

Chapter 1

Introduction: Digital Touch Communication



Abstract In this chapter, we make a case for the significance of touch for communication and suggest that developments in sensory digital technologies are bringing touch to the fore in ways that move digital communication beyond ‘ways of seeing’ to include new ‘ways of feeling’. We argue that this shift requires us to take new measure of digitally mediated touch, or ‘digital touch’, as a communicational resource, what it is and can be, how it is designed and imagined, and its communicative potentials and limitations. We situate digital touch communication in relation to a technological awakening to a broader social revaluing of people’s sensorial experience. We introduce and reflect on the socially orientated stance to digital touch we take in this book, and the InTouch project more generally. The chapter provides an overview of the book which also serves to introduce the key themes that it explores, that is the research and technological terrain of digital touch, social norms of touch, presence and connection, sociotechnical imaginaries of digital touch, and the ethics of touch. Finally, we introduce six InTouch case studies which examine digital touch across different contexts, perspectives and participants. We draw illustrative examples from these (alongside extensive engagement with the research literature) in order to enliven and consolidate the book’s exploration of the sociality of digital touch communication across different contexts.

Keywords Touch capacities · Touch practices · Art · Parental touch · Designing touch · Tactile emoticon · Digital touch · Remote touch · Virtual touch

1.1 Introduction

Touch has a central role in the construction of our experiences and understanding of the world, ourselves and one another (Bull et al. 2006). We discuss why touch matters, and how the digital remediation of touch may inaugurate and develop new ways of feeling. We situate this book on digital touch communication within a broad

social revaluing of sensorial experiences and the senses, a technological awakening to the sensory. This book comes out of ongoing work from InTouch: Digital Touch Communication, the five-year project (funded by the European Research Council), introduced in this chapter. We close the chapter with an overview of the book chapters and sketch the social themes addressed across the book.

1.1.1 Touch Matters

Touch is the first sense through which humans apprehend their environment and it is central to our development (Field 2003). Touch may not be much spoken about, yet it provides significant information and experience of the world; it is crucial for tool use (Fulkerson 2014) and is central to communication: ‘Just as we ‘do things with words’ so, too, we act through touches’ (Finnegan 2014: 208). Indeed, knowing how to infer meaning from touch is considered the very basis of social being (Dunbar 1996). It is significant for developing and maintaining personal relationships, from ritualized greetings, to communicating emotion or intimacy (McLinden and McCall 2002), and is an effective means of influencing attitudes, creating bonds between people, places or objects (Krishna 2009), and improving information flow and compliance (Field 2010).

1.1.2 Digital Touch

Advances in the design of digital touch and the importance of touch in communication require social science and designers to understand its place in the sociality of interaction. Throughout this book, we use the term ‘digital touch’ to emphasize our attention to the social orientation of touch and to refer to the digital-mediation of touch by a broad range of technologies, beyond the hand. We prefer ‘digital touch’ rather than ‘haptic’ which references a technological or physiological orientation and are strongly linked to the hand via its etymological roots ‘grasping’. Digital touch communication can be co-located or remote, and might involve human-object, human-human, human to robot or robot to human touch.

The importance of touch in human development has long been recognised (e.g. Fisher et al. 1976), however, this sensory feature of human communication is only recently pervading the digital landscape. Digitally mediated touch matters, it is considered within computer science and HCI to have the most potential of the senses for digital communication and it is the sense most rapidly being developed in the intensification of digital sensory communication (Hoggan 2013) (while technologies to synthesise and exploit taste and smell are emerging, their potential for communication is as yet unclear). The proliferation of digital devices that have escalated communicational capacity through audible, written and visual modes, have also foregrounded debates around touch deprivation. These have been critiqued for reducing or removing touch from the communicational environment, and the limitations

of devices to date that support affective touch, which typically focus only on the hand or forearm (Huisman 2017). Whilst acknowledging our everyday interaction with touch screens, our focus in this book is on emergent and semi-speculative touch technologies that want us to be able to touch and feel objects in new ways: from tangibles, wearables, haptics for virtual reality, through to the tactile internet of skin. Developments in haptic, sensor and touch-related technologies, point to technological opportunities to develop and enhance our touch interaction and communication. The perceived value of integrating tactile qualities to digital devices, systems and interaction is considerable, given that touch is critical for our physical and emotional well-being (van Erp and Toet 2015), social development and social communication (Field 2010). More critically, tactile technological ‘innovation’ speaks to the ‘always on’, ‘hyper-attentive’ subject ‘disciplined for tactile calls to attention, a body open to these calls to be productive at all times’ (Parisi and Farman 2019: 3).

