Title: Digital Touch for Remote Personal Communication: An Emergent Sociotechnical Imaginary

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Abstract

This article makes legible emergent social imaginaries of digital touch for remote communication in personal relationships, with attention to digital touch interfaces. It draws on data from rapid prototyping research workshops with apprentice professionals embedded within digital communication. Touch is discussed with respect to four analytical themes: materiality; body; emplacement; and temporality. We illustrate how participants' past and present experiences and future visions of remote digital touch thread through these themes and weave together to form a hegemonic, emergent sociotechnical imaginary of digital touch. The article contributes to social debates within digital personal remote communication by foregrounding touch, the material, and sensorial. The paper's novel interdisciplinary framework (combining design-based rapid prototyping with a multimodal and multi-sensorial analysis within the frame of the sociotechnical imaginary) also contributes to methodology around future-facing phenomena, prior to the process of their solidification into material, political formations.

Key words: touch, digital touch, personal communication, remote communication media, sociotechnical imaginary, rapid prototyping, multimodal, multi-sensorial, speculative research

Introduction

This paper explores how touch is entering the digital communicational landscape and the dimensions of touch related to remote digital personal communication. In the contemporary landscape the body itself has become the primary means for engagement, bringing touch to the fore as a feature of digital interfaces. Touch-interfaces, 'real', fictional or imagined, matter given the general social and cultural importance of interfaces, the ways in which the body-screen relationship structures everyday practices, and the insights that interfaces provide on the values and conventions of the cultures that they emerge out of (Manovich, 2001; Richardson and Third, 2009; Johnson, 1997). Interfaces enable us to excavate the common understandings and practices of the 'social imaginary' (Taylor, 2004) that they articulate and generate. As we will discuss, the immediacy and intimacy of touch makes remote personal relationships a primary market for the promise of 'digital-touch'. A term that we use to emphasize our social orientation to touch and refer to the digital-mediation of touch by a broad range of technologies, rather than 'haptic' or 'tactile' which reference a technological or physiological orientation (Jewitt et al, 2020).

The paper analyzes a series of research workshops exploring personal remote touch communication through brainstorming, cultural probes and rapid prototyping - a human-centered design process that advocates for thinking with your hands as a way of quickly and practically exploring an idea (Dunne and Raby, 2013). Rapid prototyping has recently been used within the humanities and social sciences to explore future-facing concepts (Salazar et al., 2017; Lupton, 2018). The workshops were facilitated with apprentice professionals in the field of digital communication (e.g. Human Computer Interaction, Media and Communication) embedded in the ongoing global production of sociotechnical futures. They

provided a context for participants to collaboratively explore and critically interrogate digital touch communication through the processes of making, touching, and manipulating materials and objects together. Their significance comes from their embed-ness within the hegemonic social structures and in-equalities of the digital communication economy and their power to shape digital touch futures. As a result of this hegemony, and the uneven value it attributes, the imaginaries of digital touch that circulate across other social groups do not, for the most part, get to be inscribed in the dominant socio-technical imaginary that circulates in any particular moment.

Two interconnected sets of materials were generated and collected: the ten prototypes produced by participants and video recordings of the participants' interactions that they supported, both of which inform the four analytical themes discussed in this paper. The prototypes evoked a range of touch materialities, relationships to the body and temporality, and senses of emplacement, palpable in their naming: Haptic Chair, Tactile Emoticon, Sparking Presence, Blocker, Bed-Touch, Emotional Whirl, Mood-ball, Intimate Connections, Walk-the-Dog, and Touch-Cape. An image of each prototype and a brief description of its use scenario and function is presented in Table 1. We draw on the concept of the sociotechnical imaginary (Jasanoff, 2015), which we elaborate on later, to frame our analysis of the ongoing production (or becoming) of digital touch for remote personal communication. In doing so, we engage with a particular emergent future imaginary of digital touch, not in an attempt to predict the future, or to claim *the* imaginary, rather to articulate what present imaginations reveal.

The paper makes a significant methodological contribution to the interdisciplinary study of digital touch by showing how the concept of the sociotechnical imagination, a multimodal and multi-sensorial analysis, and design-based methods can be productively combined. It demonstrates a novel framework to access insights on the 'hard to access' and future facing experience of digital touch communication. A significant aspect of the framework is that it brings imaginative, bodily and materially orientated forms of exploration, discovery and experience of touch communication to the fore. This emphasis provides participants with opportunities to use their bodies as a multimodal and multi-sensorial investigative means in the research workshop, engaging with remote personal digital touch communication in ways that differ than those provided by talk-based or visual-based methods.

The findings explore digital touch across four interconnected themes: materiality; body; emplacement; and temporality. The paper contributes to mapping the emergent area of digital touch communication through these themes. We conclude by reflecting on how these four thematic strands weave together to create a narrative of the emergent socio-technical imaginary of digital touch. As our use of the term 'emergent' suggests, the direction of this not-yet-fully-formed imaginary of digital touch remains lively, contestable, and has a degree of instability. In this paper, through our description, we open it up to conversation with other imaginaries, to be contested and resisted. It also contributes to methodology around future-facing phenomena, prior to their solidification into material, political formations, through an approach that brings the sociotechnical imaginary newly into conversation with design-based methods and multimodal and multi-sensorial approaches (Jewitt and Leder Mackley, 2018).

