a marked acceleration in the rate at which Science Festivals are being set up. Of the 56 Festivals which contributed to the survey, only five had been founded in the period up to and including 1995, with 11 in the 5 year period 1996-2000, 13 in 2001-2005, and 27 in the 4 year period 2006-2009. One possible explanation for this is that many Festivals may have only a short life span, meaning that Festivals which were founded in the earlier years do not appear in the data because they are no longer in existence. However, the findings are in line with previous work, for example OST (2004) identified around 15 Science Festivals operating on a regular basis in the UK at the time their report was published.

The proportion of Festivals which are based in Europe has been relatively high throughout the timescale under investigation: within the first three periods shown at least 80% of the Festivals started each year were located within Europe, dropping to 57% (n=16) of the Festivals set up in the period 2006-2009. This high degree of activity in Europe was formally recognised in 2002 by the founding of the European Science Events Association (EUCSEA). The purpose of EUSCEA is to 'exchange ideas and experiences, to communicate across borders and to develop new ways of funding and marketing Science Communication Events in Europe.' (EUSCEA, 2008). In 2008 EUSCEA had 69 member institutions (not individual Festivals) in 33 countries.

The evidence from Figure 1 demonstrates that within Europe the growth is slowing (although note that the data were recorded in 2008/09 so the final column does not represent the full


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data category). Growth in other geographical areas now appears to be increasing, especially in North America and South & Central America. In the USA the growth of Science Festivals is being actively promoted through a recent National Science Foundation (NSF) grant to set up the 'Science Festival Alliance' in 2009 with four founding institutes as members. The stated intention of the Science Festival Alliance is to 'support the development of science festivals' in the USA (Science Festival Alliance, n.d.).

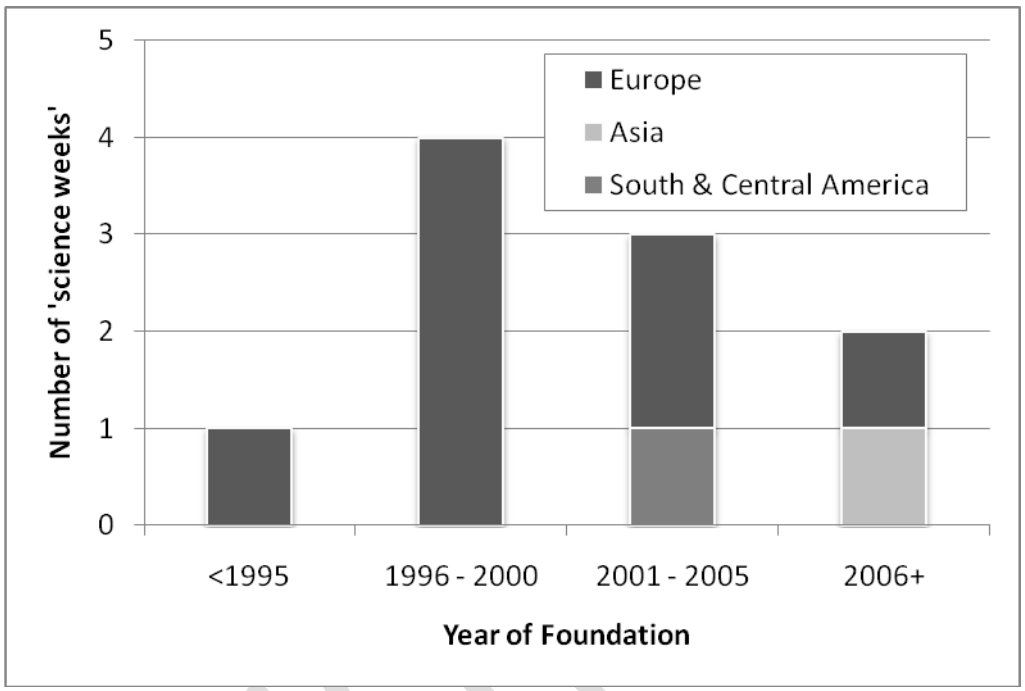


**Figure 2 – Global growth in the number of 'science weeks'. Note that the data sample was collected in 2008/09 (n=10).**

If the questionnaire responses from the 'science weeks' included in the sample are considered separately then the trend in growth is quite different. Figure 2 demonstrates that growth peaked in 1996-2000 and has declined since then, with only two 'science weeks' starting post-2006 in comparison with 26 other Science Festivals during the same period. This may be due to the more frequently national scale of 'science week' activities: it is likely that only one such enterprise would be developed per country, meaning that growth in other Science Festival types can occur at multiple locations within a country, but a 'science week' event once started will not be replicated in the same country. Many 'science weeks' appear to have developed as annual events following on from year-long celebrations. For example, after South Africa's Year of Science and Technology (YEAST'98), annual Science Weeks were developed with the specific intention to sustain momentum and encourage initiatives to continue (Joubert, 2001).

