Witnessed Presence in Networked Wearables

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Witnessed Presence in Networked Wearables

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kwamecorp

Executive Summary

Wearable electronics is a nascent sector of technology that is already generating a lot of excitement and speculation as a clear candidate for (yet another) disruptive innovation. Data from the (social) Internet in combination with various deployments of ubiquitous computing such as the Internet of Things (IoT) together a promise of unprecedented intersection of the online and offline worlds, a new dimension rich with ambient information. Wearables present therefore an incredible opportunity to re-invent how we connect to ourselves and the world around us. And perhaps this is a timely intervention for modern civilisation.

The technological aspect of modern socio-technical systems enables great flows of information, vastly extending human agency as well. Essential social processes are enabled and carried out over communication technologies; fundamental social structures are changing. However, the opportunities to witness one another, already tenuous in physical presence, do not smoothly transition into the new generation of technology-mediated interactions, be it person-to-person or person-to-system. It is only through the act of witnessing one another that people establish presence and develop trust, in ever-expanding merging biological, social and algorithmic realities. As a technological medium acting at the very boundary of the individual in both the physical and digital world, it would be interesting to design wearables that enhance witnessing in modern network(ed) societies.

This work approaches the effort simultaneously from Policy Analysis, sociology and Science and Technology Studies (STS) perspectives. Key references include Marshall McLuhan (Medium Theory), Barry Wellman (Networked Individualism) and Caroline Nevejan (Witnessed Presence). This is coupled with a case-study of an upcoming wearable called *BOND* by *Kwamecorp*, a new media agency. *BOND* utilises the touch modality that wearables uniquely can harness, to send tickles between a pair of synced devices. The product is targeted at intimate couples. As such, both the wearable form-factor as well as the novel communication channel make *BOND* ideal for investigating witnessed presence in wearables.

It was found that wearables in their mobility and portability can be imagined as technological organs on the modern human being. A useful design mantra for wearables was condensed as *contextual embodied augmentation*. Context-sensitivity demands specialised affordances; embodiment refers to intuitive extensions and calls to action that keep users immersed in the real world, as opposed to the reality-in-a-screen; and finally augmentation is recommended as a design principle such that wearables provide ways the enrich reality with information. Touch-modality is seen as a promising new avenue unique to wearables; digital stimuli can be 'affective' on users.

Wearables in their selective and portable enhancement divorce traditionally conflated social function and physical place, condensing expertise into portable devices. In bridging the digital-physical world, wearables become the offline equivalent of digital 'avatars', which gain value by storing valuable personal information and furthermore using them to provide pointed affordances for (inter)actions in both online and offline worlds.

An ethnographic study of *Kwamecorp* and a design history of *BOND* contributes an insider look at new technology development in a contemporary startup setting. Interviews conducted with nine designers from *Kwamecorp* are analysed to elucidate the design intentions of *BOND*.

BOND's *Touch* module is confirmed to facilitate witnessed presence by enhancing co-presence among interacting parties. This is enabled by a 'quantum of presence' interaction. This discretised form of connectivity is in line with a general trend of affordances to counterbalance the greater frequency of connection and communication in modern living. These kinds of communications, in their reduced format, are both easily deployable in wearables and, while the reduction in complexity can be ambiguous, it is a feature that invites more creative participation from both parties.

Ultimately, the thesis is useful to anyone interested in developing both industrial and consumer applications with wearable electronics, those interested in how sociological insights can help actively in the design of new technologies for socio-technical systems, or as a primer for witnessed presence.

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This thesis marks the end of a fruitful and eventful chapter in my life: the completion of the Masters programme in Engineering and Policy Analysis. I'd like to take this opportunity to thank the many people who have helped me reach this point in one way or another.

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1. Introduction

Wearable electronics are primed to be one of the next trends in the consumer electronics industry. The *Pebble* smart watch kick-started the consumer wearable era, raising an unprecedented US$10.3 million on *Kickstarter* (Pebble Technology, accessed August 2014). Major electronics giants like *Apple*, *Google* and *Samsung* are also showing interest in developing products in this area. According to industry business intelligence, wearable electronics are estimated to enjoy a market exceeding US$8 billion by 2018 (ReportLinker, 2013). Why the hype, one may ask.

State of the art

From a technical feasibility perspective, wearables represent a convergence of advances from multiple fronts: that of materials science and innovative textiles, as well as the miniaturisation of electronics into the micro and nano realms (Canina, 2014). A former *WIRED* editor-in-chief claims that the "peace dividend of the smartphone wars" is the know-how and ready availability of miniaturised sensors and chipsets that manufacturers can leverage to build next-generation wearable devices (Wasik, 2013).

While the consumer electronics interest in wearables has spiked only recently, the International Symposium on Wearable Computing (ISWC) reported 17 years of history, with the most recent conference met with the highest demand (Roggen, Perez, Fukumoto and van Laerhoven, 2014). The ISWC sees wearables as one component of a larger paradigm of pervasive and ubiquitous computing; the latest research trends were noted to be *context-awareness*, *textiles*, *sensor technologies*, *eyewear computing* and *interaction* (ibid).

Thad Starner used *Google Glass* at ISWC 2013 to demonstrate the 'micro-interactions' that facilitate the use of wearables seamlessly augmenting reality on the basis of discreet bodily gestures (Roggen et al., 2014). Based on *Google*'s insight from *Glass* design, he recommended the time for micro-interactions to trigger between two to four seconds (ibid). Starner also proposes that "bringing technology and computing closer to the body can actually improve communication and attention, allowing technology to get further out of the way" (Starner, 2013).

The IEEE Consumer Electronics Magazine affirmed the inclusion of wearables in the broader category of 'Internet of Things' (IoT), saying "While most wearables are connected to the cloud via smartphones, they can still be considered a subset of the IoT... The IoT is still in its early infancy, without any standard definition; thus, any "thing" that can be connected to the Internet beyond the traditional IT devices is deemed to be part of the IoT" (Wei, 2014).

Furthermore, Wei pointed out the main concerns of the wearables-as-IoT endeavour would be the following technical hurdles (ibid):

- *connectivity* (and interoperability) of devices with one another;
- the deployment of *cloud computing* to process the new data sources;
- *security challenges* to protect both the devices and the collected data;
- aesthetic *design* to promote wearing wearables visibly even in public;
- *design for manufacturing* that must balance volume of demand with the precision and reliability required for consumer products.

The impending wearable revolution may hit its prime even sooner than the mobile phone did. Consumer electronics manufacturers, both large companies and small startups, have equal access to this space thus increasing the likelihood of innovative products in time. These are astute observations that the industry as a whole must tackle for wearables to achieve mainstream adoption.

Information as a new dimension

Ubiquitous computing as a paradigm suggests a revolutionary change in technology's relationship to man (Weiser and Brown, 2014). As technologies become increasingly embedded on man and imbedded in the world around him, Mark Weiser and John Seely Brown argue that these essentially create information *peripheries* (ibid). Here, peripheral does not mean unimportant; rather, information is ambient and accessible on-demand, but dissolves into the *periphery* when not immediately relevant. Wearables take this further, allowing conscious personal choice of information *peripheries*.

If the promise of ubiquitous computing becomes reality, then the volume of interactions and information will also rise astronomically. As such, Weiser and Brown suggest a paradigm of "calm computing" (Weiser and Brown, 2014). The focus of user-centered design must become user-*centering* design in the context of ubiquitous computing, that allows users to negotiate the myriad of new interactions intelligently (ibid). This is one focus area in this thesis: design principles for wearable technologies.

Such pre-emptive constraints will allow ambient information to move from centre (of focus) to *periphery* (and back) quickly and gracefully (Weiser and Brown, 2014). Additionally, wearables can also enhance *peripheral reach* providing contextual information for increased agency while avoiding information overload (ibid). Weiser and Brown give the example of videoconferencing, which provides peripheral information of posture and expressions on top of the speech content of an equivalent phone call (ibid). This is also a form of augmentation, ripe with applications.

Thus, information itself becomes a rich dimension; or rather, ubiquitous computing, wearables included, will provide unprecedented ways to access, expand, explore and navigate the dimension of information.

Untapped potential

One influential proponent of wearables is Steve Mann, a professor at the University of Toronto who has spent close to four decades improving, modifying and most notably, wearing his wearable devices. His *WearComp* system has

evolved, from a backpack-sized photographic apparatus in the 1970s to its present eyeglass and "underwearable" clothing form that features a fully functional *UNIX* workstation (Mann, 1998). Mann claims that with daily use and long-term adaptation, the *WearComp* begins to function like a "true extension of mind and body" (ibid).

Consider the *Recon Jet* sports goggles (Recon Instruments, accessed July 2014). It has built-in sensors that measure and record data critical to professional athletes, like GPS, speed, altitude, heart rate and other metrics. This is not remarkable in itself since smartphones already have the capacity to monitor the same information, given the right apps. However, the goggles feature a visual interface that directly augments the athletes' visual field, displaying the metrics in relevant infographics. This allows athletes to track and modify their performance during the activity itself, with no distractions or interruptions. Athletes access vital information on the fly and modify their activity in real-time without breaking stride. This is an unprecedented level of technology-mediated situational awareness.

Thad Starner, the technical lead of *Google Glass*, agrees, revealing that the design focus is "on keeping them [users] in the flow and aware of the world around them" (Starner, 2013). Most devices till now have been computing consoles that we interface with at-will, conscious interactions to achieve known ends, be it making a call, reading an email, sending a text or taking a picture. Passive contextual computing is now close to becoming reality. For example, a major design intention behind *Glass* is reducing the time between user intention to do a task and the first action to perform (ibid).

The first few forays into wearables by major consumer electronics manufacturers, while technically impressive, have not been convincing demonstrations of the potential of wearables; even *Glass*, arguably one of the most ambitious undertakings, has received considerable backlash for its behaviour-altering interface that challenges current social norms (Honan, 2013).

Despite these initial stumbles, there remains an air of optimism about the potential of wearables. In an article questioning the feasibility of wearables, Isabel Pedersen commented: "Are wearables really ready to wear… what is overwhelming is our general acceptance that [products like] *Glass* is a mass

social phenomenon that *will* take place... accepted for better or worse as a given with as much certainty as the setting sun" (Pedersen, 2014).

Perhaps the very friction that wearables are experiencing to achieve mass deployment is an indication that wearables are not just incremental innovations of existing technologies, but a new category of devices instead; that is to say, wearables are a new medium. Marshall McLuhan's prolific works relating to Medium Theory is used to understand the qualities of the wearable medium, independent of its myriad functionalities. Specifically McLuhan's four Laws of Media, are condensed and applied to elucidate the potential of wearables (McLuhan, 1975).

A timely intervention

The trend of technical advances is sufficiently convincing; wearables *are* within reach. The technical hurdles and current explorations however are only one part of the wearable puzzle. There is a larger discussion to be had on the social implications of the technology.