Across a range of social contexts and technological domains, touch-based technologies promise to supplement, heighten, extend and reconfigure how people (and machines) communicate, leading to new touch-based capacities and practices. However, this raises significant technical challenges for engineering, computer science and robotics, requiring detailed research into areas such as understanding mechanical touch and physiological touch. It requires complex developments in exploring optimal ways to make robot hands move, for example, or how to build and programme how to ‘sense’, for example through ‘skin’, raising the need to solve issues of creating ‘senses’ not typically present in technology. Alongside these technical drivers of touch-based technologies there are a number of social drivers. Changes in ‘globalisation’ have led to more ‘distant’ relationships – family, friends and romantic partners – generating a perceived demand for generating physical sensations across a distance, extending the ‘touch’ channel of communication remotely. Opportunities to enhance the quality of life for people with a disability or sensory loss (e.g. of vision) bring digital touch capacities into rehabilitation and prosthetics. Within robotics the need to develop touch awareness and touch capacity in robotic agents for teleoperation contexts is essential for enhancing robot capability in undertaking delicate operations, such as bomb disposal, and in health care contexts, where robot touch need to effectively convey emotion or meaning through touch, and interpret emotion or meaning through touch. These socially oriented considerations are drivers for technical development and underpin the design and development of many emerging digital touch technologies.

1.2 Situating This Book: A Social Revaluing of the Sensory and Multimodal

Our exploration of digital touch communication is situated within a broad social revaluing of people’s sensorial experience and re-evaluation of the roles of the senses, a part of which is a technological awakening to the sensory. Digital touch

can be related to changing social configurations (produced through the global economics of work and migration for example), that generate a desire and/or need to achieve digital immersive connection with others at a distance, as well as the possibilities of technological innovation. This is driving a new wave of digital sensory communication devices and environments. In light of this we approach digitally mediated touch as a communicative mode (albeit one in a state of flux and development), and a sensorial experience entangled in the materiality and sociality of the body, the environment and technologies.

Our concern with the sociality of digital touch, in this book, and *InTouch* more generally, provides an alternative starting point to the physicality of touch. While the body remains at the heart of our thinking, we move away from a concern with mechanisms and processes of perception, the senses as a universal biological-physiological matter of information-processing, physical realizations (the brain and the body systems), and the relationship between stimuli and the sensations and perceptions they affect. Rather than, for instance, approaching the skin as an organ, to explore its sensory receptors (nerve endings and corpuscles), we approach it as “lived as both a boundary and a point of connection...the place where one touches and is touched by others; it is both the most intimate of experiences and the most public marker of raced, sexed and national histories” (Ahmed and Stacey 2001: i). Similarly, when we explore the memories and emotions that touch evokes for people, our concern is at the level of their social and sensorial experiences, rather than at that of tactile perception and the somatosensory activity and processes of the brain (Spence and Gallence 2014). This is not to dismiss the physiology of the body, but rather to draw attention to the socially shaped and interpreted sensorial experiences of the body, specifically of touch, and to argue that these different levels of bodily meanings are always in conversation always, always becoming, as “the interfaces between bodies and their worlds are made and unmade through social practices” (Scarry 1985: 5).

The sensory and the social are paramount in the development of digital touch devices and environments in ways that point both to the ‘shifting, contingent, dynamic and alive’ character of the senses, specifically in this case, touch (Jones 2007: 8), and the ever-closer relationship between the sociality of touch, technology and sensory communication. This shift poses a challenge for research and design to illuminate touch communication, particularly given that the social sciences have a patchy relationship to touch, beyond a few references to touch within seminal communication studies (e.g. Goffman 1979; Simmel 1997; Bourdieu 1986). This work provided an early basis for the sociological and cultural turn to the body, the interdisciplinary foundation for sensory studies (Bull et al. 2006), and the sociology of the senses (Vannini 2015). Similarly, in Human Computer Interaction (HCI), the Somatic Turn (Loke and Schiphorst 2018), a part of Third Wave HCI, has resulted in interdisciplinary and mixed methods research that reflects upon the body.

While interest in embodiment is not new, most socially orientated methodological strategies that attend to the body continue to be inadequate for getting at the social aspects of touch as they are primarily based on talk alone. In addition, despite the interdisciplinary turn to the multimodal and the sensory, and the increased

centrality of embodiment and materiality, touch has, with a few notable exceptions (Classen 2005, 2012; Finnegan 2014), been neglected by both multimodal and sensory scholars. Cultural and media studies has brought touch into focus through touch metaphors and haptic visuality (Marks 2002; Cranny-Francis 2011), although the newly emergent Haptic Media Studies provides a historical and philosophical grounding for the study of touch as it is digitally mediated (Parisi et al. 2017). Despite these new developments, however, touch communication is not well understood at a crucial moment when its extension into the digital realm raises new questions for social interaction and development.