*Scale and scope of activities*

Science Festivals vary dramatically in size and scope. Within the questionnaire data, the number of activities delivered within any particular Festival varied between three and 11,000 activities, and between a minimum audience size of 120 people to a maximum of over 3

million. This wide variation demonstrates the breadth of scale in events that call themselves 'Science Festivals' but it should be noted that the data are spread right across that range, as demonstrated in Table 1.

**a)**

| | Year of Festival Foundation | | |
|---|---|---|---|
| **Number of Activities** | **Pre-2000** | **Post-2000** | **Total** |
| <50 | 3 | 15 | 18 |
| 51 – 200 | 3 | 13 | 16 |
| 201 – 500 | 4 | 8 | 12 |
| 500+ | 6 | 3 | 9 |

**b)**

| **Audience Size (number of people)** | **Number of Festivals** | **Science Weeks only** |
|---|---|---|
| <10 000 | 21 | 1 |
| 10 001 – 50 000 | 18 | 3 |
| 50 001 – 200 000 | 8 | 2 |
| 200 000+ | 2 | 2 |

**Table 1 – Variation in the scale of Science Festivals. a) the number of activities offered as a function of the year of foundation of the Festival (n=55). b) categorisation of Science Festivals by their total audience size, including all festivals in the sample (n=49) as well as 'science weeks' only (n=8).**

There are no discernible trends in terms of the scale of activities on offer at a particular Science Festival and factors such as its geographical location. However if the data are divided into pre- and post-2000 year of foundation for ease of comparison (as demonstrated in Table 1a), a clear trend emerges whereby newer Festivals tend to be smaller, incorporating relatively fewer activities, whilst older Festivals tend to be larger. This may be due to older Festivals having capitalised on learning from previous years, with younger Festivals taking time to grow and develop a recognised 'brand' as a suitable attraction for members of the public to participate in (and one which funders will support financially).

Looking at Table 1b, it is evident that the majority of Festivals (n=39, 80%) reach fewer than 50,000 people, with 21 Festivals in the sample reaching less than 10,000 people in total. The 'science weeks' are major contributors here, representing 4 of the 10 largest audience sizes (including the top two).

One point worth raising here is that seven Festivals within the sample (including two of the 'science weeks') could not supply information regarding their audience size, meaning that they did not have accurate records of participant numbers themselves. Some Festivals openly acknowledged the difficulty in accurately recording visitor numbers, stating 'Difficult to

measure' or supplying values marked as approximate within the appropriate response category. One respondent described the problem more specifically:

> 'It is difficult to answer this question ... since admission to the Festival was free, we did not have a method to ascertain the breakdown of the audience.'

The respondents also highlighted the different ways that audience sizes were measured, for example via individual ticket sales or counting the numbers of participants, family groups or schools attending etc. Therefore some respondents were concerned that the values given by different Festivals may not all be comparing like with like. Other respondents acknowledged that figures for individual events do not necessarily sum together to produce an overall 'participant number'. For example one respondent indicated that their Festival attracted:

> '30,000 visits, including 19,000 ticket sales and 11,000 to free activities. But some people visit more than one event - accurate figures for numbers of people are not available.'

There is also the issue that many Festivals deliberately strive to deliver free events in 'unusual' venues such as shopping centres and public parks in order to attract the widest possible audience (EUSCEA, 2008; Fikus, 2007; OST, 2004). Accurately estimating the number of participants in such environments is not easy (McDonald, 2009) therefore it is no wonder that some Festivals cannot provide absolutely accurate data.

*Target audiences*

Given that many Science Festivals reported difficulties with estimating their audience sizes, the data on the different types of audiences who attended the Festivals are somewhat patchy. However, of the 38 Festivals who could provide some sort of breakdown, 36 (95%) reported targeting families with children, whilst 33 (87%) included school students in their target audience categories. This aligns with the EUSCEA (2005) overview of European Science Festivals, which indicated that 'most Events talk about the general public and/or school children as their major target groups' although they did note that 'everyone' isn't an entirely valid target group (EUSCEA, 2005). Little specific mention was made of otherwise excluded audiences, representing a disappointing lack of development from the criticisms on this front outlined previously (OST, 2004).