Can one ask, *how* should wearable technologies be designed and *what* are the implications? Perhaps these are questions that are uncommon to the consumer electronics industry but, policy measures like (social) impact assessment are routinely stressed for industries whose processes affect countless lives, be it genetic modification of food crops, the generational costs of nuclear power or even the ecological impact of pesticides.

Given the global influence exerted by communication media, perhaps it is time questions of this nature also temper the path of these (consumer) technologies. Pedersen says it best: "Emergent digital media, like *Glass*, are invented, designed, adopted, and even celebrated even before society is able to understand their impact on lives, culture, values, art, politics, privacy and social practices" (Pedersen, 2014). So, there is a need for a policy perspective that guides the design of these media that (will eventually) reach and affect millions of lives around the world. Pedersen continues, "We need to explore how devices will affect digital life at the design stage and not only rely on policy-making after the fact, when it is too late" (ibid).

Wearables present therefore an incredible opportunity to re-invent how we connect to ourselves and the world around us. As technological devices at the very interface of the biological organism and the natural world, they deserve to be developed with a grander (trans)humanist philosophy. And perhaps this is a timely intervention for modern civilisation.

Re-thinking connection(s)

The technological aspect of modern socio-technical systems enables great flows of information, vastly extending human agency as well (Castells, 2001). Essential social processes are enabled and carried out over communication technologies; fundamental social structures are changing (Castells, 2001; Wellman, Boase and Wenhong, 2002).

Internet sociologists Barry Wellman and Manuel Castells have long studied the impact of the Internet (as a dominant communication medium of our time) and associated media on culture and social structures (Castells, 2001; Rainie and Wellman, 2012). Castells reports that the Internet allows each individual to view, process and participate in unique experiences, while reducing shared experiences and consequently shared meaning, minimising sense of connection with immediate peers (Castells, 2001). Wellman's body of work affirms this observation, suggesting that a modern citizen (typically one with a mobile phone and access to the Internet) is in fact a networked individual whose personal circles resemble loose networks rather than close-knit groups (Rainie and Wellman, 2012).

Physical presence among individuals is no longer necessary to make contact as these technologies increasingly allow for communication across any distance almost instantly. However, in physical presence face-to-face with another, it is easier to witness one another (Nevejan, 2012). Kelly Oliver introduces witnessing as a strong basis for ethics in her book, 'Witnessing: Beyond Recognition' (Oliver, 2001). Witnessing implies not just perception and passive observation, but participation as well by reflecting or acting upon these perceptions and observations, thus sharing responsibility in the outcome of the interaction (Oliver, 2001). This aspect of witnessing does not seamlessly translate to technology-mediated interactions.

It is through the act of witnessing one another that people establish presence and develop trust, in ever-expanding merging biological, social and algorithmic realities (Nevejan and Brazier, 2012). Interacting without witnessed presence is to be connected without a sense of trust, or have agency without a sense of responsibility - an unappealing prospect. Trust and truth are essential for dynamic multi-actor systems, and witnessing facilitates the important prerequisites of transparency and empathy.

One area of interest at the Participatory Systems group at the Technology, Policy and Management (TPM) faculty at TU Delft, is the theory of Witnessed Presence: a framework for interaction space design based on the concepts from (tele)presence and witnessing (Nevejan, 2012). Witnessed Presence employs witnessing as a foundation to implement the *YUTPA* (being with You in Unity of Time, Place and Action) framework, which provides a granular means to better design interaction spaces for two parties to witness one another, across various modes in merging realities (Nevejan and Brazier, 2012).

Wearables and witnessed presence

What can wearables add to communication and connection? Since consumer wearables will be deployed in the contemporary context of network societies, it is not a leap to assume that networked wearables will have some capacity for communication and connection between individuals. Given the rich social layer of the Internet in society, such networked wearables bring into daily life relevant information from the *periphery* of both online and offline living. As such, wearables especially can go a long way in bridging the merging biological, social and algorithmic realities of everyday life (Nevejan and Brazier, 2012).

As a technological medium acting at the very boundary of the individual in both the physical and digital world, it would be interesting to design wearables that enhance witnessing in modern network(ed) societies. This is the primary motivation behind this work.

A significant portion of the research effort is thus interested in establishing whether wearables can support witnessed presence interactions using the *YUTPA* framework, given the unique advantages and constraints of wearables.

Cue BOND

Kwame Corporation (*Kwamecorp*), an innovative new media company, has great interest to enter the high-potential wearables market. They have already invested in a prototype platform called *BOND*, which uses a familiar wristwatch form-factor featuring mix-and-match modular units ("Bond - Kwame Corporation", 2013).

BOND is intended to make user lifestyles even more seamless, each optional module behaving like a dedicated contextual app for everyday situations. One module for instance is an NFC payment module which does away with the momentary hassle of retrieving one's travel card when using public transportation.

Figure 1: Concept render of BOND (circa May 2014)

Notably, there is also the *BOND Touch* module that comes exclusively in synced pairs; when one user touches it, the other receives a tickle. As its slogan goes, "touch to stay in touch" (ibid). The wearable form-factor of the product with the unique mode of communication that *BOND Touch* enables, make it an ideal case study to investigate witnessed presence in networked wearables. In studying a networked wearable specifically to extend a trusted

relationship, it may also be possible to understand the essential qualities of trust and truth in modern technology-mediated connections.

I had the opportunity to spend some time at the Lisbon office of *Kwamecorp*, conducting nine formal interviews with six designers over the span of three months. (Full transcripts from these interviews can be found in the **Appendix**.) Nevejan's *YUTPA* framework is used to analyse the interviews in an effort to establish if *BOND* does indeed facilitate witnessed presence interactions.

New media development in startup environments is exciting. It is also globally transformative; one has only to count how many times Silicon Valley startups have debuted disruptive technologies in the span of decades. It would be interesting from to study the role of such startups in their role of pushing new technologies into mass use. Notes and observations from working with teams at *Kwamecorp* are presented in this work to give some sense of how such startups work. Furthermore, the evolution of the *BOND* product from inception till now is compiled. Together, they help elucidate an active innovation process in a contemporary new media company.

Orientation

Ultimately, this thesis is intended to be useful to anyone interested in developing both industrial and consumer applications with wearable electronics; those interested in how sociological insights can help actively in the design of new technologies for socio-technical systems; or as a primer to applications of witnessed presence. I hope it is an interesting read!

This thesis is structured thus: **Chapter 2** details the design and methodology of the research effort; **Chapter 3** is dedicated to a comprehensive literature review to define wearables in a technological, social and socio-political context; **Chapter 4** covers the ethnographic analysis of Kwamecorp, a design history of the product and analysis of interviews done for the research, and additionally discusses emerging themes for future study; and **Chapter 5** is reserved for conclusion and recommendations. Last but not least, the **Appendix** contains the transcripts of interviews with the designers.

(Oh, one more thing. As a mindful reminder to remain inquisitive but objective, I refer to myself in third-person as ‘principal investigator’ in the analytical parts of the thesis.)

2. Research Design

Before undertaking the research endeavour, it is first necessary to design the plan of approach. This chapter describes the research scope and outline. First, the main research questions are proposed. A comprehensive research methodology is then detailed, describing hows and whys of operationalisation and execution. And finally, the relevance of *BOND* as a case study is justified at the end of this chapter.

Research questions

As discussed in the introduction, the central goal of this thesis is to understand how witnessed presence can be designed in wearables. This effort is coupled with an in-depth case-study of *BOND*, which is a wearable product currently in development at *Kwamecorp*.

Thus, the main research question of this study is:
Can witnessed presence be designed in a system of networked wearables used in shared intimate space?

To answer this, the following sub-questions guide the arc of the research effort:

- What are essential qualities of the wearable medium?
- What are the ways in which networked technologies connect people?
- How can digital connections be enhanced?
- How is *BOND* designed to create meaningful connections?
- Can *BOND* interactions be mapped on the *YUTPA* framework?
- Does *BOND* permit witnessed presence between intimate partners?

The results from this work are intended to incorporate into the on-going design trajectory of the product at *Kwamecorp*. This is a secondary goal, to provide *Kwamecorp* with relevant insights to guide and develop *BOND*.

From an academic perspective, this is also an attempt to demonstrate how sociological insights can actively inform new technology product development. The work provides commentary on the implications of contemporary communications media on connection, as well as the role of technology startups in the diffusion of new media in society.

The work also hopes to further explore some aspects of Witnessed Presence theory, namely the role of imagination in witnessing. The benefits of touch modality, rendered freshly relevant by wearables, may also become clear. Overall, the broader implications of the research effort may also suggest interesting directions for future research in improving human connections in complex socio-technical systems.

Choice of case-study

Kwamecorp is a global innovation agency and incubation fund based in Lisbon, London and Palo Alto. Presently, they would like to enter the budding wearable market. *BOND* is the modular wearable device they envision. It adopts a wristwatch form-factor, with optional modules that can be mix-and-matched depending on users' needs and preferences.

Indeed, it is this modularity that distinguishes it from most other smart-watch offerings at the moment; each module is dedicated to a single simple task, tasks being typical actions in modern lifestyles. In that sense, the *BOND* platform is decidedly "dumber" than other smart-watches, and aims instead to seamlessly smooth rough edges in everyday interactions. The company is fully committed to design this brand of meaningful modules on the *BOND* platform. Of special interest to this thesis is the *BOND Touch* module; it comes in synced pairs that when one is pressed, the other tickles its user.

Figure 2: BOND: *touch to stay in touch*

The *BOND* project is currently in a conceptual product development phase. However, *Kwamecorp* has already publicised its product, first during a crowdfunding push in late 2013 on *Indiegogo*. However, the project failed to reach its funding target. *Kwamecorp* has since focused on pitching the idea to venture funds.

Meanwhile, the social media posts on *BOND*, especially the couple-friendly *BOND Touch*, are still shared widely on the Internet, occasionally going viral in various social networks. Indeed, the designers at *Kwamecorp* are aware of the compelling "pull factor" of the *BOND Touch* module, and hope to leverage that sentiment to push more *BOND* units as a viable wearable product in the marketplace (personal communication).

From an academic perspective, *BOND Touch* is of special interest. As a paired communication module, what is novel is that it attempts to utilise touch modality as a form of one-to-one communication for a target audience of intimate partners. If designed right, *BOND Touch* is intended to extend the couple's sense of intimacy across a distance of separation via technological means.

The implications of such a feat could include learnings on how tactility offers an interesting dimension to digital presence, and ways in which relations based over digital means can be enhanced to share some of the intangible advantages that physical presence offers.

From early communications with *Kwamecorp* regarding *BOND*, I wondered if the sublime intimacy that the *Touch* module alludes to was related to the faculty's on-going work on Witnessed Presence, headed by Caroline Nevejan. Witnessed presence applies presence design to facilitate interactions in participatory systems. Specifically, it traces how people find ways to establish presence and develop trust among one another both on and offline (Nevejan, 2012).

It is hoped that the insights from this line of work would serve to improve the design of the *BOND Touch* product, so that it achieves what it is attempting to do. To that end, in this thesis, the *BOND* wearable platform is the subject of a case-study.