Personal relationships and digital touch

Personal relationships, communication technologies, and technological innovation are inextricably entwined, and work to shape and transform one another (Madianou and Miller, 2012). While technologies offer affordances - potentials and constraints, for action (meaning

making), it is material, social and cultural histories, practices and contexts that constantly shape them (Kress, 2010), including the personal social relationships that they are taken up within. Digital technologies have increased the possibilities to establish, develop and maintain intimate relationships at a (physical) distance. This has been achieved through the designed configuration of key concepts, such as mobility, interactivity, temporality, social cues, storage, replicability, reach, and materiality (Baym, 2015; Madianou and Miller, 2012). People configure a rich mix of technologies to create different senses of 'co-presence' across relationships: mobile phones and text messaging (Licoppe, 2004; Christensen, 2009), email, video-chat (Share, William and Kerrins, 2018; Harper, 2016), and a plethora of social media (Ellison et al., 2014). People navigate this complex landscape of affordances in order to manage their relationships, encountering affordances and materialities that differ markedly from those associated with earlier forms of remote mediated communication (e.g. audio cassettes, letters, and costly land-line phones). Supporting and maintaining offline relationships is key to online activity, with the boundaries between the two becoming increasingly blurred (Baym, 2015). As geographical distances between loved ones increase (for a range of social, climate and work-related reasons), and digital infrastructures improve and spread, digital technologies increasingly support a culture of ubiquitous 'always-on' connectivity. Making notions of emplacement central to the evolving digital landscape. This allows for new types of connection at a distance which is becoming (at least for some) more important than face-to-face contact (van den Berg Arentze and Timmermans, 2012). Digital touch is a new frontier of these expanding and communicational possibilities.

Media choice and use is a point of negotiation in a relationship, and in addition to content, the materiality of a media is key to this process (Madianou and Miller, 2011). It follows that understanding the potential communicational consequences of media requires consideration of both technological features and the personal, cultural, and historical assumptions and values they evoke (Baym, 2015). Materiality is a key theme that cuts across all of these considerations. When a new technology enters a the 'Technoscape' (Appadurai, 1990), societies reach a consensus over time and develop a set of norms and etiquette for their use. The norms of social media (e.g. Facebook, Twitter, Instagram, and WhatsApp) serve to establish explicit and implicit rules of what is acceptable in a given context (Waterloo et al, 2018), and the consequences of violating them is felt by users (McLaughlin and Vitak, 2011). These shifting norms carry over into other contexts to shape the ways people communicate and what is considered socially acceptable. With each new technology, the process begins again (Licoppe, 2004). What, we ask, happens when digital touch enters the social imaginary of the technoscape?

Touch has a central role in the construction of our experiences and understanding of the world, ourselves, and one another. It is significant for developing and maintaining personal relationships, from ritualized greetings, to communicating emotion or intimacy (McLinden and McCall, 2002). Touch is an effective means of influencing attitudes, creating bonds between people, places or objects (Krishna, 2010), and it improves information flow and compliance (Field, 2003). The importance of touch in personal relationships and advances in digital touch design require better understanding of its place in the sociality of personal relationships as they play out across the technoscape. Devices that support affective touch, that is, positive, intimate or playful affectionate touch, use sensors and actuators to add emphasis or to communicate different kinds of touch (Huisman, 2017). Although digital touch devices are currently limited, digital (mediated) touch has been shown to be effective in communication, conveying affective support, valence and arousal, and a range of emotions (Eid and Osman, 2016). Attempts to bring touch into the digital realm continue a-pace, with

industry ideals of a working body (e.g. within the military or sex industry) that is 'always on', 'hyper-attentive' or 'disciplined for tactile calls to attention, a body open to these calls to be productive at all times' (Parisi and Farnham, 2018:3). Alongside this focus on the temporalities of touch, the ongoing process of digital dematerialization is seen to have disengaged with and neglected the values of the physical world (bodies, artefacts and interactions) to reduce or remove touch from the communicational environment (Van Campenhout et al. 2016). Touch-based technological innovation has a significant history, and how touch technologies draw the body (often only the hand or forearm) into meaning making, and question human-digital boundaries is a key point of critique (Parisi, 2017).

Researching an evolving landscape and the sociotechnical imaginary of touch

The imaginary describes people's visions, symbols and associated feelings about a phenomenon. The social imaginary refers to a supple yet deeply embedded framework of cultural value and identity, common understandings that make possible common practices which reside in society, a collective imaginary, instead of reducing it to a faculty of the individual mind (Taylor, 2004). The pervasive significance of the imagination is rooted in the idea of the social imaginary as underpinning the ways in which groups of people imagine and design their collective social life. It helps to produce the shared systems of meaning and belonging, that guide how people collectively see and organize the world, in its histories as well as its futures (Jasanoff and Kim 2009). Social imaginaries are a central element of globalization, a part of the global cultural flow of 'Technoscapes' through which technologies promote cultural interactions (Appadurai, 1990). Indeed, the development and usage of *all* technologies is embedded within and animated by social imaginaries (Herman, Hadlaw and Swiss, 2015). In this way, the social imaginary has itself come to be a 'social fact' (ibid:299): a social process key to all forms of agency, with material outcomes that contribute to the making of social order.

People mobilize a wide variety of imagined technological possibilities as a resource to understand and frame sociotechnical contexts (Flichy, 2007). The sociotechnical imaginary is a conceptual tool with which to investigate shared visions of desirable futures and resistances against the undesirable 'animated' by science and technology (Jasanoff, 2015). Sociotechnical imaginaries have been used to explore how people make sense of their visions and practices with communication systems, for example, Mansell's *Imagining the Internet* (2012). While digital innovation is concerned (albeit, to different degrees) with creating design fictions of speculative technological futures that engage with the sociotechnical imaginary (Shedroff and Noessel, 2012).

We use the sociotechnical imaginary to frame our exploration of emerging digital touch communication. The ability of sociotechnical imaginary to generate a discursive space which 'oscillates between imagination and reality' (Kim, 2018: 176) is particularly salient for our purposes given that digital touch communication occupies this space: most digital touch devices are un-domesticated, unstable and in labs, rather than 'in the wild'. Understanding futures as they unfold is methodologically complex. The concept of sociotechnical imaginaries enables us to: attend to the framing and representation of the futures of digital touch, and promotes ways of thinking about possibilities for touch (Borup et al., 2006); connect the past as a 'prologue' and a 'site of memory' with participants' contemporary societal understandings of the present and its future hopes and desires (Jasanoff, 2015); descriptively map digital touch affordances and constraints; and explore potential guides for social practice (Herman, Hadlaw and Swiss, 2015). The sociotechnical imaginary thus enables us to approach the

contemporary configuration of digital touch as a moment of social and cultural reflection. In this paper, we explore the imaginaries of digital touch of apprentice professionals, we argue that their shared visions and proximity to the hegemonic power of the digital communication economy makes them significant. This is not to dismiss the importance of the imaginaries of other social groups, rather it offers a starting point for our investigation, and perhaps creates space for other imaginaries to contest and resist the emergent social imaginaries described in this study

DATA AND METHODS

This article draws on the analysis of data collected from three research workshops designed to explore digital touch for personal remote communication (i.e. friendships, family, and/or intimate partnerships).