Somewhat more surprisingly, 72% (n=26) of Science Festivals described 'career scientists' as an audience for their Science Festival, although not the main audience. Additional audiences listed were journalists, politicians and staff in the corporate sector, indicating a very broad range of audience coverage by Science Festivals, and a wide range of anticipated outcomes. The publicity opportunities and policy implications presented by large scale 'celebration' events such as Science Festivals have been recognised previously, for example in the Philippines a major part of an agricultural communication strategy involved tying into local events such as Festivals to take advantage of the increased publicity:

> 'An important event in the strategy is to hold a high profile launching day… where government officials, such as the vice minister, provincial governor and directors of

> agriculture are invited… Such publicity helps to focus attention of the campaign and can motivate neighboring provinces into action.' (Heong & Escalada, 2005)

However the development of Science Festivals as policy-relevant activities is relatively recent and is more prominent in some cultural contexts than others: in the OST / Wellcome Trust (2001) review of science communication and public attitudes toward science in Britain, the purposes of Science Festivals were classed as being substantially more closely related to the dissemination of 'facts' than linking into 'policy' (OST / Wellcome Trust, 2001).

*Types of activities included*

Festivals varied dramatically in the types of activities that they offered. Table 2 shows the proportions of the four main types of activities identified within the questionnaire survey.

| Proportion of all activities delivered | hands-on activities | lectures / talks | discussion / dialogue | plays / concerts |
|---|---|---|---|---|
| none | 0 | 5 | 7 | 17 |
| 0 - 25% | 16 | 30 | 31 | 33 |
| 26 - 50% | 18 | 12 | 10 | 1 |
| 51 - 75% | 6 | 3 | 2 | 0 |
| 76 - 100% | 11 | 1 | 1 | 0 |

**Table 2 – Types of activities offered by Science Festivals (n=51).**

All of the Festivals who were able to answer this question (n=51) included 'hands-on activities' in their offer, the content of which ranged from workshops to laboratory activities, and included aspects such as quizzes, interactive exhibitions, live experiments and so on. Hands-on activities comprised more than 75% of the Festival content for 22% of respondents (n=11). More traditional 'lectures/talks' were also popular, being included in 90% (n=46) Science Festivals, although almost two-thirds of those Festivals (n=30) considered 'lectures/talks' to comprise less than 25% of their content. 'Discussion/dialogue' was incorporated at similar levels to 'lectures/talks', although 14% of Festivals did not incorporate any 'Discussion/dialogue' at all. This does however represent an improvement on previous criticisms of Science Festival content, where for example a UK government report argued that Festivals:

> '...still follow the 'deficit' model of the Public Understanding of Science in their approaches and including too few dialogue-based events in their programmes' (OST, 2004)

The inclusion of a greater proportion of discussion and/or dialogue events within Science Festivals is in line with recent trends in the rising popularity of Cafés Scientifique (Grand, 2009). Also known as 'science cafes' and 'sci-bars', these events and other similar formats

are specifically designed to encourage informal discussion between scientists and members of the public.

'Plays/concerts' were the least popular category, with no Festivals suggesting they made up more than half the programme content, and one third (n=17) not including 'Plays/concerts' at all. There were in addition a very wide variety of 'other' activities noted, ranging from live radio and TV broadcasts to wildlife and/or tourist walks, a poetry slam, a religious service, a 'green market', formal scientific meetings, arts-based activities, treasure hunts, storytelling and film festivals. This variety of content is a key factor to the success of many Science Festivals: by tapping into local interests and ensuring a diversity of subject matter the Festival is more likely to succeed in attracting a broader range of participants (EUSCEA, 2008; OST, 2004; Yeoman et al., 2004).