Research methodology

To answer the research questions, the thesis is divided into four phases. The first phase involves desk research, the second an internship at *Kwamecorp*, the third phase is the design and execution of interviews. The fourth and final phase is the analysis of gathered input. The outcome is a design primer for networked wearables.

Phase 1: Desk research

Given the novelty of wearable electronics, the study begins with a theoretical analysis of the nature of the wearable medium. The highly influential Medium Theory put forward by Marshall McLuhan, is used as an academic lens to critically analyse the medium of wearable electronics independent of its functions (see **Chapter 3.1**; McLuhan, 1975).

McLuhan's central premise is that tools in mass use become media, whose entrenched position makes them 'invisible' as they continue to influence both humans and their societies (McLuhan, 1964, p.7-21). The effects of media on

our societies can be profound and systemic; consider for instance the role of the automobile in shaping the development of cities and settlements. Medium Theory offers a framework to reveal and analyse even invisible media, and qualitatively describe their effects and impact (Faculty of Communication Studies, 2013). Going through this analysis elucidates a more nuanced definition to the term 'wearable electronics', which can serve as the foundation for the rest of the research effort.

Treating wearables as a medium from the get-go is also a choice indicative of the assumption of near-future mass deployment making them a *de facto* socio-technical environment accruing additional network effects, rather than designing them product-centrically. This coalesces into an informed definition of what "wearable technology" as a medium uniquely allows, that was not possible before.

To contextualise the benefits that networked wearables can offer, it is of interest to also understand how existing communications media, especially the Internet, have changed the way we communicate and connect. Manuel Castells' work captures the historical, technological and social development of the Internet, giving equal importance to the cultures that spawned it and the cultures that thrive on it (Castells, 2001).

There is also a growing body of research that compiles the social aspects of Internet culture, shedding light on the usage patterns of contemporary technologies in everyday life (Rainie and Wellman, 2012). Internet researchers like Barry Wellman have long been studying the fundamentally different dynamics that are arising as a result of increasingly networked societies, coining the term networked individualism (Wellman, 2002). In a seminal report from 2008, Wellman's study revealed that even core family units were interacting differently in the digital age, parents and spouses creating a "sense of connectedness" among themselves based on digital communication technologies (Wellman, Kennedy, Smith et al., 2008) .

Indeed, technology is even changing the way our social structures form and evolve. These works contribute to an appreciation of the scale and scope of the changes these communication technologies bring to society. The analysis will try to place wearables into this modern context (see **Chapter 3.2**).

Kelly Oliver's work on the philosophy of witnessing is next, and this work attempts to contextualise witnessing to multi-actor socio-technical systems to illustrate the necessity of its deployment (Oliver, 2001). Take this example. Even among connections enabled by videoconferencing technology, there can be a world of difference in terms of quality of connection. Both through *Skype* or a combat drone's camera, one can observe and (inter)act with another person, but the two experiences are not even comparable.

Caroline Nevejan's theory of Witnessed Presence operationalises the act of witnessing, both on and offline, through presence design (Nevejan, 2012). Specifically, Nevejan's *YUTPA* framework (being with You in Unity of Time, Place and Action) – a granular scorecard developed to measure level of witnessed presence – is introduced, with a working summary of its constituent dimensions, which correspond to social implications of sharing Place, Time, Action and Relation (see **Chapter 3.3**; Nevejan and Brazier, 2012).

Phase 2: Internship

In the second phase, the principal investigator spends 3 months embedded on-site at *Kwamecorp*'s Lisbon office, where the bulk of the operations take place. The principal investigator engages in a discussion and analysis of the *BOND* platform, with special focus on the intimate connection that *BOND Touch* aims to extend. Conversations with *Kwamecorp*'s CEO Kwame Ferreira and COO Christoph Dressel deeply inform the compiled recommendations for *BOND*.

First, an ethnographic analysis of *Kwamecorp* details the design environment in which a product like *BOND* is being designed. This hopes to capture how the innovation process works at *Kwamecorp*, offering a behind-the-scenes look into the unique design environment in which a product like *BOND* is developed (see **Chapter 4.1**).

Next, *BOND*'s design history is compiled, following the progress of the project since its inception. Here the principal investigator participates in *BOND*-related discussions at *Kwamecorp*, and compiles a summary of the product based on the official archive of *BOND* related documentation (see **Chapter 4.2**).

Phase 3: Interviews

In the third phase, the principal investigator designs a list of interview questions inspired by the dimensions of the *YUTPA* framework. The principal investigator then proceeds to execute these interviews, recording them in audio form for later transcription.

These open-ended interviews are conducted with designers from *Kwamecorp*, each with varying degrees of involvement in the *BOND* project. The following list details short bios of the various contributors.

- **Kwame Ferreira**, the CEO of *Kwamecorp*, whose diverse ventures consistently revolve around the notion of socially conscious technology. Kwame is also the inventor of the VOID design methodology for growing innovation through rapid prototyping and validation at every iteration. He is a compulsive traveller.

- **Christoph Dressel**, is COO and partner at *Kwamecorp*. He has been an entrepreneur on the web and mobile since the '90s, consulting on operating systems for mobility. He is currently exploring Design for Happiness, which mixes aspects of yoga and well-being, for best practices on how technology best enables life.

- **Joao Ferreira**, a senior UX/UI designer with close to 15 years of experience in digital media, an alumnus of *BBDO* and *YDreams* – a leading interaction design company. He has been involved in the *BOND* project since its inception. He is also an Assistant Professor at the Faculdade de Belas-Artes (Faculty of Fine Arts, University of Lisbon). Also, a devoted family man.

- **Dominik Seeger**, senior communication designer skilled in graphic design, branding and UI. He has passing acquaintance with *BOND* so far but has acquired valuable marketing acumen for new media. He is afraid of shaving.

- **Eduardo Ulrich**, UX and motion designer with a background in psychology; gravitated to new media and interaction design naturally. No

formal involvement with *BOND*. He is extremely enthusiastic about surfing, body-boarding and collecting guitars.

- **Guillermo Landin**, UX director, now full-time CEO and champion of *LokLok*, a *Kwamecorp* venture. (*LokLok* is a simple, intuitive shared cover-screen app for *Android* smart phones.) *LokLok* shares many core notions of connected intimacy with *BOND*.

- **Hugo Alves**, social media strategist and community manager, handling new media copy, marketing and outreach for a range of *Kwamecorp* projects, *BOND* included. He is trained in clinical psychology and has 2 years of experience in social media. He is also a voracious reader and a 'mind-hacker' whose hobbies are "failing and learning".

- **Pedro Cardoso**, UX/UI designer and design team lead. More than 15 years of experience in digital media design, and was a senior designer at *YDreams*, working on a variety of new media applications from printed electronics to museum experiences. He came to *Kwamecorp* just after the inception of *BOND* but his ideas have profoundly influenced its development. He moonlights as a professional photographer.

Of these, nine interviews with the six of the designers (all except Kwame and Chris) are formally recorded as the source text for analysis. The content of these interviews range from specific details from development trajectory of *BOND* to the design intentions behind the *BOND Touch* module.

Phase 4: Analysis

Finally, in the fourth phase, the principal investigator undertakes a critical analysis of the collected research material. The interview recordings (nine in total) are transcribed into text; (these can be found in the **Appendix**). A detailed *YUTPA* analysis of the *BOND* product is done by the principal investigator based on personal observations and the design history. These are systematically contrasted with the interview transcripts, thus validating *BOND*'s ability in various sub-dimensions of the *YUTPA* framework (see **Chapter 4.3**).

Ultimately, the principal investigator arrives at a comprehensive conclusion of whether witnessed presence can be enacted by *BOND Touch*. Moreover, the emerging themes from the research material are also briefly discussed (see **Chapter 4.4**).

Outcome

The literature review deconstructs the major terms of the research question, namely *networked wearables* and *witnessed presence.* The unique qualities of wearable electronics and the larger networked context in which wearables will enter and serve in society are useful to provide an informed philosophical backing to the design of the *BOND* platform. Likewise, the application of witnessed presence via wearables will contribute qualitative validation parameters to test the design of the *BOND Touch* module. The conclusion consolidates the major learnings from the research effort in a comprehensive summary that serves as a primer for the design of networked wearables (see **Chapter 5**).

In all, the main deliverable is a thesis document, conforming to the requirements of the Engineering and Policy Analysis (EPA) Masters Programme at TU Delft.

3. Theoretical Insights

The principal investigator refers to literature to arrive at wearables from three separate perspectives: namely, the technological, cultural and socio-political. The study thus explores wearables as a medium, networked wearables for social connectivity, and finally wearables as an opportunity to implement witnessed presence in socio-technical systems. Each perspective is contained in a dedicated section.

In the first section, Marshall McLuhan's Medium Theory is elaborated upon, and then applied to wearables to capture the unique qualities of the new medium. In the second, Manuel Castells and Barry Wellman are key references whose work details the role of the communication technologies in society; insights which contextualise the demographics and social relevance of networked wearables. And finally the third section summarises the work of Kelly Oliver and Caroline Nevejan, on witnessing and witnessed presence respectively, generating parameters to validate witnessed presence in *BOND Touch*.

3.1 Wearables as McLuhanesque media

To arrive at a working definition of the essence of wearable technologies, the work of Marshall McLuhan is chosen as the basis for investigation. Marshall McLuhan was a Canadian communications theorist who wrote meta-analyses about the impact and implications of technology in society. As a disclaimer, the principal investigator must disclose that McLuhan was not without his critics, and for a time, was dismissed by some experts (Meyrowitz, 2001).

McLuhan is (in)famous for his process-oriented dialectical approach (Bobbit, 2011). As such, his open-ended prose, intended as probes (Norden, 1969), invited much criticism for its floral style and general lack of methodology (Meyrowitz, 2001). However, there has been renewed interest in recent years. The principal investigator was particularly encouraged by a keynote address by Joseph Meyrowitz (Meyrowitz, 2001), calling to renew McLuhan, whose works have only become more relevant in the digital age than they ever were at the time they were originally published.

Meyrowitz specifically recommends McLuhan's works are best utilised *in combination* with other sociological theories, because Medium Theory was primarily intended to cast light on the significant effect of technological media on society, not serve as the primary worldview to study society (Meyrowitz, 2001). Other papers have also since been published that explicitly formulate clear and linear theory from McLuhan's prolific works of 'exploratory Practical Criticism' (McLuhan, 2008).

The simplest introduction to McLuhan's approach to Medium Theory can be demonstrated thus. Consider a violin playing a rendition of Mozart. Insofar as the violin is one of many instruments *with which* the composition can be played, the violin can be said to be a tool. However, it can also be argued that the violin is a medium, *on the basis of which* the music was composed. Marshall McLuhan was among the first theorists to identify this strange transcendence of (some) technologies in his seminal book "Understanding Media".