1.3 InTouch Digital Touch Communication

This book provides a snapshot of the authors' ongoing work on InTouch: Digital Touch Communication. InTouch is a five-year project (funded by the European Research Council) which explores the social implications of digital touch technologies for communication, with the aim of enhancing socially orientated understandings, research and design of digital touch. We seek to anticipate and confront the social, political and ethical challenges raised by digital touch (e.g. privacy, safety, and digital exclusion); to enhance our capacity to fully imagine and engage with the social relevance and potential of digital touch for communication; and to support the development of digital touch devices, systems and environments that take adequate account and care of people's communicative practices and social contexts. We examine digital touch across various contexts of communication and technologies, from future speculation to bio-sensing to robotics. In particular, our research is grounded on a number of key research areas related to understanding and designing digital touch.

We examine how touch is conceptualized, imagined and experienced by people through different technologies and in different contexts. We investigate the aspects of digital touch (e.g. physical, emotional, social) that are central to a range of communicational situations; explore how people improvise around digital touch; review the skills, experiences and communicative repertoires that they draw on/or speculate they will use for digital touch to communicate; and explore how they experience and imagine connection/connectivity, social relations and emotions, being experienced or communicated through digital touch.

We are interested in how designers and users take up the resources of touch that are available to them. In particular, we attend to what sensory-affective qualities and affordances, and the materiality of different touch technologies feature in different social and situated contexts; we explore how designers and users (re)appropriate touch technologies for the purposes of communication and the sensory concepts and categories that they employ, evoke, and imagine in their development of digital touch technologies.

We seek to understand the role of digital touch technologies for communication: how it might supplement, heighten, extend or reconfigure touch and touch

communication. We are interested in how digital touch technologies are situated and embedded in the wider contexts and experiences of everyday life, and how touch technologies ask (require) people to reimagine these for the future.

1.4 Overview of the Book

In this section, we provide an overview of the book chapters and sketch the social themes addressed across the book.

Chapter 2 introduces and reflects on the multimodal and sensory and interdisciplinary methodological stance of this book, and the InTouch project more broadly. We introduce our main framework, which combines multimodality and sensory ethnography. We outline the collaborations and interdisciplinary dialogues that we have engaged with to explore digital touch, and argue that this approach brings different aspects of touch to the fore in ways that are productive for research and design. Finally, we then turn to discuss our use of prototyping as a way to gain access to and generate digital touch experiences and imaginations.

We begin to map the complex terrain of digital touch in Chap. 3, by drawing attention to key developments in digital touch capacity. This descriptive map of digitally mediated touch communication provides an overview of current state-of-the-art digital touch technologies, that enable new forms of touch communication in various contexts, such as work, leisure, learning, personal and social relationships and health and well-being. It is a ‘history of now’, that is, it outlines the conditions of the present state of digital touch technologies, on which the production of knowledge including understanding about the past and the future is itself contingent. It maps an array of digital touch communication research in relation to different communicative relationships: human-human touch, human-robot/robot-human touch, and human-object touch. We use these distinctions to help to raise questions and start debates about the interlinked nature of social issues that arise across these different communication spaces and contexts, whilst acknowledging that there is inevitably some overlap of the technologies/devices being developed and designed for use across these different contexts. This map documents the resources for touch, the touch interactions and communicative practices that are being designed for and starts to bring to the surface the social potentials and constraints of touch that are taken up by the designers of digital touch. Finally, the chapter, building on chapter two, provides an overview of the scope, extent and findings of user studies to date, and identifies emerging issues around the social aspects of digital touch communication, that might involve human-object, human-human, human to robot or robot to human touch.

The broader social debates that digital touch is situated within and emerges from are the focus of Chaps. 4, 5, 6 and 7. In these chapters, we attend to four topics: Social Norms, Connection and Presence, the Sociotechnical Imaginary and Ethics. While these are not the only topics that matter to understanding digital touch, they have repeatedly been to the fore across our case studies, the research literature, and conversations with others working within digital touch. They each show the poten-

tial of a socially orientated approach to research and design of digital touch, and the benefits of interdisciplinary research in this complex field.

We focus on social norms in Chap. 4, with attention to their significance for researching and designing digital touch communication in a global world, notably gendered and cultural touch norms. We explore how social and cultural norms shape the ways that people (and machines) touch. The ways in which touch norms are shaped, regulated and enforced through social, economic, familial and legal mechanisms, to organise our experiences and expectations is examined. We argue that understanding of the touch norms that people, including digital touch researchers and designers, bring to their interactions with others provides a route into understanding the sociality that informs digital touch. This is essential as the expectations of the user, their touch repertoires, and the social cultural norms in play in an environment shape the take up and use of mediated digital touch communication devices and systems and environments. This leads us to make a case for reflexive engagement with touch norms to provide insights and inspiration for thinking about, researching and designing digital touch communication, and to help to address how cultural and gendered norms of touch might be engaged with, to constrain and reproduce or open-up the meaning potentials of digital touch.