*Financial models*

An initial investigation of Science Festival budgets and funding sources demonstrated a broad range of approaches. Table 3 provides an overview of the indicative budgets for the Science Festivals who contributed to the online survey, along with their estimated audience sizes. It should be noted that although all the budgets provided have been converted into Euros, no weighting has been applied relating to the different costs of living in the respondent countries. This means that the total costs may not be immediately comparable between different Festivals.

| | Total Audience Size ('000 people) | | | | Total Number of Science Festivals* |
|---|---|---|---|---|---|
| **Budget Range (€)** | **<10** | **10 - 50** | **50 - 200** | **200+** | |
| 0 | 1 | 0 | 0 | 0 | 2 |
| 1 - 10K | 2 | 1 | 0 | 0 | 4 |
| 11 - 50K | 10 | 4 | 0 | 0 | 15 |
| 51 - 100K | 5 | 3 | 0 | 0 | 8 |
| 101 - 200K | 0 | 4 | 2 | 1 | 8 |
| 201 - 500K | 2 | 4 | 4 | 0 | 10 |
| 501K - 1 million | 0 | 1 | 1 | 1 | 3 |
| 1 - 5 million | 0 | 0 | 1 | 0 | 3 |

**Table 3 – Comparison between Science Festival budget and total audience size. Note that some Festivals did not answer both questions therefore the total number given in the final column may not equal the sum of the numbers in the other columns. (n=47 for both questions; n=53 for the estimated total budget).**

The Science Festival budgets ranged from zero (where all costs incurred are absorbed by the partners institutions as part of their normal business) to €3.5 million. Just over one quarter (n=15) of Science Festivals had budgets in the region €11 – 50K, with the majority (58%) of budgets between €11K and €200K. When comparing the Festival budgets with their total

audience size, a broad trend is evident in that the larger the budget the more people a Science Festival appears to reach. This result is not surprising however due to the low sample sizes it was not possible to statistically determine the relationship between the two factors.

It was noticeable that the majority of the Festivals who responded to the survey sourced their funding from multiple locations, including central and local governments, grants/sponsorship, admission charges and a variety of 'other' sources. Only seven (of 54 respondents to this question, 13%) obtained all their funding from one single source: two from central government, one from local government, and four from grants / sponsorship. 15 Science Festivals (28%) received no income at all from either central or local government, indicating a strong reliance on support from the private sector and non-governmental public bodies. This suggests that one of the major roles of any Festival management team or organisation is fund raising and sourcing financial contributions to the Festival to ensure it continues. Additionally, 34 of the Festivals who supplied an indication of their funding sources (63%) gained zero income from admissions charges, indicating that their events were offered to all participants for free. One host science centre even indicated that they opened their normal (charging) exhibition for free on the day of the Science Festival. This evidence of success in obtaining financial support for Science Festivals aligns well with recent reporting of the economic benefits to the local and/or regional communities hosting such events (British Arts Festival Association, 2008; SEEDA, 2009; Yeoman et al., 2004). Quite apart from the positive publicity and increased education and engagement of participants with science (Grant, 2004; OST, 2004), Festival sponsors may also be interested in the broader financial incentives.

*Dedicated staff involvement*

Within the survey the Science Festivals were specifically asked to estimate the total amount of paid staff time committed to their Festival management, calculated in Full-Time Equivalents (FTE), where 1 FTE = one person employed full time for the entire year. The results show that the majority of Festivals (n=35, 67%) have less than one FTE staff member paid to prepare the Festival. In terms of their resultant reach, Festivals where staff are employed for less than 12 months FTE tended to deliver fewer activities and have lower audience sizes, although it should be noted that one of the largest Festivals (which reaches more than 2 million people annually) has less than 6 months total FTE of dedicated paid staff time. This may assist to explain why so few Festivals have detailed information available online as noted above – there is little dedicated time for ancillary actions, with the main focus being on delivering the Festivals themselves.

*Evaluation*

Only three Festivals (5%) did not perform any evaluation at all. The majority of Festivals conducted internal evaluations, either formally (n=21, 38%) or informally (n=13, 23%), whilst a further 19 (34%) Festivals had commissioned a formal external evaluation from an independent body. Evaluation has long been recognised as an important, yet frequently under-resourced area within science communication practice. Within the specific area of Science Festivals and events in Europe in the mid-2000s, Edwards (2004) noted that

> 'It would greatly help if funding bodies identify some proportion of funding for evaluation purposes and Science Week organizers give increased support and advice to encourage this.' (Edwards, 2004)

Around the same time a government report in the UK investigating Science Festivals noted that:

> 'An area that is beginning to cause concern in Government and in the science communication community at large is the lack of sensible evaluation of science festivals.' (OST, 2004)

More widely, it has been noted that in the area of arts, cultural and leisure Festivals 'Little evidence on the economic, social and cultural impacts of Festivals is available across the sector' (SEEDA, 2009). The low proportion of Science Festivals within the sample under investigation here who did not complete any form of evaluation is at least a step in the right direction, however the fact that around a quarter of Science Festival respondents conducted their evaluation 'informally' suggests that this work could still be conducted more professionally.