Tools as extensions

First, it is important to define the term 'technology' to narrow down which (material) artefacts we refer to as technology. Humans create both hammers and paintings, computers and moisturisers, but not all of these would be classified technically as tools. The importance of tool as a descriptor of technology was emphasised by McLuhan and other thinkers in this area – wherein a tool is defined as *an extension of human capability either by replicating, complementing or amplifying* (Lawson, 2010). For example, a telescope extends vision, and robotic arms extend the reach and strength of human arms. McLuhan famously diverged from earlier extension theorist Ernst Kapp by distinguishing between extensions of the body and extensions of cognitive functions (Lawson, 2010).

David Rothenberg generalised this dichotomy further to extensions of action and extensions of thought, concluding that any technology is an extension of human intention given the mechanism of that faculty is known and understood well enough to automate (Brey, 2000). In recent years, Philip Brey comparatively analysed the extension theories of Kapp, McLuhan and Rothenberg, noting the need for 'extension' to apply to any example artifact without counter-examples.

Specifically, Brey further narrows the definition of tool as an addition to an "*inventory of means*", much like a repository of tools to pick and choose and mix-and-match at will, that allows us to extend our capabilities and realise our intentions, whatever they may be (Brey, 2000). This updated definition of tool as one extension in the collective "*inventory of means*" seems compatible still with McLuhan's Medium Theory.

Tools as media

McLuhan begins with the premise that all tools are intended as extensions of ourselves, be they physical, social, psychological or intellectual. Tools typically extend in that they amplify and/or speed up human functions, intentions and processes (McLuhan, 1964, p.8). However, he differs from other extension theorists in his elaboration of the (social) effects and consequences rather than the content or potential of the tools themselves.

His notion is simple but profound: that technological media are to be seen as not just objects to manipulate in the human environment, but as the environment itself, in which case, the use of media shapes entire societies the same way geographic terrain or the regional climate would.

McLuhan's use of the word 'medium' is with good reason; in the same way the life of a fish is very different from the life of a bird, the expectations of a pre-Internet TV consumer would be very different from that of an Internet surfer (Slunecko and Hengl, 2006). In his own words then, "[McLuhan's] work is designed for the pragmatic purpose of trying to understand our technological environment and its psychic and social consequences" (Norden, 1969).

Given the trends of his time, the advent of widespread use of television, radio and the earliest computers, McLuhan was pondering the effects that these media would have on society as a whole. The principal investigator, as agreed by many, posits that McLuhan was in fact presciently anticipating the far-reaching effects of what we now call the Information Age. Indeed he says, "Rapidly, we approach the final phase of the extension of man – the technological simulation of consciousness, when the *creative process of knowing* will be collectively and corporately extended to the whole of human society, much as we have already extended our senses and nerves by the various media." (McLuhan, 1964, p. 3-4; emphasis mine). The principal investigator interprets the phrase "creative process of knowing" that McLuhan refers to, as the unprecedented flow of information itself.

Considering his emphasis on the profound changes that literacy (reading & writing) brought to earlier oral societies, it is easy to see why he would see electric media as a means that essentially freed knowledge from its typographic and geographic prison, accessible only to those with access and the required literacy.

All technologies can be said to be (originally) tools, and some technologies become media. Of course, one could argue that by McLuhan's definition, all tools once in use become media. However, the principal investigator of this paper would like to make a distinction in the scope of transformation afforded by different media, in which case, hammers cannot be said to have transformed society as fundamentally as computers, for example. Perhaps there is an

element of temporal relevance as well, in that a club (hammer-equivalent) would be more transformative to Neanderthal society than a computer.

Alternatively, one could cast the hammer as a derivative of a broader know-how of the blunt-heavy surface, or the nail as a derivative form of the sharp point as a know-how. In this view, the blunt-heavy surface is manifested in hammers as well as clubs, paper-weights, wrecking balls etcetera; that is to say, assimilated into civilisation to such an extent that even discussing it as a technology seems irrelevant, though these qualities were once un-obvious to primitive men.

Each tool, however simple, requires (basic) tacit knowledge of its use; to understand a text written in hieroglyphics (or in truth, any foreign alphabet), one must first recognise it as a language, and in addition must be passingly fluent in that language. Otherwise, the text remains undeciphered as a mass of curious scribbles. From a Heideggerian *dasein* perspective, a foreign script may be initially *ready-to-hand* but it gains most value only with fluency and familiarity, thus becoming a medium, *present-at-hand* as a mental concept not unlike the tacit understanding of the benefits of the blunt-heavy surface across a broad range of applications (Turner, 2012).

The popular adage "*if all you have is a hammer, everything looks like a nail*" (Maslow's hammer) casts light on the transition between a tool and a (temporally transformative) medium. Namely, a technology is a tool as long as it remains *one of many* means to achieve an intention whereas a medium dictates operationalisation of intention uniquely in ways it (alone) can excel at. In simpler words, a medium changes the perception of a problem into one that employs that medium as the solution.

A good example of this would be *Google* (*Search*) as a tool and *Google* as a word in the dictionary. The former refers to a specific functionality that the tool provides whereas the latter (used in context as a medium) is a paradigm-shifting lens reflecting a worldview of omniscient digital interconnection. Technology in a sense transcends its physicality as a tool and gains semantic & semiotic status to become a medium (Faculty of Communication Studies, 2013).

This is in fact McLuhan's greatest insight, that we are prone to using the light bulb or the book or Google in much the same way as Maslow's hammer. Now this is not to say that technologies becoming media is a phenomenon to be cautious of. Rather the implications are significant but rarely noticed.

The effects of media

McLuhan's famous one-liner, "the medium is the message" is indeed thought-provoking (McLuhan, 1964, p.7-21). By this he meant that the existence of the medium itself is a sign of the significant structural socio-technical change (Federman, 2004). McLuhan illustrated in one example that whether one plays baseball at night in a stadium or reads a newspaper under a lamp, the message of electric light itself is one of on-demand liberation from human inability in darkness (McLuhan, 1964, p.8-9). It is this 'message' that fundamentally shapes societies therein – perhaps best exemplified by a slogan like "the city never sleeps" – not the information consumed under electric light.

Insofar as media are extensions of ourselves and primordially enhance our *being-in-the-world*, we establish an equilibrium of sense-ratios. New media (or extensions) stimulate existing sense-ratios in new ways, which momentarily excite the user. McLuhan terms this *self-adulatory numbness* in reaction to new media as 'Narcissus-narcosis' (McLuhan, 1964, p.41). Narcosis here signifies a kind of 'closure' to the media-as-extension-of-self, wherein the initial narcissistic fascination from over-stimulation of existing sense-ratios effectively hides the process where a new equilibrium of sense-ratios is being established (ibid).

By the time this numbness wears off, the depth-effects of media have been rendered invisible, according to McLuhan. Not only this, the new sense-ratios are inevitably in favour of the new media, thus prolonging symbiotic and sustained use (McLuhan, 1964, p.45). Given that multiple tools are in mass use at any one time, one can get a sense of a media ecology (of multiple tools sharing use and dominance) in a socio-technical system. Various media, new and old, are dynamically reassigned in application, and in turn dynamically reassign their users sense-ratios, changing their scales of influence (Meyrowitz, 2001).

As pointed out earlier, the content of any media is always other media in the same sense electric light is only recognised as a medium on the basis of the content it illuminates.; "The content of writing is speech, just as the written word is the content of print, and print is the content of the telegraph" (McLuhan, 1964, p.8).

This is an interesting line of thought. When a new medium (*M* for clarity) emerges, it delivers prior media forms as content – that is to say, *M* is initially a carrier-medium. But as *M* (alongside other media) evolves, it become content for newer media; or one could say that *M* becomes a content-medium for other media. Given that *M*-as-content-medium is still also a carrier-medium, there is an implicit recursion of media-within-media. This is a novel way to think about the term *multimedia*: as a media-within-media experience.

There is also the notion of *amputation* to discuss. With growing dependence on new media, there is an *amputation* of the embodied ability that the new media amplifies or accelerates (McLuhan, 1964, p.45). This 'closure' of now-irrelevant native faculties might be seen as a loss; but also as a re-configuration of sense-ratios to fully take advantage of the newfound technology. A contemporary example would be the gradual inability, or perhaps unwillingness, to perform mental arithmetic now that calculators are ubiquitous. On the other hand, it is perhaps only on the basis of such closure that new paradigms of computational analytics can be developed.

Amputations may also be socio-political in nature, and therefore more apparent. McLuhan provides the example of bus conductors in Thailand who keep long fingernails on their little fingers to mark used tickets (Fankboner, accessed 2014). However the long fingernails (literal, and in this case figurative, extension of the nail) have taken on a sociological meaning, denoting status above menial labour; but in so doing, the bus conductor has unwittingly *amputated* his ability to do menial labour for the ability to mark tickets (ibid).

Hot and cold media

McLuhan's designations of *hot* and *cold* media deserve some exposition. "A *hot* medium is one that extends one single sense in high definition. High definition is the state of being well filled with data" (McLuhan, 1964, p.22). And so, *hot*

media are 'hypnotic', requiring very little cognitive effort to 'fill in' missing information, ultimately demanding low interaction or participation of its users (ibid). On the contrary, *cold* media are low-definition, requiring users to interpret and therefore participate more.

Hot media are hypnotic, which suggests unwitting involvement nevertheless, so what is the difference between *hot* and *cold* media with respect to participation? *Hot* media exclude and *cool* media include (McLuhan, 1964, p. 23). The principal investigator posits that McLuhan's use of the words 'exclude/include' implies a sense of total-field awareness; creative participation of the user with not just the technology but the contemporary technological environment itself.

In a nuanced example, he describes the defragmentation of an Aborigine tribe – whose patriarchal culture was traditionally tied to (scarce) stone axes owned by the men – when missionaries provided an abundance of steel axes to every man, woman and child (McLuhan, 1964, p.24). He implies further that the steel-axe was a *hot* medium (in contrast to the stone axe).

What is the difference between a steel axe and a stone axe in this curious case? They both provide the same functionality (or content). However, the stone axe was scarce (*read: the making of the axe itself implies creative/participative improvisation of natural and social environment*), requiring the community dependent on it to share and collaborate. On the other hand, the steel axe was abundant (*read: mass-manufactured and reductively operationalised for a specialised task*). Thus, the sense in which McLuhan claims that *hot* media de-tribalise and *cool* media re-tribalise becomes clear (ibid). Furthermore, it is seen that *hot* high definition media are specialised to their task.

McLuhan points out that a photograph is visually in high definition, whereas a cartoon is low definition (McLuhan, 1964, p. 22). Compare a photograph of a natural disaster to a political cartoon in a newspaper. The amount of interpretation required for the latter is higher, and the effort is successful only if there is an intent to 'participate' and decipher the image and its satire. On the other hand, the photograph requires no interpretation; it is obvious at face-value. (Perhaps this explains why the term 'photoshopped' has such a negative connotation on the Internet, implicitly referring to this forced manipulation of interpretation in a way that is deceptive and obfuscated.)