Technologies are intrinsically linked to the ways in which physical, temporal and emotional distances are thought of and managed. Likewise, social relations and communication technologies mutually shape each other as they are developed and maintained. Chapter 5 explores the social ‘connections’ that digital touch technologies are beginning to shape, with a focus on the related experiences of presence and absence through mediated touch and the questions this raises for the design space of interpersonal relationships, that is, the mediation of touch between people. We first consider how these concepts have been defined and addressed in the literature on communication technologies in general, and touch technologies in particular. We then use three case study vignettes to explore and reflect on these concepts. They include people’s interactions and responses to a series of artistic technological provocations designed to enhance feelings of connection and tackle isolation in the ‘Remote Contact’ exhibition, an output of the *Art of Remote Contact* case study; the social aspects of sending and receiving digital touch as a form of tactile support, drawing on our study of people’s use of a prototype *Tactile Emoticon*; and parents’ use of the Owlet Smart Monitor (OSS), a bio-sensing baby monitor and app, which we conceptualize as a form of mediated touch in the context of parent-infant interaction in the *In Touch with Baby* case study. We consider how touch technologies might challenge us to think about the interaction between human and machine. We close with a consideration of design implications and possibilities for future research.

Chapter 6 explores the potential of the concept of sociotechnical imaginaries for digital touch communication research and design. It discusses and defines the social imaginary and how it works to produce and animate shared systems of meaning and belonging that guide and organize the world, in its histories as well as performed visions of desirable futures through advances in science and technology and imagined technological possibilities. The chapter explores the ways in which this concept can be employed as both a design resource, and as a methodological

resource. We argue that as new digital touch technologies enter the communicational landscape the setting for interpersonal sociability is/will be reworked. Looking across our case studies, we explore and make legible emerging sociotechnical imaginaries of digital touch, asking how might touch practices be changed through the use of technology, and how might this shape communication. In particular, the chapter explores the core themes of the body, time, and place in relation to participants' sociotechnical imaginations of digital touch. Turning our attention to the sociotechnical imaginary as a methodological resource, we describe our use of a range of creative, making and bodily touch-based methods to access participants' sociotechnical imaginaries of digital touch and to both explore and re-orientate to the past, present and futures of digital touch communication.

Chapter 7 examines key ethical considerations and challenges of designing and researching touch technologies, with a focus on incorporating ethical touch sensitivities and values into digital touch communication. We discuss the difficulty of researching and designing ethically in the context of an emerging technological landscape, as reflected in wider HCI ethics debate. The chapter then explores the central role of the human body as site for digital touch communication, before focusing on key challenges around trust, control, consent, and tactile data. In line with preceding chapters, we draw on our case studies and the literature, to argue that digital touch practices are part of, and impact on, wider social relations and communications. The kinds of touch practices and relations designed *into* touch technologies bring with them implications for power relations and social cohesion, and it is these wider processes that digital touch design is able to – at least in parts – anticipate and shape. We close with a summary of key points and their implications for research and design.

Chapter 8, closes the book with a note on closing thoughts in response to the speculative and emergent character of digital touch communication, signalling our desire and need to keep the conversation open. We point to the significance of a social take on digital touch, particularly with reference to the types of questions this perspective raises and the way it positions technology in relation to people and society more generally. We draw attention to the research insights on digital touch communication discussed throughout the book that may inform design. Finally, we comment on the theoretical and methodological routes that we have taken to research digital touch communication; and draw on the ideas and research presented in this book to sketch an emergent research and design framework for digital touch communication.

1.5 InTouch Case Studies

In this section, we introduce the six case studies that we refer to and draw examples from in this book. Each case study is designed to examine project research themes discussed earlier, and to explore the different ways in which touch is conceptualised, how it is materialised and operationalised in different contexts and for different

purposes, as well as how it is situated within the broader sensorium and with other media. The case studies draw attention to the social uses of digital touch, the losses and gains of touch for meaning making and communication, the reshaping of touch practices, as well as showing some of the ways that touch ‘stands in for’ or gets ‘translated’ into other representational and communicative modes in digital designs. Each case study is outlined below.

1.5.1 Imagining Remote Personal Touch

Digital technologies have increased the potential for establishing, developing and maintaining relationships at a distance, through the configuration of key concepts, such as mobility, interactivity, temporality, social cues, storage, replicability, reach, and materiality (Baym 2015; Madianou and Miller 2012). As geographical distances increase, online communication increasingly supports an ‘always on’ culture of ubiquitous connectivity that allows ‘a new type of connected family at a distance’ (Madianou 2016: 184). Touch is increasingly being designed into digital communication devices/interfaces, with remote personal relationships becoming a primary market domain. When a new technology enters the ‘technoscape’, societies reach a consensus through an etiquette on their use and, over time, develop a set of norms (Licoppe 2004). Given the embryonic stage of digital touch devices, the norms for digital touch use are in a state of flux, most devices are un-domesticated, unstable and in labs rather than ‘in the wild’, making observing their everyday use impossible. Nonetheless, as with the history of other technological developments we know that the development of digital touch communication will be shaped by a sociotechnical imaginary. This case study explores how we begin to capture what that socio-technical imaginary about digital touch is.