There were no obvious trends between the type of evaluation process conducted and the audience size for each Festival although one point to note is that the very largest Festivals (reaching more than 200,000 people) tended not to commission external evaluation studies, preferring instead to conduct such evaluation internally.

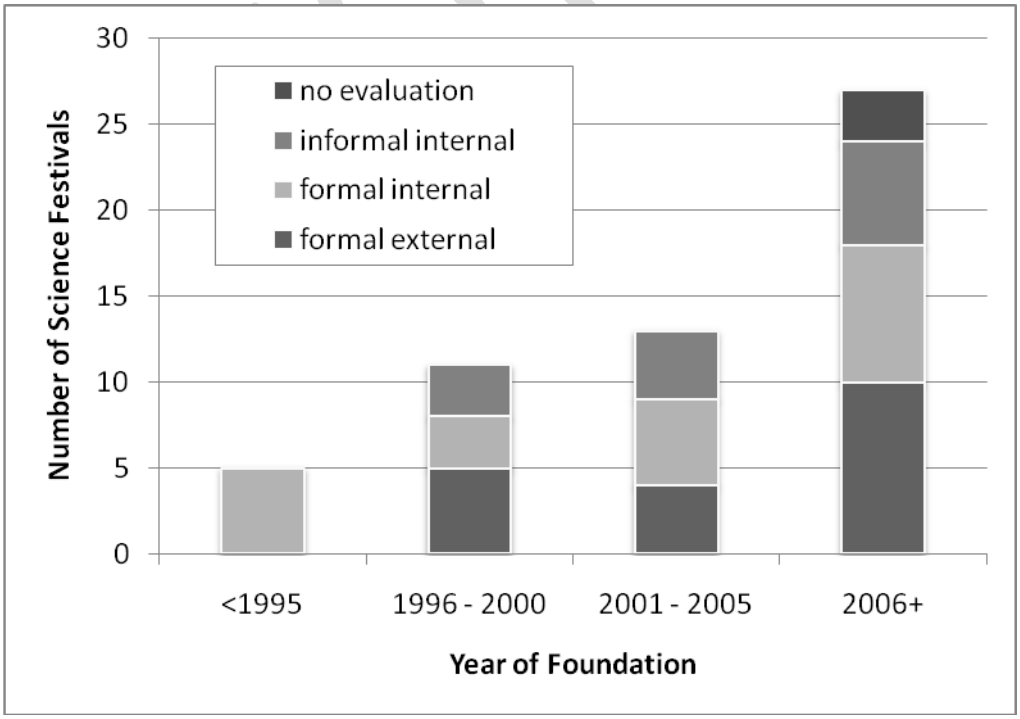


**Figure 3 – Variation in type of evaluation conducted with year of Festival Foundation (n=56).**

Figure 3 demonstrates the variation in the type of evaluation that was conducted according to the year of foundation of the Festival. Science Festivals that began prior to 1995 all conduct 'formal internal' evaluations. From the authors' experience, this is possibly because such organisations have commissioned extensive external evaluations in the past, implemented the suggested recommendations and now run a regular internal evaluation themselves at lower expense. However further research in this area is necessary to identify the reasons behind this trend. Figure 3 also shows that all three Science Festivals that did not conduct any evaluation were founded within the most recent time period, suggesting that their general proficiency and expertise in science communication may still be growing. There was no apparent trend observable between the size of the Festival budget and what sort of evaluation they undertook.

In a similar vein, Festivals that don't perform any evaluation were observed to have the lowest amount of paid staff time dedicated to planning the Festival. Likewise, there is a more general apparent trend between lower amounts of paid staff preparation time and the likelihood that the Festival will perform an 'informal internal' evaluation, although the data sample was too small to be able to confirm this trend via statistical analysis. Looking at the 'science weeks' separately, eight (of ten in total) conducted some form of 'formal' evaluation, with three of those commissioning an external evaluation.