McLuhan gave numerous examples for *hot* and *cold* media, but given his emphasis on the terms not being absolute but relative to the surrounding media ecology, the principal investigator posits that the *hot/cold* media of his time have not stayed exactly the same over the decades. For example, a cartoon strip is a *cold* medium (requiring creative involvement) whereas a modern graphic novel (an evolved form of the comic strip) is more likely a *hot* medium (with high-definition visual illustrations).

Thus, the importance of recognising *hot/cold* media slowly becomes clear. The Internet (including the media that access it like personal computers and smartphones, and the media on it like *Facebook*, email or *Twitter*) is equally capable of being a *cool* medium or a *hot* one, depending on the kind of multimedia accessed on it. As such, it is not a leap to say that the Internet (and personal computers and smartphones) can become in certain cases *hot* and 'hypnotic', denying reflection and creative involvement.

Wearables as media?

Now that the terminology of tool and medium have been established, with a brief look at the implications of a technology being either (if not both), the principal investigator would like to return to the original premise: wearable electronics as a new medium. Perhaps the principal investigator's move to claim that wearable electronics should be seen as a new medium is not unexpected at this point.

Making this claim helps define the research scope. Firstly, there is a departure from product-centric approach to consideration of the network effects of a platform. Secondly, a McLuhanesque look divorces the medium from its content, allowing for analysis not distracted by specific implementations, previous media paradigms or the quality of content. As pointed out earlier, the content of any media is always other media (McLuhan, 1964).

Consider this: the content of television are the media of image, sound and video. To discuss the impact of television should not be side-tracked by a consideration of specific media shared via television. In the context of wearables, many present smart-watch offerings directly translate existing

functionalities of the mobile phone, such as notifications and stripped communication functions. By considering wearables in theoretical isolation from already existing use-cases, it may be possible to discover new use-cases that capitalise on the unique advantages of wearables. Put simply, one can answer what wearables can do that even a smartphone would struggle at.

Firstly and most simply, the term 'wearable electronics' is deceptively generic, with no direct or associative semantics describing its function. While a screw or a hammer retain a primary use pattern, a computer or a book do not in any way suggest similar information. As forms of media more than just tools, the computer or the book could be used in many contexts with many applications, from education to leisure to industry. The term 'wearable electronics', in a sense, already lends itself to many different contextual uses in multiple arenas, implying that is in fact a medium, and not a tool with a primary use pattern. This is not just a question of semantics; from the business intelligence on wearable electronics, it can be seen that potential applications are currently expected in areas as diverse as personal fitness & healthcare to leisure & fashion to industrial applications (ReportLinker, 2013).

Alternatively, one could consider other incumbent technologies which transitioned from tools to media. Georg Rückriem argues that computer technology is a medium on the basis that its influence on society and our current over-dependence on it is irreversible (Rückreim, 2003). Indeed, McLuhan's successor Derrick de Kerckhove described media as "*weltanschauungsapparate*" or apparatuses of world-views (Rückreim, 2003). Consider that the bulk of content that computers produce can only be appreciated with a computer or be transformed into other media via computer peripherals. This self-referential loop is also indicative of how a medium becomes indispensable. Thus the principal investigator suspects there might be a correlational, if not causal, link between network effects of use and the rise of a medium. Wearables, as one upcoming component of larger trends in ubiquitous computing, promise similar network effects, becoming more useful with a richer ecosystem.

Given the rapid rise of the Internet from an niche military-academic network to *de facto* global communication platform within the span of a few decades (Castells, 2001), and similarly the adoption of the mobile communication technologies resulting in entirely new social structures (see **Chapter 3.2;** Rainie

and Wellman, 2002), it is not hard to see that communications technologies are transforming into media faster and faster. The ubiquity of smartphones is “the biggest [technological] leap in history”, transcending even the impact of the printing press (“A world of witnesses”, 2008).

Indeed this insight desperately highlights that designing a medium requires much more careful consideration than designing a tool, with the implications of long-term, widespread adoption and of course, the network effects that accrue when the medium becomes so essential it can be categorised as infrastructure.

Haptics and embodiment

One key aspect of wearables that remains ripe for exploration is its eventual location on the person of the user, likely in contact with skin. This raises interesting questions. Firstly, the sense of touch is finally open for technological stimulation, whereas most present (communication) media predominantly engage visual and aural senses. Sense of touch, in turn, is inextricably bound to notions of embodiment, personal space and intimacy. As such, tactility is an interesting dimension to explore in wearables.

McLuhan takes effort to make the point that the alphabet (as a medium) in combination with the cultural impact of the printing press, shifted the sense-ratio of typographic man (analogous to Western man) to a primarily visual field (McLuhan, 1964). In contrast, the oral traditions and close-knit groups of tribal man means his sense-ratio remains predominantly an aural-tactile field of sensory experience (ibid). Such discussions of visual primacy and its implications on (Western) culture and philosophy are not uncommon in phenomenological discussions (e.g. see Loomis, 2003).

"Oral man acts and reacts simultaneously, whereas the capacity to act without reacting, without involvement, is the special gift of 'detached' literate man." (Norden, 1969). McLuhan suggests that electric media re-tribalises typographic man due to its lack of centre and boundaries, harking back to the encompassing aural-tactile sensory field of tribal man, contrasting with the highly ‘rational’ sequential logic of the visual space (McLuhan, 1964, p. 24). Human acoustic space is a sphere where we hear from all directions with no intuitive centre or margins, and tactile space in a broad sense is a region of

embodied presence; whereas our visual space is one-directional and organised in lines of sight and perspective. The principal investigator reinterprets the word 'space' as an *envelope of real-time sensorial experience that encompasses each individual*, an individual's phenomenological bubble (Turner, 2012). This is also supported by a cultural psychology treatment of Medium Theory (Slunecko and Hengl, 2006).

The haptic sense needs no introduction per se. To McLuhan, tactility is not just the sense of contact on skin, but also an "interplay of the senses" (Johnstone, accessed May 2014). He conflates it with synaesthesia and attentive participation. From a Heideggerian *dasein* perspective, this definition of tactility can be re-interpreted as embodiment itself (Turner, 2012). In addition, the notion of (creative) participation in *cool* media can also be better understood by this new definition of tactility – participation via a multi-sensory experience, as opposed to the high definition stimulation of a single sense by *hot* media.

Despite its speculative basis, there is an intuitive logic to this thought; the relevance to the touch modality of *BOND Touch* is uncanny and raises similar questions. Can the ability to effect disembodied, space-time-decoupled touch change the way we connect on digital networks?

According to extension theory, man himself is embodied and extended in his tools (Brey, 2000). In a Heideggerian sense, if embodiment is at the core of *being-in-the-world*, tools extend the capabilities of embodiment the way prosthetics optionally extend the embodiment of disabled individuals (Slunecko and Hengl, 2006; Turner, 2012). In Medium Theory, tools-as-media don't just extend the body, they 'enhance and escalate the human's *being-in-the-world* in totality' with an implication of mutual constitution (Slunecko and Hengl, 2006). There is every indication that wearables, deployed right, fundamentally augment an individual's perception and response in a native embodied sense (Mann, 1998; Starner, 2013).

We assume our tools are within our control (as one-of-many means to achieve a goal), but in fact the tools can become proverbial Maslow's hammers, in which case, the tools control our behaviour. Such fundamental change in use-patterns, of *being-in-the-world* as it were, must surely affect the organism profoundly. Medium Theory's embedded technology is thus a natural counterpart to phenomenology's embodied situation (Slunecko and Hengl, 2006).

In simpler words, technology-mediated haptic stimuli extends the exclusive embodiment of human touch.

From the perspective of wearable electronics, given the wide range of functionalities made possible, the corresponding *amputation* of abilities might be individualised and fragmented in the population. More pertinently, the scope of such *amputations* might be more invasive, substituting or perhaps replacing biological abilities. Consider this research paper on tailored displays automatically compensating for abnormal biological vision (Pamplona, Oliveira, Aliaga et al, 2012). Implementing such technology from an optical wearable might enhance user vision seamlessly. But the principal investigator questions if there is a foreseeable cost to biological integrity.

In 'Understanding Media', McLuhan quips off-hand that "electric light is pure information", highlighting that the bulb has no content in itself (McLuhan, 1964, p.*x*). In the same sense, the principal investigator observes that electric *touch* is also primordial kinaesthetic information in the *BOND* concept.

Continuing the analogy, tactile wearables like *BOND* must be designed to not unwittingly *amputate* the kinaesthetic sense with overstimulation, in the same sense of being blinded by too-intense lighting. Imagine the horror: invasion of personal space by physical touch (human or technological) at the same frequency as email/FB notifications!

On the other hand, deploying tactility tastefully and tactfully to emphasise emotional significance might add a new dimension to existing multimedia, a metadata field for the human touch. The principal investigator sees this as analogous to fully-capitalised text on a page effectively transmitting the same sense as vocal shouting, transforming otherwise disembodied text into strong personal messages. The principal investigator enthusiastically recommends further user experience research into this novel sensory experience.

Digital & electronic skin

Wearables can be compared to a large extent to the earlier technology of clothing in that they are both worn or adorned by the user to serve a useful function. McLuhan asserts that clothing is an extension of human skin, which in

its present form serves both to protect against the elements and to distinguish its user in social settings (McLuhan, 1964, p.119).

Just as clothing extends the skin, wearables can be thought of a electronic layer of skin. At minimum, this can already inspire a range of applications for wearables, enhancing some of the present functionalities of skin: namely, sense of temperature, sense of pain, sense of pressure, sense of touch etcetera. More pertinently, networked wearables can also access digital information and transmit digital stimuli. The principal investigator finds this potential area of application very promising; digital stimuli can be 'affective' on users. Imagine for example a *Facebook* 'poke' physically transmitted as a 'poke' by a networked wearable – an unprecedented physical relationship with information. Recalling the earlier assertion that information is a rich new dimension made accessible by ubiquitous computing (see **Chapter 1**), this is indeed a timely advance.

Equally, McLuhan highlighted clothing's historical on-off courtship with the visual sense. In tribal culture, man with his more 'tactile' sense-ratios only cared for the functionality of clothing while in feudal culture, clothing exposed social classes in an explicit manner (McLuhan, 1964, p.119-122). Visual couture was de-emphasized with the paradigm of mass-manufacturing brought on by the Industrial Revolution, but brought back yet again by the populist notion of individualism which favours uniqueness (ibid).

Wearables will no doubt be subject to similar trends based on the importance of visual distinction among contemporary social norms. It is recommended that at least some degree of visual customisation is present in wearable offerings to present a compelling product for customers.

The electronic nature of wearables however subject them to technology adoption trends as well. On the one hand, the traditional technology adoption curve suggests that new technology is first patronised by *innovators*, then *early adopters*, *early majority*, *late majority* and *laggards* (in that order) (Downes and Nunes, 2014). However, the same article reports this model is increasingly irrelevant for some new technologies, suggesting instead a 'Big Bang' model where markets take off suddenly, or they don't take off at all (ibid). Effectively, this divides the adoption curve into only two populations: *trial users* and *everybody else* (ibid).