The case study revolved around three research workshops designed to explore future possibilities for digital touch design for personal remote communication in three fields: friendships, family, and/or intimate partnerships. Our aim was to not only explore design ideas, but to also better understand key socially oriented considerations when designing for touch forms of communication, such as, where on the body can be touched, who can touch, how can we touch, and how norms of privacy and power relationships shape touch imaginaries. An interdisciplinary and multicultural group of 31 participants were recruited, to capture a range of perspectives on personal communication relating to distance and the digital. The first workshop activity was designed as a brainstorming session focusing on participant histories and experiences of remote digital communication in general, discussing continuities and change over the last 10 years. The second activity was a rapid prototyping session, described in the previous section (Fig. 1.1). Kissenger (Zhang et al. 2016), a working remote communication device, was the basis of the third workshop activity, in which it was used as a ‘disruptive probe’ to explore participants’ interactions and reactions, and reflections on an existing digital touch communication device.



Fig. 1.1 Rapid prototyping sessions and prototypes in the Imagining Remote Personal Touch Case Study

A combined multimodal (Jewitt et al. 2016; Kress 2010) and sensory ethnography (Pink 2015) approach to the analysis showed five thematic characteristics around digital touch for remote communication, namely: materiality (e.g. in terms of loss of particular sensations expected of touch, like warmth), embodiment (whole body sensation versus specific body location for communicating touch), post-human aspects (e.g. concerns over loss of emotional and sensorial aspects of communication through machinic touch), emplacement (e.g. appropriate space/places for touch communication), and digital touch temporalities (e.g. attending to questions of duration of touch experience, social timing of touch, storage of and asynchronous touch experience), all of which provide insights on the emerging landscape for digital touch personal communication (Jewitt et al. [under review](#)).

1.5.2 *In Touch with Baby*

This case study focuses on bio-sensing technology to explore the potential new conceptualisations of ‘digital touch’ that this brings about. Proliferation of bio-sensing technologies in various contexts remediates bodily and physiological information through the ‘touch’ of the device on the skin, or even as an implant, to bring



Fig. 1.2 The Owlet Smart Sock and bedtime re-enactments, In Touch with Baby case study

new awareness of our own or others' bodies, with information commonly derived through touch, e.g. taking a pulse, or temperature. We focus on the Owlet Smart Sock (OSS) baby monitoring device (designed, developed and marketed by Owlet), which detects babies' real-time heart rate and oxygen levels, and alerts caregivers if readings fall outside the norm (Fig. 1.2). We view this bio-sensing technology as digitally mediated touch, in part due to the contact of the smart sock on babies' skin, and in part through wireless transmission of physiological data to parents' smart phones, imparting information about the baby's physiological state and well-being. Different from other case studies, the use of a ready-for-market technology enabled InTouch to explore the use of a stable touch-related device 'in the wild', with the full use of its accessibility, and connotations and status for the public.

The study focuses on how the technology may interact with or reshape the ways in which parents and babies communicate, know and experience each other through touch – especially given the role of parental touch in assessing baby's temperature, breathing, body tone, through for example, laying a hand on the baby's back or chest while sleeping. Specifically, this technology raises socially orientated questions about how parent/child touch is digitally mediated through early parenthood, and to what social, sensory-affective and communicative consequences; how the use of digital touch technologies (bio-sensing baby monitors) co-constitute and re-imagine babies' and parental bodies, their boundaries and (biological and/or physical, cultural and social) connections; how the technological design maintains, interprets, disrupts or generates new touch and sensory-affective practices and routines in parenthood.

The case study drew on ethnographic approaches and comprised a number of stages. Focus group discussions, involving a total of 13 participants in parent-group formats, provided insights into parental touch practices with their babies, and their initial perceptions of the potential or value of the Owlet technology, or similar devices. Subsequently, four families volunteered to take the Owlet Smart Sock home and use it over a 3-week period. Sensory ethnography methods combined with multimodal analysis were used to generate qualitative data in the homes of participants, involving semi-structured interviews and bedtime video re-enactments. The trialling of the technology was accompanied by participant-led WhatsApp updates across the use period, and a subsequent reflective interview explored the Owlet experience post-use. This allowed us to investigate the perceptions of connection and communication that the device afforded parents who used it with their babies, specifically relating these to touch-based practices, and implications for any changing touch-related communication.