Workshop participants

Workshop participants were postgraduate students (studying Media and Communication, Design, Computer Science, and Linguistics) from four leading UK universities. While participants can be situated - to different degrees, as apprentice professionals in the ongoing hegemonic production of future digital communication, none had specialist knowledge or experience of haptics or digital touch. Our rational for selecting these participants was to capture a range of disciplines and experiences in relation to the sociotechnical imaginaries of digital touch; not to attend to their individual imaginations or designs of digital touch as a lens through which to construct future sociotechnical imaginaries. Participants were recruited via the project twitter and research networks. Attendance was voluntary and a total of 31 people participated in the workshops (age range 22 to 51 years, of whom 25 were female, and six male). Participants were selected to ensure a range of disciplinary perspectives on the digital and communication.

The workshop participants worked in small groups (3-4 people), giving a total of nine groups. The groups were organized by the researchers to ensure an interdisciplinary mix in each group (each included at least one participant with a background in HCI or Computer Science, in Design, and in Communication or Linguistics). Participants stayed in one group throughout the workshop. The groups were initially numbered and later took the group's prototype name.

Workshop activities

Following introductions to the project and participants, three activities were facilitated. These were designed to generate talk, hands-on interaction, and future-facing exploration to support participants to think through touch technology with an emphasis on social and sensorial experiences, including their experiences of remote personal communication, their practices, cultural-social narratives, and imaginations of touch across communication and technology in the context of personal relationships.

1) A brainstorming session focused on participant histories and experiences of different types of distance communication technologies, continuities and change over the last 10 years. Collective group feedback was used to map the groups' experiences of remote digital communication and explore cross cutting themes.

2) A rapid prototyping session was facilitated with the task to build a device, system or environment for remote personal communication through 'touch'. The method required them to externalize and explore touch through materials and making. The IN-TOUCH team

introduced the task, which was led by two 'maker-facilitator' experts. They explained the process of prototyping, led a sensory tour to guide participants around a 'buffet style' array of available materials, and assisted participants in practical aspects of prototyping. The sensory tour was akin to 'tactile window-shopping' to give felt experiences and spark ideas, and participants were encouraged to physically engage with the wide range of materials and tools provided (e.g. foam/polystyrene, cardboard, fabrics: fun-fur, silk, leather, silicone, feathers; glue guns, scissors, etc.). An A-to-Z list of touch words (written on post-it notes) from 'bite' to 'yank' was displayed alongside the materials. The sensory tour supported ideation on touch-based practices, and served as a bridge between brainstorming of remote digital communication and prototyping. In developing their prototype, participants were asked to consider who would use it, how each material may translate into a touch function/experience, and the parts of the body they wanted to engage. The activity closed with a prototype demonstration, during which other participants asked questions about each prototype.
3) Kissenger (Cheok and Zhang, 2016), an exemplar remote-communication prototype, was used as a disruptive 'technology probe' to explore participants' reflective and sensory interactions and reactions with an existing device. Kissenger was originally designed as a physical interface designed to support remote kissing between people over the internet, more recently, and controversially, it has been re-positioned as a device to form emotional and intimate connections with robots or virtual characters through kissing (Cheok and Zhang, 2019). (Given the sensitivities of the device and the debates it is embedded within, this activity included an additional specific consent process). Each group had a free play session with the device where they used and experimented with it. The whole group fed back on and discussed their interaction, and also imagined how the Kissenger might operate in different scenarios of use (e.g. amongst friends, family, one-to-many).

Materials and data

The activity of the workshop groups was video recorded using a mix of fixed cameras to record the interaction of participants in each small group (seated at tables), and hand-held cameras to capture participant interactions with the materials (away from the table). We moved and 'felt' with participants to gain insights into their sensorial experiences. The video data was supplemented with written research observations, notes made by the groups and flip chart notes, photographs, and audio recordings. A total of 31 hours of video data was collected, consisting of between 7 and 14 hours of data per workshop (depending on the number of small groups in a workshop). Video recordings provided us with a record of the activities to be analyzed in retrospect, and a sensory-experiential and reflective tool for the generation of data (Jewitt and Leder Mackley, 2018).

The collaborative experience of prototyping and interacting with prototypes created a context that promoted awareness and criticality of touch. It provided touch experiences and explorations that enabled participants to externalize and materialize their ideas - to literally put them on their body and feel them. This provoked and supported the participants to explore their experiences, memories and imaginations of touch, their touch practices and skills, and engagement with the features and character of touch as a communicative form. The groups worked collaboratively, and disciplinary differences between participants generated considerable discussion, occasionally differences regarding terminology (e.g. output and input, system) and approaches led to productive conversations, argument and debate. Nonetheless, the participants expressed a shared sociotechnical imaginary of digital

touch, their desires and fears coalesced through shared discourses of digital touch communication (e.g. on appropriate and inappropriate touch).

Group participants collaboratively agreed the focus of their digital touch prototype and use scenario based on their brainstorming session and experiences of remote personal communication. A set of 10 prototypes produced by the groups were photographed and collected. These are described below in Table 1.