Moreover, "Big Bang disruptions" not only experience meteoric rise in market penetration but also an almost-overnight fall as well (ibid). The authors advise that the product strategy needs to account for this and either be prepared to scale down, or move their assets to a different industry (ibid).

This is in line with the trend of a technology landscape increasingly defined and dominated by disruptive innovation; where new entrants undercut existing solutions in both price and complexity, thus overtaking incumbents in ways that the larger companies cannot afford to explore (Christensen, accessed August 2014).

So these market trends should also inform the development, pricing and deployment of wearables.

The essence of wearables

McLuhan and son designed the following tetrad to analyse any form of media critically (Sandstrom, 2012). These are empirically testable questions whose answers reflect not only the unique characteristics of the medium, but also its features and capabilities cast in comparison to other contemporary or even atemporal media. The resulting questions were based on the 4 Laws of Media: *extension*, *obsolescence*, *reversal* and *retrieval* (The Deoxyribonucleic Hyperdimension, 2008).

- What prior functionality is *retrieved* in the new media?
- What *reversals* of original traits does the media display when pushed to its limits?
- What forms of media does the new media *make obsolete*?
- What functionality does the new media *enhance*?

It is clear from McLuhan's examples as well as the open-ended nature of the questions that they are intended as points for exploration, rather than categorical right or wrong answers. A McLuhanesque interpretation of computer technology according to these questions yield the following answers (The Deoxyribonucleic Hyperdimension, 2008):

- Computers *retrieve* a numerical/deterministic mind-set, at least in direct interactions.
- Computers *reverse* from sequential to simultaneous processing.
- Computers *obsolesce* human logic and reflexes in (repetitive) sequential actions.
- Computers *accelerate* sequential calculations exponentially.

Now one can attempt to frame wearable electronics in this context. First the conceptual wearable is deconstructed, stripped independent of its specific functionalities, to a generic state of *portable mobile electronic hardware worn on select body areas to extend or enhance certain actions*. The following then would be one possible interpretation of wearable electronics in the framework of the tetrad (McLuhan, 1975).

Retrieval

- Wearable electronics *retrieve* the freedom and mobility that was lost with reading/writing/computing as media - one has to physically sit down at a table or console, temporarily setting aside the reality-we-are-in for the reality-on-the-page/screen (Starner, 2013).

  Wearable computing on the other hand can be situationally adapted to context and environment, in much the same way our biological eyes dynamically adjust to see in the dark. There is much to be said about the role of acute situational awareness in increasing the level of presence, which in itself is essential for ethics, well-being and survival (Nevejan, 2012).

- Wearables *retrieve* the specialisation and individuality that McLuhan posited was lost with the advent of anonymising power of electricity (McLuhan, 1964). Wearables buck the trend of standardised mass-media devices with truly individual device choices. An easy analogy would be the option of uniform devices (metaphor for popular smartphone models, one-size-fits-all philosophy) versus the freedom to wear/extend what you please (immense variance, easy dynamic mix-and-match permutations). This has implications beyond mere market demographics. There is an incredible opportunity for personal data tracking and analysis.

- Wearables *retrieve* a balance to embodiment given the merging realities of both online and offline worlds in our socio-technical societies. Digital stimuli can now also be 'affective' on the user.

- Wearables *retrieve* the co-ordinates of space to disembodied information flows, both geographic place and social position. A note sent to an address only catches the owner upon returning home; a note or SMS sent on mobile only catches the user when there is notification, motivation and time to look. A communication sent to a wearable however catches the user wherever, whenever, providing a digital means to 'intervene' in real-time. This can be a distinct advantage.

Reversal

- Wearable electronics *reverse* convenience of access with the inconvenience of too-much-information. On a related note, wearable electronics may be technologically possible but culturally frowned upon, as is observed with *Google Glass* (Yarow, 2014).

- Wearables also *reverse* the relative holistic autonomy of the human animal to reductive mechanised specialisation of certain organs, in turn profoundly influencing individual sense-ratios in unforeseeable ways, much like the onset of blindness would dramatically increase the influence and sensitivity of hearing and touch. Thus the *amputations* prophesied by McLuhan, in the case of wearables, may be biological in nature.

- If there is an information overload, wearables *reverse* from providing heightened situational awareness of the world (*cool* media) to hypnotising *hot* media experiences (McLuhan, 1964).

Obsolescence

- Wearable electronics *obsolesce* privacy and anonymity of the user - always-connected networked devices are always uniquely identifiable unless extraordinary measures are taken to protect such data. On the other hand, the omniscience of *Google* or *Wikipedia* could transcend

from option to second-instinct.

- Wearables *obsolesce* the distinction between man and machine, especially in the sense of cognition versus computation. As Steve Mann attests, long-term adaptation to powerful on-demand at-the-fingertips computing becomes native expectation (Mann, 1998).

- Wearables can *obsolesce* the interface between man and technology. In a way, *Google Glass* already has this as a design philosophy, which is to reduce the time between user intention and first action (Starner, 2013). The implications being seamless media experiences, and a sense of user experience design of lifestyle itself via wearables.

- Wearables might *obsolesce* certain technological rituals through closure, thus reducing the attention such actions might require. With *Google Glass* for example, taking a picture can optionally be triggered by a simple wink gesture. This not only obsolesces the physical delaying act of aligning a camera device and framing the composition, but also visually anonymises the 'silhouette' of a potential photographer.

  Generalising the analogy of the 'silhouette', there is a change in the ritual of an action, but the gain is less friction to effect the action.

Enhancement

- Wearable electronics *enhance* a visceral tactility and connection that traditional computing media do not share with other tools and media. This need has been partially observed in the industry shift to touchscreen and haptic feedback systems. This paradigm shift in computing interfaces may help rescue us from our Baudrillardian obsession with reality-on-a-screen, bringing us back to a Heideggerian *being-in-the-world*, echoing the *Google Glass* design focus (Starner, 2013; Turner, 2012).

- This visceral tactility can also *enhance* our technology-mediated interactions, thus extending our presence in both the material world and the digital world, keeping us "in the flow" more often than not (Starner,

2013). *Google Glass* is a good example.

- Wearables *enhance* embodied action with the benefits of real-time computation, to the extent of enhancing the situational awareness of its user. As demonstrated by wearables like the *Glass*, it can be of benefit to high-performance situations to seamlessly track and modify performance with the help of technology.

- By virtue of their form-factors, wearables will necessitate a conciseness of information with clear calls to action with almost instinctive follow-through, *enhancing* a responsiveness to digital stimuli thus far limited to primal bodily responses to pain, hunger, heat or touch.

Overall, this set of answers to McLuhan's laws of media is by no means comprehensive or complete, but for the purposes of this analysis, serves to highlight important and essential qualities of wearables.

Learnings for wearables

Coming to the end of the review of McLuhan's work, the principal investigator will now attempt to summarise the gestalt understanding of wearables from the theoretical discussion above. In view of McLuhan's theory-encompassing quip "the medium is the message", it seems apparent that wearable electronics as a medium, independent of the functionality they might provide, benefit uniquely from their form-factor.

It is established that wearables can by virtue of their form-factor enhance embodied functions contextually, thus mimicking biological organs. As such, in their symbiotic functioning as devices 'worn' on the person of the user to enhance the "*inventory of means*" *ready-at-hand*, wearables become removable technological organs. Based on the answers to the laws of media discussed in the previous section, many practical considerations of wearables come to light.

Design principles for wearables

Many qualities of wearables are already of obvious interest to professionals in specialised fields, but how can wearables be relevant as consumer electronics? How will they benefit everyday life? The emerging theme here then is **contextual embodied augmentation** as a underlying philosophy maximising the potential of wearables.

Augmentation

By *augmentation*, the principal investigator implies specialisation as opposed to amplification. Mechanical amplification in the context of wearables suggests users themselves become part of the amplifying machinery; given the implications of Medium Theory, this is not recommended as a design paradigm. Mechanical specialisation provides intuitive affordances for tedious tasks. Cognitive amplification on the other hand, *a la Google Glass,* seems possible. Cognitive specialisation is clearly a ripe opportunity to assist action through cognitive enhancement.

Augmenting via specialisation creates nuanced situation-specific affordances; this context-sensitivity aspect is discussed shortly. However, specialisation (catalysed by affordances) can be said to *heat* up a medium, making it more high definition and 'hypnotic' (McLuhan, 1964).

Thus, the principal investigator sincerely recommends that wearables should be mindful of *hotness* and *coldness*. Both qualities can be valid depending on the intended application. For example, for visual augmentation of reality with notifications or real-time tracking, the infographics are recommended to be *hot*, supporting quick cognitive use. On the other hand, creative or communicative functions must strike a balance between (*hot*) quick interactions and (*cool*) creative participation.

Context-sensitivity

In general, context-sensitivity is another way to say specialisation and personalisation. C*ontext-sensitivity* demands specific affordances (Soegaard,

accessed August 2014). Not only can wearables ease or nullify unnecessarily repetitive bodily movements in full context of modern lifestyles, from finding car keys to unlocking doors and phones, from taking a picture to answering a call, clicking the back button or checking in on *Foursquare*; they can also contextually enhance specific activities with real-time data for situational awareness (like *Glass*).

Speaking of situational awareness, this may work to enhance passive monitoring of a known activity like the dashboard of a car, but also, to actively guide the user through an new or complex situation like an interactive cue card. In augmenting everyday life, the design focus is on minimising cognitive load and physical tedium. This extends experience design into everyday life.

Embodiment

This is not to say that wearables cannot succeed if they employ intelligence beyond context-sensitivity; rather, this is a conscious design recommendation.

Embodiment here refers to this intuitive sense extension; the use and response should be directed always towards physical actions and physical things, and minimising distractions that lead away from it. An everyday wearable that disengages the user from physical reality in favour of a virtual reality in-the-screen is not only recreating the existing functionality of computers and mobile phones, it becomes itself a virtual-reality experience, which is not the desired notion of enhanced everyday life.

As Weiser and Brown recommend, ubiquitous computing, wearables especially, should be a "calm" and "user-centering" experience (2014). Thus wearables must provide just enough additional agency to promote higher involvement of *being-in-the-world*. The presentation format should be amenable to quick cognition, and the call-to-action should encourage intuitive response.

The more affordances wearables are designed with, the more specialised the augmentations, the more they "get out of the way". Only now, users can stay immersed in physical reality augmented with rich digital information, foregoing the false ultimatum of participation limited to either the offline world or the online one. Equipped with an unprecedented technological jump in awareness,

wearables may allow their users to see themselves, each other and the world in a whole new way.

Touch modality in BOND

In the case of *BOND*, *Kwamecorp*'s current 'non-smart' approach to implement modular simple applications to ease the user-experience of everyday actions, is for the most part in line with this guiding principle of *contextual embodied augmentation*. The concept can serve its purpose well in the development of future modules.