Along with the focus group discussions, the video re-enactments highlighted the ways in which touch is dispersed across, situated and made meaningful in family routines and wider everyday activities, which in itself problematizes the notion of ‘replacing’ human touch. We found the OSS to enter an already existing ecology of home that contains other technologies, bodies, material contexts, and wider sensory environments. Parents adopted, adapted or rejected the device as part of their wider roles and responsibilities as caregivers, actively negotiating OSS readings with their own sense of baby’s well-being. The OSS was most disruptive where it could not slot into existing practices of parent-infant touch interaction, and most revealing where the sensor readings enabled parents to make sense of their babies’ bodies and activities (e.g. falling asleep) in new ways.

1.5.3 The Art of Remote Contact

The ways in which touch technologies are designed can change the types of touch we can give/receive, and the ways in which we can communicate through touch, which raises interesting questions about what these might look like, and how people might use them. Communication technologies, like the phone, enable you to leave a voice message, and even record video messages – but what if you reached out to touch someone, and could leave a touch message? How might it be recorded and what would the life of that message be? In what contexts or situations might this be beneficial?

This case study was a collaboration between the interactive artist studio Invisible Flock and InTouch. The aim was to design and develop a series of interactive digital artefacts to engage people with touch, and creatively explore ways of enabling ‘touch messaging’. The artworks explored the theme of facilitating different kinds of interaction at the level of touch between people with dementia, their friends and families, as verbal communication was difficult. We explored how a social science research project, can engage with artists, the digital artefacts that they make, and



Fig. 1.3 Art of Remote Contact case study four exhibition artefacts. (Photo credit: Ed Waring)

their practices, to research digital touch communication as the ‘new interpreters of digital innovation’. InTouch used ethnographic methods to document the development of the artefacts over a year, this included meetings, sharing links, papers, and photographs, studio-visits, in-progress demonstrations, interviews and the process of developing the exhibition. This enabled us to situate the exhibition and artefacts in a broader understanding of the histories, ideas and processes that informed its development.

The works formed an artistic research exhibition, *Remote Contact*, which was open to the public (Fig. 1.3). We also used the exhibition as a research environment to explore how members of the public who visited it engaged with the artefacts and one another. We conducted video walk-throughs with 31 visitors to the exhibition (lasting 30 to 90 min) to understand: the kinds of touch experiences, sensations and practices the exhibition invoked, provoked, supported and mediated for visitors; the touch resources and capacities visitors deployed; the cultural social norms, etiquettes, touch sensitivities that visitors articulated; as well as the memories, metaphors and experiences that visitors drew on to reflect on their touch experiences with themselves, others, and objects in the exhibition.

In this book, we use illustrative examples of visitors’ interaction with three of the exhibition digital artefacts, which we briefly describe here. First, ‘I wanna hold your hand’ draws on how we communicate through the touch of hand holding, a squeeze, a stroke, to enhance experiences through durable re-representations. It included two separate artefacts, a pair of gloves and a ‘Rain’ installation. The ‘Rain’ installation made using Kinect, produced the sound of rain and a visual mapping of movement

when visitors held hands. The pair of gloves map the walks of those holding hands, recording GPS and pressure, flex and galvanic skin response. This digital data from the gloves is transformed, using an Arduino plotter, into graphical drawings that can be kept and shared by users as a memory provocation. Second, ‘Motion Prints’ was a piece designed for Dementia Care Homes, to encourage physical interaction through therapeutic putty. A MYO arm-bracelet senses muscle movements while the users manipulate the putty, and this activity data is converted into a digital visualisation displayed on the table top. Third, the ‘Water Synthesizer’, involved the tactile sensation of moving water dynamically to create sounds related to the water movement. The online exhibition catalogue ([Invisible Flock 2018](#)) provides further context and information on these artefacts and the case study more generally.

1.5.4 Tactile Emoticon

This case study is a collaboration between the InTouch team, and UCL Computer Science, HCI Design and neuroscience. The Tactile Emoticon study aimed to explore the notion of ‘tactile emoticons’, building on ideas of visual emoticons used extensively in multiple communication contexts. The focus was on affective touch and how this could be digitally communicated between people remotely located. To do this we organised a workshop to explore the broad context of participants’ engagement with emoticons and digital communication, and the role of different materials, sensory outputs and communication contexts for tactile emoticon messaging. Fifteen participants from Computer Science, HCI, Interaction design, Social science, Art and Design, and Neuroscience engaged in a brainstorming, participatory design activities, which aimed to explore tactile associations, and how different tactile materials might be used to create tactile messages associated to different emotions, for example, providing affective support through stroking.

The workshop results informed the iterative design and development of a prototype research device, configured to send and receive features of touch-based feedback, specifically heat, pressure and vibration to and from the hands of users. The prototype consisted of a mitten and a set of control buttons allowing synthesis of tactile messages by manipulating pressure, temperature and vibration ([Fig. 1.4](#)). Touch communication here takes place with and on hands.