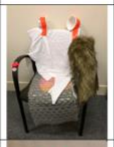
	Name	Image	Description
1	Haptic Chair		Designed for those missing the intimacy, closeness and comfort of remote close friends or family. It is a digitally enabled chair for use in the home, it is a holistic sensory environment (heat, pressure, movement, sound)that enables users to feel one another's presence, touch, hug and provides sense of being 'held' as part of communication.
2	Tactile emoticon		Designed for teenage friends & family members, it responds to the difficulty of quickly sending an emotional signal beyond words. It pairs with a mobile-phone and can send playful emotional messages via a range of touch features – slap, poke, tickle, hug, etc.
3	Sparking presence		Designed for use within close friendship groups (3-6 people) to support long yet fleeting, non-verbal exchanges in which you signal presence to one another – low effort 'hanging out'. It consists of a set of wearable or implant devices networked to a sparking 'enchanted object' triggered via 'thinking of someone' to produce a shared felt group sensation of connection.
4	Blocker		Designed for people with a range of medical or social conditions that can make touch painful or unpleasant. It can be used in a range of contexts (e.g. public transport) to block or filter selected (customizable) types of touch, to alter the character of the touch or reduce its felt intensity.
5	Bed-touch		Designed for a young person away from home, feeling home-sick and wanting physical comfort. The bed-set – mattress, pillow and duvet, generates a sense of safety, calm and belonging through enabling loved ones to provide another with a be-spoke multi-sensory environment.
6	Emotional whirl		Designed for use with close friends (not in workplace). It is a device that enables a person's emotions to be 'machine read' and then sent to another persona to be felt as a tangible experience.
7	Mood ball		Designed for use by friends and family, it is a device that supports fleeting, non-verbal communication to signal different levels of 'presence' or 'thinking of you' to a person. It is a tactile 'enchanted object' with a pet like quality that moves to make you felt in the environment of the other.
8	Intimate connections		Designed for use by sexual partners, this is a collection of interconnected devices that enable people to tickle, stroke, and hug one another.
9	Walk the dog		Designed for use by a couple with a dog, this device responds to the difficulty of sharing mundane routine experiences that maintain the fabric of a partnership when at a distance. The device remotely connects two partners via the shared experience of walking their dog as well as connecting the remote partner with the dog.
10	Touch-Cape		Designed for use by close friends, family and intimate partner, the device responds to the difficulty of seeking support and comfort from those you are close to when at a distance. The device enables people to have a physical sensation of being 'hugged' or 'held'.

Table 1: Set of ten prototypes developed in the workshops

Participants collected the materials as a group, trying out the feel of the materials on their own and one another's bodies. They touched and hugged themselves and group members - making and thinking through the body (Jewitt et al, 2019) Initially participants with backgrounds in design and HCI were more confident in prototyping, however, all actively engaged in the process. The vignettes and examples presented in the findings section provide a detailed snapshot how members of the groups interacted, and give a sense of the discursive environment of the workshops, and participant engagement with the activities. A full account of the group interactions, and related discursive issues (e.g. in relation to gender and technology) is discussed elsewhere (Jewitt et al, 2019).

Analytical framework and procedure

The critical analytical framework we used to study digital touch communication employs the sociotechnical imaginary (outlined earlier) alongside the design-based method of rapid prototyping, and a multimodal and multi-sensorial approach. This novel combined approach descriptively grounds participants' emergent desires and preoccupations within speculative futures of digital touch.

The 'sociotechnical imaginary' provides the conceptual framing for our analysis of digital touch within the context of remote personal communication. In taking this approach, we seek to 'illuminate the role of imagination in the fabrication of social lives' (Appadurai, 1990) with respect to touch communication. Bringing the sociotechnical imaginary into contact with communication studies enables us to examine past, present, and future developments that may impact on the media landscape and engage with communication in futures research (Bouwman and Van Der Duin, 2007). Within this frame, we use the design-based method of rapid prototyping as it is attuned to researching 'emerging and uncertain worlds' (Salazar et al., 2017), including the digital (Lupton, 2018), and draws the body explicitly into ways of knowing, exploring, and thinking (Jewitt et al. forthcoming, 2019).

Our analytical approach combines multimodality (Jewitt, Bezemer and O'Halloran, 2016) and sensory ethnography (Pink, 2015) – two inductive data-driven approaches that place interaction and/or re-enactments at their centre and make significant use of video-recorded materials (Jewitt and Leder Mackley, 2018). A fine-grained account of participants' multimodal and multi-sensorial interactions and experiences is achieved through immersion in and iterative engagement and reflection with the video. This consists of multiple viewing of the video recordings and supplementary materials (both team and individual) to describe interactions between participants, materials, and the prototypes with attention to a range of bodily modes - position, posture, gesture, gaze, and movement alongside speech. Alongside viewing the video as a record of events, we reflected on our embodied researcher experiences of the workshops and materials, occasionally re-enacting participants' interactions, and handling the prototypes as artefacts with attention to their sensorial and social properties. Attention was paid to significant multimodal discourses, practices and norms related to remote digital touch communication, within and across the groups. We honed in on aspects of digital touch that participants' interactions privileged, valued and ignored. This included identifying repeated and shared actions, revelatory moments, and how events unfolded over time. We traced the connections through their discourse (bodily as well as linguistic) across their past, present and future visions of remote digital touch communication, to explore the influences of these different planes of time on one another.

Through this inductive process of analysis, four interconnected themes emerged as central to participants' understanding, discourse, practice and imagination of digital touch for remote

personal communication. These were explored and refined through further engagement with the workshop materials, and collections of interactional data sequences significant for touch (e.g. comments on touch, touching materials, objects, and others) were built around each theme. Thematic vignettes attuned to the multimodal and multi-sensorial were produced, providing an analytical account of participants' process of discovering, defining, developing, designing and demonstrating the touch interfaces in the workshops. These enabled us to identify and unpack the social and physical possibilities, and constraints that participants explored and considered regarding touch experiences. Collectively these four themes, discussed in the following section, are indicative of emergent sociotechnical imaginaries of touch for remote personal communication.

FINDINGS AND DISCUSSION: FOUR THEMES OF TOUCH

This section presents and discusses four inductively developed thematic strands central to the emerging sociotechnical imaginary of digital touch for remote personal communication. These themes are not stand alone, rather they are always entangled: the body, for example, is material, emplaced and temporal, while emplacement and temporality are each a part of the spatio-temporalities of touch, and all are experientially encountered as a single category. As noted earlier, they are also in process, not yet-fully-formed, open to contestation and resistance. However, we tease them apart for analytical purposes to enable their exploration to map the high-level semiotic potentials that touch makes available as an emergent mode. Throughout this section, we reflect on what each of the above themes tells us about people's engagements with digital touch. We conclude by reflecting on how these four thematic strands weave together to create a narrative of an emergent socio-technical imaginary of digital touch.