McLuhan's phenomenological dichotomy between the visual field and the aural-tactile field, influenced by our history with media, also suggests here that the tactility of BOND Touch not only captures a wearable-exclusive strength, but may also have a deep influence on the sense-ratios of contemporary media users. To the extent that the haptic sense is deeply tied to our embodied experience, the hypothesis is that extension of touch via digital means may indeed extend a sense of embodiment. The transmission of a digital *touch* however ambiguous, constitutes a low definition signal that could serve as *cool* media, thus actively involving the user in its interpretation.

3.2 Wearables and social connectivity

To say that communications technologies have been profoundly transformative to the world is an understatement, more so considering the implications of Medium Theory. At present time the Internet is an undeniable dominant medium, which in turn fundamentally influences the media ecologies it is found in, in a particular way that can be said to be typical of the Internet.

But exactly how have these transformations manifested in culture and everyday life? What are the implications to traditional social ties like family, friend and neighbour? This section investigates these questions to contextualise the social environment in which networked wearables will be deployed.

The Internet and culture

Manuel Castells begins the opening chapter of his book 'The Internet Galaxy', with a title paying homage to McLuhan: 'The Network is the Message' (Castells, 2001). As one can imagine, the book quickly delves into the all-encompassing nature of the Internet in modern society, justifying that the physical networking of computers internationally, regardless of military, commercial or civil affiliations, uncannily mirrors the functional effect of the Internet, a global opportunity to connect and network (ibid). The Internet is now inarguably more than the mere multitude of connected computers; it is no longer *just* a technology, it is a *bona fide* medium - a medium *on the basis of which* yet other media are regularly spawned.

"The culture of the Internet is the culture of the creators of the Internet," Castells claims, linking the particular path of technological developments on the Internet to the diverse and diffuse motivations of the core interest groups that act on it (ibid). Even so, he suggests that while the Internet's boundaries are constantly shaped by them, with its contemporary ubiquity even casual users become creators; and as creators, every user and each new application, ever so slightly modify the state of the Internet as well, adding to its growing significance. It has transformed the realm of business. And vice versa as well

Castells argues, business has profoundly shaped the Internet too (Castells, 2001).

The Internet has also allowed for political movements to organise and operate transcending territorial concerns or boundaries. By seizing the "power of the mind", the Internet allows such movements to even act upon powerful institutions and organisations (ibid). Nowadays, entire cyberwars for social justice are waged by civilian activists on the Internet (see *Anonymous*); and their uncanny weapon of choice is to intentionally disable the offending organisations' activities on the Internet.

The Internet as a communication medium has allowed individuals to form a new generation of communities no longer defined by geographic distances or boundaries. Internet-as-media as content for computers-as-media has created virtual social spaces for real interactions, roles and relationships, thus extending human presence into cyberspace (Rheingold, 1991,1993; Riva, 1997). In this everyday sense, the uses of the Internet are overwhelmingly instrumental, an extension of everyday life, "in all its dimensions and with all its modalities" (Castells, 2001). The keyword is interaction, where there is the capacity to act and react simultaneously.

A hypertext paradigm

Unique to digital interactions is the possibility to have both synchronous and asynchronous communication (Riva, 1997). Here, the principal investigator would like note an interesting phenomenon. Historically, speech was the primary synchronous form of communication whereas (reading and) writing primarily asynchronous. Consider that writing was rather one-directional, confined to a single page for a finite set of eyes at any one time, while not offering the capacity to respond immediately; writing essentially encouraged uninterrupted monologues for limited audiences. (McLuhan rightly defined the book as a *hot* medium.)

In the age of the Internet, writing too can finally enjoy the benefit of a conversational space, with multiple parties all jointly participating in the visual (rather than aural) conversation. In response to the capabilities of its new visual form, the understanding of conversation itself has expanded from a time-

bounded dialogue to an on-going sharing of information. Indeed the character limit of SMS or Twitter could be counted as evidence of this sea-change, de-emphasizing lengthy monologue for 'opportunistic' dialogue. In that sense, a contemporary online forum is exactly the visual counterpart of a physical forum, a conversational space shared by a great number of people.

Synchronous mass communication then, is the trump card of the Internet in that it has enabled the bridging of huge multitudes of people over great distances communicating in common cyberspaces, with both one-directional broadcast and bi-directional dialogue. The scale of this is unprecedented. To get a true appreciation of this, consider this example: it is possible now for thousands of people to connect to the same *Google Hangout* at the same time and participate in a live constructive discussion, with no greater effort than connecting to the local wi-fi network. Imagine the incoherence of a similar group attempting the same feat in the offline world!

When multiple presences interact, culture inevitably emerges. In cyberspace, the exchange of information itself is the sole building block to construct and maintain a presence (Cutler, 1995). Communication is the primary act that functions as both a means of establishing presence and as the medium of exchanging information; online, it is ‘words that act’ (Nevejan, accessed 2014). Perhaps it can be generalised that social communication itself is vital to elevate a digital service into a cyberspace. In this sense, virtual communities even offer a new context to understand human identity in the Information Age (Castells, 2001).

Culturally, the Internet has sparked new communication patterns and even new cultures. Taking its native content stream of multimedia, users on the Internet routinely engage in creative remixing and share them at unprecedented scales (see viral memes). Given the sheer ubiquity of the Internet and its myriad applications in everyday life, Castells writes that there is a “culture of real virtuality” (Castells, 2001). Virtual in the sense that it is primarily based on electronic communication but real also because it is the material basis on which present society operates, and through which social concepts and value(s) are routinely created and propagated (ibid).

The personal Internet

Most distinctively, there is a new wave of individualistic creation of meaning through the virtuality afforded by the Internet. On the Internet, free communication is held as sacrosanct; censorship is seen as damaging and is actively and routinely circumvented (ibid). Users of the Internet are free to create their own content; and create they do, utilising a multitude of democratised self-publishing platforms. There is also a freedom, perhaps an incentive also, to self-network and choose one's own communities (ibid). And these communities stay in contact over a variety of media and modes (Wellman, 2002).

On the Internet, mass media are similarly services or protocols with multiple users engaging and communicating within a short period of time. Here it is interesting to re-define the term *mass media* from its colloquial reference to the size of the audience. To McLuhan, *mass media* is so defined due to the simultaneity of the transmission, rather than the reach (McLuhan, 1964). The total reach of the audience is important too, of course, but only in the sense of the maximum reach attained within a time window where the information is still relevant. In selectively using various mass media for their desired mediated experiences, individuals in the Information Age are building and maintaining desired levels of presence by communicating, thus giving rise to fluid community and culture in a multitude of cyberspaces.

Riva suggests that the new sense of digital presence, and the wide variety of media in which to do so, have shifted the sense of community from "culture-defining mass media" to intentional choice of diverse media as alternative sources of mediated experience (Riva, 1997). Networked wearables may open up a new dimension (or *periphery*) of cyberspace to establish presence in, just like video-chat adds a visual dimension to a phone call.

Castells also posits that the hypertext paradigm that enables individuals to view, process and participate in distinct streams of information necessarily makes each one's experience distinct, thus minimising shared experience (ibid). He says, "we may be heading toward life in parallel universes whose times cannot meet because they are warped into different dimensions of social hyperspace" (Nevejan and Gill, 2012, p.1).

This is in line with McLuhan's reversal law of media. Electric media in the mid-20th century re-tribalised isolated groups with shared experiences via television, radio and newspapers institutionalised and internationalised for the masses (McLuhan, 1964). But the ever-increasing specialisation of these media in the decades since has pushed the trend into retrograde. Even as the possibilities for connection are extended manifold, the sense of community is becoming more fragmented, de-tribalised. Perhaps ironically, an individual in a modern network society is also alone in his experience, just as typographic man in his individual literacy (Castells, 2001; McLuhan, 1964). This ties in directly with the concept of networked individualism, which is covered in the following section.

New media and community

Wellman's studies on horizontal community interactions on a variety of communication modes including the Internet, are interesting to understand how personal networks connect in a network society (Haythornthwaite and Wellman, 2002). This answers the first research sub-question: how do communication technologies connect people?

Communities in network societies

Wellman first updates the notion of *community* to the realities of the present, namely the advances in transportation modes as well as the proliferation of communication modes as well: communities are no longer close-knit village-like groups. Instead, they are increasingly independent of proximity, becoming "networks of interpersonal ties that provide sociability, support, information, a sense of belonging and social identity" (Wellman, Boase and Chen, 2002). Wellman claims this definition is not only indicative of modernity, but also the role of the Internet in modernity (ibid).

In a study of social connectivity patterns of an American sample between 2002 and 2007, results found that the rapid proliferation of new technologies and Internet services did not diminish, correlated with the increased social network sizes, both fostering old ties and forming new ones (Wang and Wellman, 2010). Social structures were also found to be changing with the times, from close-knit

groups to fragmented, sparsely-knit, permeable and specialised networks - this new structure is called the network society (ibid). Rather than be limited to one group, people interact in multiple sets of vaguely overlapping relationships (Wellman, Boase and Chen, 2002). Computer-mediated communication is a part of everyday life, rather than a separate set of relationships (Haythornthwaite and Wellman, 2002).

The Internet is seen to neither 'increase' or 'destroy' community, but rather integrates into the daily life of the community, blurring online and offline interactions. "Internet users socialise as often as non-internet users" (Wellman, Kennedy, Smith et al, 2008). Just as there is an increased independence from distance as a factor in relations, the Internet continues the trend providing not only more alternatives for communication, but also cheaper, faster and more convenient forms (Wellman, Boase and Chen, 2002). It supplements face-to-face and (mobile) phone communications without threatening either; in fact, it is suggested people have more relationships now than before, and contact is made at a higher frequency (ibid).

The Internet is seen to increase social capital; however instead of depending on a single group for support, individuals actively engage a variety of people and resources in different situations (Boase, Horrigan and Wellman et al., 2006). The strengthening of ties through frequent contact both on and offline means "more community members can be mobilised for aid" (Wellman, Boase and Chen, 2002).

The transformation of interpersonal social structures from geographically bounded networks to person-to-person and role-based relations in network societies is referred to as *networked individualism*. (Chronic) dependence on relations for help is minimised in increasingly individualised societies, and personal communication devices are becoming very important to support social connectivity (Wang and Wellman, 2010). Interestingly the trend of networked individualism started even before the advent of the Internet, but is definitely accelerated by it (ibid).

Networked individualism and social connectivity

Networked individualism means connections are person-to-person, with connectivity tied to individual profiles, not households (ibid). Mobile phone ties are also person-to-person. As Wellman puts it, "It is the I-alone that is reachable wherever that I happens to be… The person has become the portal" (Wellman, Boase and Chen, 2002).

He continues, "Each person is a switchboard, between ties and networks… Each person operates a separate personal community network and switches rapidly among multiple sub-networks" (ibid). This is neither a loss or gain but rather indicative of a transition to a fundamentally different social structure with new interaction etiquette.