Respondents to the online questionnaire were also asked whether the evaluation from their Science Festival was available publicly. Of the 46 respondents who answered this question, 26 (57%) responded in the affirmative, with 7 (15%) of those having a policy of publishing their evaluation on their website and the remainder making it available to interested parties on request. Of the 20 respondents who did not make their evaluation available publicly, 11 (24%) did indicate that they distributed relevant information internally to specific partners and funders, whilst 9 (20%) gave no explanation. The public availability of evaluation findings has become a key concern within many science communication communities (see for example recommendations made by the Science for All (2010) group in the UK, and the informalscience.org evaluation repository in the USA described by Friedman (2008)). Indeed, within the Science Festivals community one of the key aims of networks such as EUSCEA (2008) and the Science Festival Alliance (n.d.) is to encourage collaboration and mutual learning between different Festivals. Whilst a publicly available evaluation report is only one contributor to encouraging such collaboration, it is noticeable that Science Festivals could arguably do more to share their findings and learn from one another's experiences.

It is notable that no longitudinal studies of the longer-term impacts of Science Festivals were identified during this research. Whilst some Festivals did conduct short-term follow-up studies with their participants (typically a telephone or online survey 4-6 weeks after the event), the research team were unable to find any examples of Science Festivals that conducted follow-up evaluation more than a year later. As with other Science Festival evaluations it is of course possible that such research does exist however is not readily available in the public domain.

**Recognised Limitations to the Research**

Although the overall reach of Science Festivals identified within this study is impressive, with over 5.6 million people attending such events annually, the overall number of Science Festivals identified (94) is relatively low. This has meant that statistical analysis of the findings has not been possible (David & Sutton, 2004; Gaur & Gaur, 2009), however this issue is unavoidable until the overall global number of Science Festivals is significantly higher. In the meantime the authors have sought to identify apparent general trends throughout this paper in order to inform further work in this area.

Due to the website content analysis and survey being conducted in English there is a likely bias towards English-speaking countries. However this bias was not the predominant factor in the results; of the 94 Science Festivals identified in the website content analysis, only 45 (48%) were from countries where English was recognised as an official language, and of the 56 respondents to the questionnaire, only 23 (41%) were from countries where English is the official language. So whilst it is certainly possible that some non-Anglophone Festivals are missing from the list, the data still provides a useful overview of the international perspective. Additionally, the identification of only two international coordinating bodies for Science Festival organisers (EUSCEA in Europe and the Science Festival Alliance in the USA) may indicate a lack of wider networking and information sharing on a national and/or international scale.

As discussed previously, the data collected were also limited by what information Science Festivals currently collect, for example about their audience sizes and makeup. Many respondents did not have the necessary data to be able to answer basic questions about the logistical operation of their event, and some of the survey terms and questions asked were not familiar to some respondents (for example the definition of a ‘hands-on activity’) or were not appropriate in their local cultural context (e.g. delineating between ‘central’ and ‘local’ government).

**Recommendations for Future Work**

This work has demonstrated that Science Festivals are an increasingly important science communication phenomenon globally. As the scale and scope of Science Festivals continue to grow, the opportunities for research and reflection will also increase.

This work mainly involved quantitative analysis in order to provide a broad-brush overview of the current state of play. Further qualitative work in this area would be invaluable, especially exploring the motivations behind different Festivals’ operation and objectives. For example it would be interesting to investigate the motivations for starting up Science Festivals – and whether these change over time as Festivals adapt to survive? A further opportunity for investigation relates to how Festivals develop – a clear trend was observed here that newer Festivals tend to be smaller but how do they develop; which ones are more likely to survive to become the successful large-scale events? Finally, comparisons of cultural

differences in Science Festivals, for example between Europe and the USA as the latter region rapidly expands it offering could be a rich source of relevant information.

It is also important to note that the rise of Science Festivals has occurred in parallel with similar global growth in other areas relating to science communication, for example the development of science centres and museums or the offering of dedicated university-level programmes of study. Analysis of the relationships between the Festivals and other aspects of science communication may identify broader key trends within the field. For those Festivals that include young people (and specifically school students) as a target audience it may also be valuable to investigate potential connections between the pupils' informal learning experience at the Science Festival and their achievements within the formal education sector.

## Conclusions

Science Festivals are a growing phenomenon, particularly in Europe and the USA, offering significant opportunities to engage public audiences with science and technology. They can provide a focus for effort and fundraising as well as a stimulus for different organisations to work together towards common goals. Whilst in the past Science Festivals have been criticised for a lack of 'dialogue' and discussion-based activities, and an unprofessional approach to evaluation, this work found evidence of improvements in these areas, although there is still work to be done in some cases. This work has confirmed that a huge diversity exists within the broad umbrella term of 'Science Festival', offering a rich and rewarding area for further research in future. There is clear evidence of an international enthusiasm for celebrating science on a large scale, offering strong possibilities for further improving the relationship between science and society.

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