Selected data 'fragments' (a term that acknowledges these are a part of a larger interaction) are used to illustrate each theme. Throughout, we discuss how the participants' histories, experiences and memories of remote personal communication infuse their imaginings of the communicational place and futures of touch, as materialized in their different digital touch prototypes.

Materiality

The mutually constitutive relationship between users and communicative technologies is cyclical and interconnected (Hutchby, 2001). Affordances are a key aspect of that relationship, as the possibilities and constraints for meaning making are continually shaped through social and cultural histories (including that of the sign-maker) and the context of use (Kress, 2010). Materialities, including those of the body, are central to the take-up, subversion, disruption, and re-shaping of digital touch affordances. The materiality of the sociotechnical imagination matters because it is *a part* of how technologies constrain and make possible what people can do (and mean) with them. In the case of digital touch the materiality and affordances for the 'feel' of the fabric of sociotechnical imaginaries of digital touch communication were significant for how people might engage and interact.

Workshop participants discussed their experiences of interfaces, their technical and social challenges and influences on remote communication. Reflecting on changes over the past decade, they spoke of the significance of materiality for communication, from letters, to phones and changing place of the voice and images (e.g. via social media). The process of prototyping enabled participants to explore the materiality of interfaces. The Haptic Chair

group, for example, wanted a '*natura*l', '*invisible*', '*smooth*' interface to enable '*communication to flow*' both metaphorically and literally engaging with the physicality of touch through their selection of materials for prototyping. While some groups maintained or extended existing touch-interfaces in playful ways (e.g. "*The enormous phone cover idea"* that became Tactile Emoji), six prototypes opened up the materialities of the touch screen as interface (Haptic Chair, Sparking Presence, Blocker, Bed-Touch, Emotional whirl, Walk the dog). Nonetheless, 'old' (pre-digital and early digital) interface features persisted: keyboards, types of controllers, and most resilient of them all – buttons. In each case, buttons (an everyday mechanism e.g. to indicate on or off) were added to an interface in response to usage or ethical dilemmas raised through the groups' bodily enactments with their prototypes.

> The Haptic Chair group are discussing how they will know someone is '*present*' and wanting to communicate. A member of the group picks up the 'nudge' post-it note, and says: *Maybe you could have a nudge then, maybe you could have an extra vibration when someone else sits in their chair* [the corresponding chair] *to let you know they are there in case you want to interact with them, and you can decide whether you accept it or not* [points at a silicone 'button']? Their talk links the interface to their experiences of existing communicative devices: phones and cameras. Through the process of making, the group move toward the idea of '*closing distance*' through an interface that was '*quiet'*, '*intuitive*', '*natural*' and '*invisible*', so as not to be remarked on, via a whole-body sensory interface.

The persistence of buttons, even in the context of digital whole-body interfaces, is suggestive of an emergent sociotechnical imagination of touch embedded in ideas of human versus machinic touch and affect (Paterson, 2007:115): that is, touch as a significant human agentive action preceeding the digital or entailing a merging of different machinic and organic 'bodies of production' (Manning, 2007: 93). The prototypes articulated concerns about living in a 'touchless' world and a desire to return to more physical controls, responsive, 'real' and tactile textured feeling (Plotnick, 2017). This can be seen, we argue, as an incidence of resisting "new epistemological ordering and deployment of the senses" in respect to the tactile modernity of the twentieth century (Parisi, 2011: 210).

Materiality was significant for participants' experiences with and responses to Kissenger:

> The participants (Touch-Cape group) are interacting with Kissenger: P1 '*It doesn't feel like a kiss, the texture is plastic, there is no warmth, and the rest of the device doesn't feel like a face, so it's like kissing a piece of plastic …it sounds very robotic'*. They hold the Kissengers, press and touch them with their fingers and discuss how the robotic sound would puncture and disrupt interaction: P2 '*I don't want to hear the vibration, I want to feel it!*' P1 [Stroking the interface] '*Maybe other materials – silicon more like a mouth*? P2 [running her hand over the 'lips' on Kissenger] *should shape and divide the mouth shape with texture, not flat, it should be more sensitive*'. They hold it to their cheeks. P3 *'If we imagine a deformable surface it could give you the relief of your lips?'*

Participants associated materiality with sensitive touch with a soft, flexible and malleable materiality, and the potential for leaving touch traces. Materialty was key to the distinctions participants made between human and non-human touch.

The body and touch

Participants brought the multimodal and multi-sensorial body into their prototypes differently. All consistently commented that the affordances of technologies "*demand talk*" and "*strip*" communication and the '*lack*', the '*not enough-ness*' of digital remote communication, notably in relation to the absence of touch. Two prototypes echo industry touch norms and trends, and focus touch on the hand and forearm (e.g. Tactile Emoticon and Mood Ball), one extended them by separating the body into zones of low-social-risk, the face (ear and cheek) and feet (e.g. Intimate Connections); and seven brought the whole body into the touch experience (three of which we briefly discuss).

The Blocker prototype situated touch as problematic, classified good and bad emotions triggered by touch, and amplified positive whole-body touch-sensations:

> *"Sometimes touch is really painful. What I really wanna communicate is 'don't touch me!' and that is very hard, particularly in a busy city*." [She throws a handful of brightly coloured small fluffy balls at a paper bag with a brick wall drawn on it.]*"I'm imagining that all the bad emotions can get filtered off! Like [reads-out-loud the touch word post-its attached to the prototype] 'tingling', 'shooting', 'burning', 'stabbing' - leaving them behind, and* [she holds a sparkling pipe cleaner key, leans forward, places it on a drawn keyhole, and 'unlocks' it] *the good emotions can get through.* [She reaches inside the bag pulls out some post-it touch words and reads aloud] *"Things like cuddling, cradling, and massaging, so that they can be sensed like where ever your threshold is".*

This points to the ways in which particular *kinds of bodies* are considered, included or excluded, in emergent sociotechnical imaginaries of digital touch. The prototypes were developed in relation to imagined gendered and sexual bodies, themes implicitly explored through participants' discussion of age, gender and culture via discussions of size and the social acceptance or appropriateness of touch. With the exception of the Blocker, the groups' prototyping processes suggest relatively healthy bodies and that some bodies are more readily thought of as being open for touching. Most of the prototypes were also designed for '*available*' bodies waiting, sitting, sleeping or relaxing domesticated (in-door) bodies. These in-active and leisurely bodies both disrupt a common association of the digital with an idealized disciplined working body (Parisi and Farnham, 2018) and situate touch as an intimate and private communicative mode.