A second workshop with 15 participants (postgraduate students and early career researchers, drawn from computer science, linguistics, communication and media studies), explored interaction with the initial prototype device. Two teams of two or three participants, situated in separate rooms (and unable to see one another), took turns in using the device to send and receive tactile messages. At the beginning of the session, they freely explored the device functionality and sensory features, then they engaged with tactile messaging (both sending and receiving) in the context of three different imagined scenarios: romantic love, social rejection and acute pain. In each of the scenarios the researchers assigned each team with one role, e.g. providing or receiving support or love, which was then reversed, so that all participants

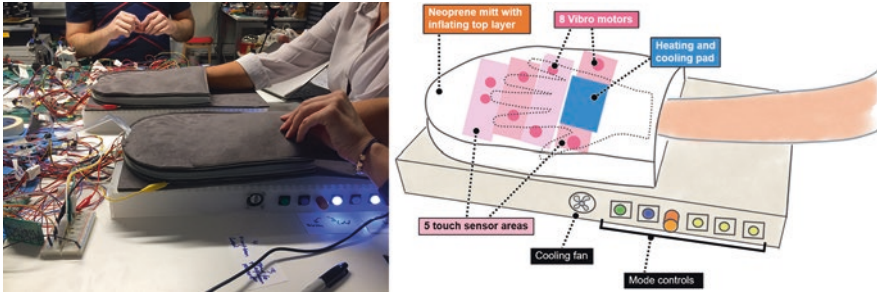


Fig. 1.4 The prototype Tactile Emoticon device, designed to send heat, pressure and vibration between the two ‘mitt’ sections. (Diagram credit: Frederik Brudy)

experienced being sender and receiver. This design had the potential for communicators to use the device to explore what meanings might be attributed to the different ‘felt’ sensations and develop their own ‘language’ of touch communication. The session concluded with a reflective discussion with both teams, aiming to inform the next design iteration.

The subsequent design prototype is being used in this collaboration as a research probe in a series of four on-going explorative qualitative studies with pairs of participants (including close friends, family, romantic partners, and students). The studies follow a three stage process of familiarisation and free-play with the device, using the device to communicate via touch in given scenarios, and a semi-structured interview covering a range of themes (e.g. agency, norms and expectations, experiences of connection/presence, memories and associations, and ambiguity) with each pair using video re-enactment of their experiences of interacting with the device, and to provide insight into the kinds of communicative messages they can send and interpret, the key aspects of touch sensations that enable this, and those that are less clear for communication.

1.5.5 Designing Digital Touch

Interviews and discussions with technical companies (e.g. HaptX) foreground the importance being placed on touch, the functional and useful designs for end users and highlight how technical companies are working within multidisciplinary teams to achieve this. Engagement with and awareness of these perspectives is essential for students studying digital design. We were interested to know how design students think about and through touch, and what happens when digital touch communication moves to the centre of the design process. To explore this, we collaborated with Design Educators, Dr. Val Mitchell and Dr. Garrath T. Wilson, at the Loughborough University School of Design and Creative Arts, to co-develop a student design brief for their BA and MA in Industrial Design and Technology, of which User Experience (UX) Design is an optional module.

Design Brief:

Develop an innovative, future-facing digital product or service that enhances communication through touch in one of three sectors: personal relationships, leisure, or health and well-being. To do this, you need to first research a specific communication context that would benefit from the introduction of touch technology, for face-to-face or remote interaction. You then need to identify specific user needs and, in collaboration with target users, develop and refine a product or service that will respond to those needs that includes an element of digital touch.

Students were encouraged to move beyond touch screens and mobile apps and to incorporate other forms of tangible interaction, existing or emerging technologies or those that could be considered as possible developments of current technological trends. While they could draw on other senses or modalities, touch was to be central to their design solution. We introduced students to the broad concept of digital touch communication and the kinds of technologies that may facilitate digital touch communication now and in the near future.

The research process involved following 70 students' work through a series of UX workshops (led by Val and Garrath), observing and video recording different design research and prototyping stages, and their associated coursework, which included storyboarding and video prototyping as well as on-going exchanges to collect learnings from Val and Garrath. (Students' participation in our study was voluntary and did not impact on their assessment.) The InTouch team reviewed and conducted a thematic analysis of their storyboards and video prototypes. We reflected on the kinds of design concepts that emerged and how the digital-touch-centred brief shaped the design process and located the students' concepts in the emerging landscape of digital touch and, in doing so, explored what types of touch resources are involved, where on the body touch is located, where and how communication happens, in relation to what other modes and senses. We examined the different ways in which the students brought the body into digital touch, from using it as an interface to something that can be sensed and differently known through the digital (e.g. through bio-sensing and wearable solutions), using touch technology as a sensory extension of the body or as sensory mediator between a person and their environment. From a social perspective, it is interesting for us to tap into the designers' imagination, to explore what narratives underlie their user scenarios, and what problems are solved through digital touch.