In contrast, the Sparking Presence prototype placed touch on and in the body to create an always-ready body. A felt '*sparking*' sensation, a '*just-perceptual sense of co-presence*' created a sense of '*belonging*', or 'connected presence' between the users (Madianou, 2016) to suggest the potential for a shared body:

> Sparking Presence: *You have this thing* [she is holding a silvery ball of wool to her body] *something physical - this little thing* [she stokes the ball down her body] - *it is an embodied thing. Affect it's like the thing that flies between people*. It's *'affecting the movement of the air around it*." They speak of the nuance of touch '*connecting with people on same wave length'*. Each participant made a personalized wearable, to interact with the '*base control*'. "*It feels like you are attached, rather than holding something, it's in me, a comfort or an attachment*".

The Emotional Whirl group explored the sensoriality of communication- the "*feel of emotion*", and developed the idea of touch interaction as a part of embodying emotional expression, that can relieve or help manage emotions.

> They are exploring textures and tactile sensations through their interaction with a range of materials, they talk about how these evoke, represent or intersect with emotional states. A participant is whittling wooden skewers into sharp points, she inserts these into a playdoh ball. She says, "*Pain - a spikey thing hurts when you hold it*". Touching it produces pain, another participant rolls it in her hand and grimaces. Happiness is made, it consists of a bunch of feathers "*Lots of colour and it feels happy - like a pet* [they stroke it gently with their hands and cheeks], *lots of endomorphins releasing, this will make you feel better if you pat that!*".

Through their embodied interaction, they develop a "*tactile and sensory*" interface designed to respond to users who feel "*disconnected*" via the distancing emotionally stripped out technologies.

While prototyping, participants discussed (and experienced some of) the gendered, cultural, and religious social taboos of touching bodies (their own and others). Engaging with Kissenger as a technology probe provoked physical unease between men and women, and more markedly, between men. Touching was performed as a gendered normative practice – even when mediated by a machine:

> Two female participants are using the kissenger. Two male participants (P1 and P2) stand back, their arms crossed.
> P1 '*How would you feel if it was erm, me and you*?
> P2 [Grimacing and leaning away] '*That would be an interesting experiment!*'
> P1 '*But why? It's a machine, it's a machine in the middle of it.*'
> P2 '*Just, but it's still trying to make an intimate interaction*'.
> P1 [Holds up Kissenger] '*Sorry mate, brace yourself now*'
> They both hold Kissenger up to their mouths and look at each other.
> P2 says in a 'seductive' tone '*Hello there*'. They each start to make noises, '*mmh, mmr*' while pressing their mouths to the kissenger.
> P1 [Moves backwards a little as if feeling pressure, continues to press his mouth against it] '*Oh!*' [Smiling he takes the Kissenger away from his face] '*Tongue!*'
> P2 '*Weird!*'

This raises the question of whether, how and why future digital touch would continue or disrupt the work of gendering of touch, a question to be explored in future work. Both the gendered body and communication were seen to be at risk through touch. Edging beyond the hand, forearm or upper-arm in their prototypes, elicited discussion of the ethics of touching, including power and control. The ability of the Blocker prototype to facilitate touch through establishing '*boundaries*', '*blocking*' and '*filtering*' it, provided the most explicit focus for this discussion. While all agreed that users should be able to block a touch, whether or not a receiver should be able to change/manipulate a touch that they receive (e.g. make it stronger or weaker, or receive it on an unintended part of the body) was more contentious regarding authenticity, touch misunderstandings and communication breakdown.

Emplaced touch

Participants approached digital touch as more intense, and riskier than other forms of communication. Imaginations of the primary space for touch were in the home. Suggesting home served as a generic symbol of a safe and neutral backdrop for touch (even if not always true). The home imagined as a place where the body is at rest, static with a calm heartbeat, ready to be 'activated' through touch: the touch equivalent of the sonic-quiet sought for a spoken conversation appears. Place and space were consistently discussed as key to how technology, and communication mutually constitute, organize and structure one another and their practices. They reflected on pre-mobile phone memories: "*having to sit on the stairs* [on the landline-phone] *in the hall of my parents' house on the landline phone, and I would spend hours talking to people.*". Participants spoke of the how mobile connectivity reconfigures their spaces of communication to stretch and shrink communicational time and language (e.g. across public and private transport). They associated the 'anywhere, anytime' dimension of mobility to authentic '*in-the-moment-communication*', but disrupted this contemporary mantra in the ways they imagined the time and space of digital touch. The excerpt below is typical of discussions of 'where' touch should happen:

> The Touch-Cape group have returned to the materials table, one member of the group is wrapping a piece of fabric around the fore-arm of another. A third says: "*I think we have to think about context.* [She is pointing at the two participants.] *Where would this happen? Not on the street? It's so personal. I wouldn't feel comfortable. You are walking in the street. I want to sit on the sofa at home and feel this warmth, cos its' like personal. Out of the home –NO!*"

None of the groups included mobility as a key concept for their design of digital touch remote personal communication. Two prototypes envisaged touch as part of a mobile device used outside neither of which involved touch with another person: The Blocker in the context of a crowded urban transport system, and Walk the dog in a public space (e.g. park). The other prototypes located digital touch in a domestic and private place: typically, the home. Although, the Haptic Chair group considered that a young user might be interested in a 'mobile' add-on, which could be rolled out over 'any chair' where they have significant waiting time (e.g. at an airport). Suggesting the public character of touch was associated with age or generation.

Temporality of touch

Through the prototyping process the participants worked with technological, social, and emotional temporal features of touch, all of which were central to their sociotechnical imagination of digital touch. In doing so their prototypes had different touch temporalities which informed the design of the communication experience in significant ways. The touch temporalities they designed were shaped through their experiences of different media in terms of communicational "*time-effort*", "*immediacy*", "*spontaneity*" and "*speed*" and managing "*response time*", *and "obligations and expectations*". They also drew on temporal associations, including remote "*real-time*" communication with a "*state of emergency*" (e.g. a sister's pregnancy, a family death). The difficulties of coordinating communication across time zones was a consistent consideration, "*I was getting texts from my mom in the middle of the night!*", as was the temporality of personal relationships (Licoppe, 2004). Temporal features included the *duration* of a touch-experience, *social timing* of touch (e.g. a special, every-day or routine time), the a-synchronicity or synchronicity of a sent touch. Prototyping enabled them to explore the practicalities of receiving and responding to a digital touch (e.g. the ability to turn touch on or off), the social time and place for touch ("*not in the street!*")

and the communicational consequence of not being available to receive a touch were explored through prototyping (e.g. the potential, and consequences, for scheduling-touch, the inclusion or exclusion of record & replay features – pause, repeat), the storage of touch and timed-filters to manipulate touch (e.g. "*amplify*", "*reduce*", or "*remove*" touch).

Several prototypes had fast, momentary, fleeting ephemeral touch temporalities. Tactile Emoji gave a felt '*Facebook poke*', Sparking Presence, Emotional whirl, and Mood ball engaged with felt emotional expression, fleeting sensations of presence, and dispersing touch-based memories. In contrast, participants in the other six groups expressed a desire to ameliorate the social impacts of a (too) fast communication temporality, "*it's something I do in gaps in my schedule now…It makes it feel more piecemeal".* While two of these prototypes were temporally orchestrated around a routine time (e.g. Walk the Dog, Bed-Touch), others rejected this temporal structuring as '*too staged*', '*practiced*' and feeling '*in-authentic*'. Some groups set out to create an '*un-orchestrated immediacy*', with dedicated time for touch communication rather than a '*squeezed in touch*', they designed an element of excitement and anticipation (imagination) of touch into their prototypes. This suggests that, at least for some participants, digital touch has potential to recover time, a form of resistance to the disciplining of the communicative body desired by contemporary industry and capital (Parisi and Farnham, 2018). The temporal aspects of performativity were, participants suggested, a challenge for the Kissenger, as a user would have to '*plan a kiss*' by saying '*put it to your mouth*' or in a good night scenario giving a child an '*instruction* to *hold it to your cheek*'.

Three prototypes include a touch record feature. The Blocker recorded touch in order for it to be received at a '*better time*', the Haptic Chair, and Touch-Cape recorded touch to manage the pragmatics of spontaneous communication. Participants explored how to record touch and what that might feel like, trying out the traces of touch on their own bodies or using thought experiments. The Haptic Chair group designed the potential for a "*body message*" - a touch message, recording taps, movements, the '*shape of the body and its impression'* – via pressure and heat, that could be played and felt. The multi-sensorial environment of the haptic chair affirmed the importance of place, sound, and visual (imaginations) for touch-based experiences. However, the recording and re-playing of touch, for instance, was considered by participants to fundamentally transform touch as an (embodied and emplaced) experience, moving touch from a simultaneous mutual exchange to an individual experience or 'fragmented' experience. This de-coupling of 'toucher' and 'touched' raised concerns regarding the ethics and techniques of storing and sharing digital touch. Non-reciprocal touch, prompted discussion of touch consent, if a touch could be given and not received simultaneously, when would one consent to touch, what would it mean to not do so, and what might determine touch ownership in this scenario? Replaying touch, opened up concerns for many participants about the "*addictive*", "*savouring*" of digital touch that enabled a person to become immersed in a familiar virtual touch landscape, leading to isolation, "*a lack of connection to others*". The temporality of digital touch, its ease, availability and replay, led participants to express fears regarding the dehumanizing potential of digital touch: "*If all hugs* [digital and non-digital] *will feel the same – how will people distinguish? How to trust? How to protect?*". Ultimately, they expressed the fear of machinic touch becoming more desirable (simpler and more readily available) than human touch, a fear with deep roots, from the Greek myth of Laodamia who fell in love with a bronze likeness of her dead-husband (Devlin, 2019:18) through to sex-robots.

A narrative of an emergent sociotechnical imaginary of digital touch

The four thematic strands presented above – materiality, embodiment, emplacement, and digital touch temporalities, weave through one another to make legible an emerging sociotechnical imaginary of digital touch for remote personal communication. The themes co-exist and intersect with each other and point towards broad sensory practices and norms of touch.

Reflecting on the participants' engagement with the materialities of digital touch, it is clear that this is central to the sociotechnical imaginaries of digital touch communication. While digital touch continued to be associated with some specific functions – alert, activation, and feedback, the sensorial experiences it afforded were a key aspect of sociotechnical imaginaries. This sensorial aspect foregrounded the potential for new digital touch experiences beyond the screen and the hand. Digital touch was presented as a smooth and natural materiality, in which texture and temperature were imbued with emotional meanings and seen as part of a communicational repertoire for interpretation. Sensitive touch was associated with a soft and flexible materiality, was malleable by users, and had the potential to leave a mark or trace of touch. Materiality was key to the distinctions between human touch and robotic or machinic touch, with the former valued as soft, warm, flexible and reactive, and the later de-valued as the opposite. The material qualities and associations of digital touch communication are, we argue, key to how people engage with them.