Designing digital touch is complex, and this led to the extension of the study to explore ways to prompt and support a border, more nuanced conception of digital touch. This resulted in the collaborative development of a prototype Designing Digital Touch Toolkit (Fig. 1.5) to support design students to go beyond technology-driven solutions by putting more emphasis on the sensory and communicative properties of touch throughout the design process, to encourage greater awareness, discussion and investigation of touch. It has been developed to support engagement with the complexities of working with touch across the Double Diamond model



Fig. 1.5 Designing Digital Touch Toolkit development

stages of Design Thinking. Our first toolkit prototype is being tested and evaluated by design students from a range of design courses. There are three types of cards for each stage: FILTERS- questions to help participants reflect on their own and others’ experiences; WILD CARDS - deliberately abstract prompts for thought or action; and ACTIVITIES – more structured exercises which require some time. Initial work is presented in (Mitchell et al. 2019) and we will continue this collaboration to trace changes in the way touch technologies and design concepts are envisaged or employed across time.

1.5.6 Virtual Touch

This case study explores dimensions of touch in virtual and augmented reality environments – where experiences are classed as immersive or non-immersive. To date in immersive VR, typical touch interactions take place through pressing buttons or moving touch wheels on hand held wireless controllers. In some immersive VR experiences, ‘touching’ and eliciting changes in visual graphics is mediated through



Fig. 1.6 Instances of touch in Virtual and Augmented Reality. From left to right: Saatchi Gallery – We live in an Ocean of Air – VR Experience by Marshmallow Laser Feast; Discussion with Dr. Isabel Van De Keere, Founder and CEO of “Immersive Rehab”; Demonstration of an exoskeleton glove by Dr. David Swapp, Manager of the Immersive VR Lab at UCL, London

body movement (e.g. walking into different spaces or using gesture-like actions), and raise particular questions about touch in these spaces, for example, around the role of materiality, and relationship between ‘virtual’ touch and other representational modalities. However, developers are increasingly seeking other ways of enabling touch sensations in immersive VR, including haptic gloves using microfluidics to create different sense of pressure, simulating aspects such as weight, size, shape, texture (HaptX), or exoskeletal mechanics to deliver touch sensations, primarily through providing multiple points of force feedback arranged over a tracking glove (e.g. CyberGrasp). These devices are also designed for use in Augmented Reality environments, along with other haptic technologies, such as the Phantom, where touch sensations are felt through a pen-like tool in the form of vibration, and can be designed to elicit a sense of pressure or resistance; and non-contact technologies, such as mid-air haptics, which enable touch through ultrasound waves, giving sensations of shape and texture of three dimensional digital objects. While developers are increasingly advocating the potentials of haptically mediated touch devices for enhancing VR experiences or training capacities (e.g. in medicine), critiques highlight that these technologies are not yet mature enough to operate reliably outside lab settings (Stone 2019). Whether combined with haptic feedback or merely using body movement to engage in VR, the role of other media – visuals and audio – and modalities of interaction (e.g. gesture) are significant in conveying touch interaction or perceiving and interpreting touch interactions (Fig. 1.6).

Given the importance of touch in communication, designing for and embedding touch into VR contexts is challenging, and raises some important questions for understanding how touch is perceived and experienced in these spaces, and which specific designs enable these experiences. In particular, we are interested in environments where (physical) touch does not take place, what kind of touch sensations can the experience elicit e.g. prod, stroke, tap, and what this means for communication; how do people perceive, interpret or make sense of touch in these spaces, and what other resources do they draw on (e.g. context, visual) to achieve this, leading us to ask, what is the relationship between touch and gesture, and how does gestural interaction with virtual objects or graphics link to touch experience? In connection with this we are examining the role or importance of materiality, and how the materiality of interaction and communication change in different digital contexts. A further related question concerns the relationships between visual and tactile, or audio and tactile, and how can design foster effective touch perception through multi-modal forms of representation.

To explore these questions, and better understand virtual touch from design to experience, we are engaging in four main research activities. First, we have conducted interviews, with (10) designers, developers, learning scientists, artists involved in the design, development and use of these technologies in different contexts, such as arts, education/training, healthcare, industrial design. This strand aims to look at aspects like what types of touch are afforded, to understand how designers and developers talk and think about touch in virtual and augmented spaces, why is touch important and in what scenarios, how touch is combined – supported with other senses, and where the norms of our non-digital touch practices are challenged. Second, we are analysing videos, audio and website texts presenting and or reflecting on VR and haptic applications, to examine how touch is talked about in the different experiences. Thirdly, in conjunction, we are analysing video walkthroughs of VR environments, where touch is featured as an important element, to examine how touch manifests in interaction and how it relates to current touch interactions with a view to exploring new forms of touch engagement. Fourth, we are undertaking a study of interaction in different VR environments employing touch forms of engagement as part of the experience and using different forms of input devices.

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Links

Cybergrasp. <http://www.cyberglovesystems.com/cybergrasp>
HaptX. <https://haptx.com/>

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