While participants found it difficult to articulate the communicative value of touch, there was a desire for it to be a digital communicational possibility. With explicit reference to the #MeToo movement and sexual abuse more generally, touch was seen as complex and risky, and remote digital touch as even risker. Several binaries of touch were expressed and explored through the prototyping process: touch as good and bad, appropriate and inappropriate, private and public. Within the social touch spaces of the sociotechnical imaginary, new concerns arose related to the digital sharing of touch, authenticity and fake-touch through the digital manipulation of touch. A shared social understanding of touch sensitivities, awareness, etiquette and regulation is essential to enable touch to enter the realm of digital communication. While on the one hand participants expressed fears that digitally mediating touch could lead to disillusion and disconnection, on the other, they shared a sociotechnical imaginary of digital touch that generated new possibilities for remote digital touch. The sociotechnical imaginaries embedded in the prototypes embraced the potentials of a richer bodily landscape for digital touch communication, although some reflected industry norms in their focus touch as the hand and most did not engage with the realities of bodily difference - working with an archetype able-bodied male body, and associated touch experiences and sensitivities. Nonetheless, digital touch was seen as having potential to support new forms of connection and attachment, including changing boundaries between bodies, shareable touch-experiences, and more porous fluid boundaries between technology and the body. How the body is brought into relationship with digital touch, the kinds of relationships established between them, are, we suggest, central to how people engage with digital touch communication.

Emplacement features in the sociotechnical imagination of digital touch, with the space for touch, at least for now, being domestic and private. Three analytical rationales appeared to underpin this domestication of digital touch. First, the social and cultural meaning of touch as intimate and the taboo on intimacy in public – a norm that polices touch in many cultures (e.g. Public Displays of Affection – PDA). Second, a desire to maintain and manage touch as

having a '*slower*' temporal quality that makes it "*more personal, more intense*" than other modes of communication and a private place (discussed in the temporality of touch). Third, a sense that digital touch requires a "*prepared place*" - the need to tidy a room or carefully frame a web-camera, or change a top to prepare for video-chat. Preparation is a feature of most forms of communication, remote or face-to-face, digital or non-digital. This includes a preparing and imagination of the self and the other for communication (Cantó-Milà and Núñez-Mosteo, 2016: 2409). However, the participant discussions and their prototypes suggest that digital touch highlights the need for preparation and a key aspect of that process is privacy and allotting dedicated time, qualities that are not a feature of mobile communication. We can envision how social norms or technological peripherals may lessen over repeated use, to ameliorate or purposively dull this imagined intensity of digital touch, enabling digital touch to come out of the home. This would be akin to the changing social norms of talking loudly about intimate personal matters when talking on a mobile phone (while wearing headphones) on public transport (Brown, Green and Harper, 2012). We suggest that social digital touch practices and capacities are likely to emerge from the home; that preparations for digital touch communication will accompany this shift; and that this will give rise to a need for different kinds of 'touch sensitivity' training for managing communication.

Reflecting on what the temporality of time tells us about sociotechnical imaginaries and engagement with digital touch, we suggest that digital touch is positioned as a more intimate, private and sensorial, felt way of digitally being-together. That is, digital touch is imagined to extend the 'ambient-presence' afforded by long duration skype, and resonate strongly with evolving temporal practices of digitally connected or mediated presence (Christensen, 2009; Madianou, 2016). Digital touch was conceptualized as slow and long connecting people through everyday routines (e.g. Walk the Dog) or the settled touch of domestic intimacy (e.g. the Haptic Chair, Bed-Touch). Creating new moments for digital touch to unfold, managed and shared across time differences. Digital touch draws on the potentials of touch temporalities to secure permanence and the management of the blurry boundaries between absence and presence (Liccope, 2004). In this way, participants conceptualized digital touch for remote personal communication as having different temporal durations and qualities than visual and audio modes. Digital touch had a longer duration in contrast to the bite size voice message or mobile call, the brevity of a written text or tweet, or the visual flash of snapchat or Instagram. This, together with our discussion of the qualities of emplaced and embodied touch, sets digital touch apart from contemporary 'anytime, anywhere, anybody' modes of communication.

As the presentation and discussion of the four themes in this paper shows, the sociotechnical imaginaries of digital touch resonate with previous moments of co-emerging communicative practices, and are shaped by the interconnectedness of developments in digital touch and existing media and communication practices. Nuanced narratives of losses and gains cut across participants' engagement with digital touch, and the continuities and changes of their experiences, memories, and histories of remote personal communication are embedded within the sociotechnical imaginaries of digital touch. These themes provide insight into the social and physical possibilities and constraints for digital touch that appear to be considered regarding users touch experiences and expectations that may endure and shape the futures of digital touch. They point to some *potential* directions of digital touch for remote personal communication futures: what digital touch might be, who might touch whom, and where digital touch happens, as well as the capacities and practices of touch, future concerns regarding changing forms of connection, and communicative practices. Together the themes

set digital touch communication apart from the contemporary mantra of 'anytime, anywhere, anybody' communication: in the sense that touch is imagined for a prepared special time, in a private domestic place, and within an existing intimate friendship, family relationship, or partnership.

CONCLUDING COMMENT

This paper contributes to studies of digital personal communication, by foregrounding touch in emphasizing the import of embodied and sensorial aspects of remote personal communication, and bringing remote personal communication into an explicit relationship with the concept of sociotechnical imaginary. It demonstrates the sense of a 'tactile lack' in the digital - a sensorial paucity, and the desire for more felt digital experiences that reconfigure the place of touch - pointing to an opening, albeit a complex and contested one, for digital touch. Through the four themes set out in this paper we have made legible emergent sociotechnical imaginaries of digital touch for remote personal communication. This is suggestive of indicative patterns and forms that touch-based technologies may be constructed through and live within.

The study discussed in this paper, is limited in scope and scale, a key limitation is its attention to the imaginaries of apprentice professionals within the digital communication economy. While our rationale for this decision is clear, further work with other social groups, is needed to bring a broader range of sociotechnical imaginaries into conversation with those discussed in this paper. Despite this limitation, the paper provides an initial investigation and thematic map of the semiotic, social, and sensorial dimensions of digital touch. It is a starting point for further research, has the potential to inform the development of digital touch communication design, offers analytical trajectories for speculative scenarios or fictional narratives, and provides insights towards the critical production of sociotechnical imaginaries of digital touch prior to their solidification into material political formations. The snapshot of imagined digital touch provided in this paper can help prepare social commentators, policy makers and regulators and designers to engage with some of the social and technological factors and changes that may be in play when creating a space for personal remote digital touch.

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