Consider this example: the mobile phone is a technology that at minimum allows people to communicate by talking or texting one another. In India however, there is a cultural practice of giving strategic missed calls, with its own logic and meaning (Canton, 2012). Since talk-time is expensive, callers specifically dial a number but hang up before the other party can pick up. While no words have been exchanged, the Caller ID function relays the message based on the relation of one person to another; an employee 'flashing' a supervisor is justified because the supervisor earns more and should pick up the cost of the call, or the mechanic can 'flash' the owner once the car is ready to pick up, without wasting valuable (talk-)time verbally communicating the same (ibid). In Portugal, 'missed call' is colloquially conflated with the Portuguese word for 'touch' (ringtone – *toque telemovel* – abbreviates to *toque*, touch). A *Kwamecorp* colleague recounted that teenagers would flirt with the girls they liked by giving them a 'touch', a low-tech version of a *Facebook* 'poke' (personal communication).

In the above-mentioned examples, there is a definite benefit to being connected, allowing interactions to happen in the first place. However, such fuzzy non-committal means allow networked individuals to establish a quantum of presence, just enough to grab attention, but not enough to necessitate complex interactions. Perhaps this is a necessary condition to being connected to extensive personal networks.

Work in this area confirms that social norms are also changing. The ubiquity of numerous friends on networks like *Facebook* is strongly suggested to have relaxed the definition of *friend* (Wang and Wellman, 2010). In another study, results suggest that some networked individuals actually prefer e-mailing to face-to-face relations with friends and relations because the interaction is quick and easy; "not everyone wants a nuanced, hugging relationship in every interaction" (Mok, Wellman and Carrasco, 2010).

Despite the fact that distance is less of a factor now, time-zones still limit the spontaneity of e-mail and phone communications (ibid). The 'filter bubble' enhanced by social media algorithms individualises each user's information feed, decreasing shared knowledge and experiences. A recent Pew study further found that a 'spiral of silence' occurs on social media if the online network does not share the same views (Perez, accessed August 2014). This also subsequently decreased conversation and action in offline settings, with Facebook users half as likely to discuss the same topic offline (ibid).

On the other hand, there is a confirmed "glocalisation" in online networks, with a healthy ratio of local and international contacts (Wellman, Boase and Chen, 2002). Email is seen to be very instrumental for this trend, such that there are different qualities of email sent, to both physically close contacts and those farther away, on a convenient asynchronous basis, with the easy choice of sending to a single recipient or many (Boase, Horrigan, Wellman et al., 2006).

Internet use has also become normalised, with the boundaries between online and offline becoming blurred. Ultimately the study concludes that while networked individualism suggests increased social isolation compared to traditional group based analysis, groups and networks are fundamentally different and networked individualism can only be contextualised in an updated sense of network society (ibid).

Studying contemporary social networks

As a sociologist, Barry Wellman's work uses Network Analysis approach to study the nature of intimate communities, on and offline. For the purposes of studying social networks online, a Social Network Approach is adapted (Garton,

Haythornthwaite and Wellman, 1997). The methodological approach is valuable for describing the intended relationship that *BOND Touch* hopes to connect.

The social network approach focuses on patterns of relations between people interacting via online communication as a study in computer-mediated communication (Garton, Haythornthwaite and Wellman, 1997). Specifically, there is an interest in the dynamics and flows in unbounded, sparsely-knit social networks such as friend networks with strong and weak ties.

To quantify these networks, the following measures are used (Garton, Haythornthwaite and Wellman, 1997).

- *Relations* are measured in terms of the shared content, direction and strength.
- *Ties* connect a pair of people with a number of relations, which are then quantified strong or weak. In the case of casual online social networks, the study of weak ties are of special interest.
- *Multiplexity* is proportional to the number of relations in a tie. Research suggests that multiplex ties are more robust, it is unclear if computer-mediated communication can foster weak ties into multiplex ties.
- And finally, *composition*. The composition of a tie traces the social position of the pair in relation to each other, thus introducing power dynamics in the study of online social networks.

These measures can help one frame the relation between a pair, useful to meaningfully discuss the relationship *BOND Touch* is designed for. So a couple, for the purposes of defining *BOND Touch*'s key audience, would have a multiplex tie of strong bi-directional relations sharing personal details. The composition of the tie is equal in terms of subject-position of one to the other.

The Social Network Approach has additional measures to measure higher orders of social connections as well. In the interests of space and relevance, these are not discussed here.

New media and intimate connections

Of particular relevance to the thesis is the dynamics of modern intimate relationships, as this will directly describe the anticipated setting in which *BOND Touch* will be used. In a seminal 2008 study of Networked Families, the results found that (Wellman, Kennedy, Smith et al., 2008):

- "Technology is enabling new forms of family connectedness that revolve around remote cell phone interactions and communal Internet experiences."
- Mobile phones increasingly connect and coordinate activities of intimate nuclear families. Despite separation due to work commitments during the day, they remain connected via phone and Internet. Multitude of communication channels correlates positively with an increased likelihood to share special moments, and keep tabs on one another.
- A majority say "technology allows their family life today to be close, or closer, than their families were when they grew up".
- "The Internet enables shared 'Hey, look at this!' experiences."
- Technologies are seen positively for improving quality of family communications.

The mobile phone is increasingly used by couples to "touch base" and coordinate activities (ibid).

- "70% of couples who both own mobile phones contact each other once a day or more to say hello or chat; 54% of couples who have one or no cellphones do this at least once a day." Parents are more likely to do so than non-parents.
- 64% of couples who both own mobile phones contact each other at least once a day to co-ordinate activities. 47% of couples with one or no cell phones do this.
- Married couples overwhelmingly prefer voice calls to text messages; moreover, communication over Internet channels like chat, email or messaging on social networks is also very minimal. These are "more intimate media than text-oriented computers".

These findings seem very relevant to understand the intimate communication patterns of the target demographic to design the *BOND* platform, especially

BOND Touch. Committed couples, especially married couples, are a clear demographic who might appreciate *BOND Touch*. Moreover, the *BOND* platform can benefit from a deeper look at usage patterns to design affordances for modern social lifestyles.

Perhaps most interestingly, despite the trend of networked individualism, Wellman's results on 'family connectedness' suggest that communication technologies are allowing families and close communities to connect and share presence. This leads to a validation of the assumption that a committed couple who are also networked individuals are likely to be witness to one another, and that communication technologies have only enhanced witnessed presence in intimate relationships. This premise is foundational to the investigation.

Learnings for wearables

Overall, Barry Wellman's work suggests that while lifestyles and social connectivity patterns have changed significantly due to the Internet, many of these changes are seen as positive. Across a breadth of related studies, the research sub-question "*how do [contemporary] communication technologies connect people?*" has been comprehensively answered.

In particular, the communication pattern between networked intimates was given special attention. These insights are supremely valuable to understand the primary target demographic of married or unmarried couples, a kind of market research. And in combination with Castell's exposition, one obtains a gestalt view of the role of the Internet as a medium in society, technological culture and intimate everyday life. These insights inform the reader of the contemporary socio-technical environment in which *BOND*, and other ubiquitous computing and communications media will enter and operate.

Barry Wellman's results show that the boundary between work and home, and friends and colleagues is fuzzier due to the increasing role of the Internet (Wellman, Boase and Chen, 2002). Wearables essentially accelerate this trend, homogenising the individual across social spaces of the merging realities one participates in.

Wearables as material-digital 'avatars'

As networked electronics, wearables have the capacity to capture personal digital information on-demand, on-person. Wearables essentially materialise an aspect of users' digital lives into physical life just like a digital avatar coalesces aspects of an individual's offline life into an online persona. A networked wearable, in being a personalised communication device providing affordances for actions both in the online and offline world, borrows Internet nomenclature becoming a material physical 'avatar' of the user.

For an online profile, an avatar is usually a photo, icon or computer model uniquely representative of the individual, to which the individual's many details and actions are associated. Wearables can also be personalised, and this personalisation aspect should be emphasised in design and development. Wearables can be personalised not just by style or function, but also by personal information.

In one sense, an application could be using a wearable as a two-way form of identification, marrying both the top-down categorisation of official ID with the fluid personalisation afforded by digital personas. Imagine seeing through augmented sense not just the physical visage of a person but on top of that, a personally-chosen status or self-designated title. Would this not instantly humanise and individualise a person, homogenising one's persona across merging realities? The age of first impressions being based purely on external looks and dress would be over; the inner individual can also be 'outered' at first sight (McLuhan, 1964). This also echoes Steve Mann's *sousveillance* principle, wherein top-down oversight is counterbalanced by horizontal witnessing (Mann, 2003).

In another context, consider that a generic smartphone becomes personalised (and valuable) through the abundance of personal and social information accumulated on the device. So such data can similarly add 'value' to wearables. Networked wearables can not only store these personal information (like blood types or passwords) for various affordances, they also provide a new range of personal metrics from health to productivity through tracking sensors. Recalling also the option of cognitive specialisation for wearables from the previous

section, wearables can even bring past cognition to present action and attention seamlessly.

For example, a user who has allergies can be informed in a timely manner to avoid certain items on the menu (whose ingredients are unknown). If a user is vocal about a certain cause or movement, then this information can be stored and intelligently utilised to shape behaviour; an activist who wishes to boycott a product or practice can technologically 'look past' appearances while being informed of certain background elements counter to their cause, so as to have the option to extend the capacity to exercise ethical principles.

These are also affordances, but intimate ones that are socially valuable and personally defined. As can be seen, these new data streams allow a user to witness oneself and act in the world very differently.

Wearables & social position

Given their context-sensitivity, easily lending themselves to professional specialised settings, wearables perform a dual-function: at the same time they provide affordances for the activity at hand, they also reflect to another the social position of the user. For example, a doctor uses a stethoscope to check a patient's heart rate, but equally a stethoscope (among other things) identifies its carrier as a doctor. If the wearables are worn continually even in non-professional settings, this secondary function carries over. This equally suggests that wearables can have different or distinct profiles, just as different attire are appropriate for different occasions, which is an alternative design paradigm.

What networked wearables essentially minimise is the necessity of specially designated geographic places (especially where specialised equipment are situated) and thus make mobile an individual's social position. Perhaps till now, social position is still coupled with geographic place. A doctor in an operating theatre is treated very differently once she steps out of the facility and onto a train. Despite her expertise remaining unchanged, her lack of access to her tools limits her capacity in a public space.

With wearables however, that social function of its user can follow the user beyond the geographic place. Furthermore, social position can be divorced from not only geographic proximity (to arena or equipment), but from expertise itself.

With the understanding so far, it is known that wearables will feature specialised sensors and/or limited intelligence to process real-time stimuli, thus augmenting their user with relevant information. For such functionality to be conceptualised in the first place, let alone designed, it must first be operationalised within its domain of expertise (an immutable mobile in the jargon of Actor-Network Theory) (Law, 2009). Only then can it be 'exported' to other applications, and other lay-users.

So, by virtue of having custom-selected specialised wearables on the person of the user, that user is momentarily enabled to perform (at least aspects of) a social function that previously only an expert could have. Say previously only a professional could have administered a complicated blood test in the correct manner; but just about anyone could distribute a wearable tattoo with nano-scale assays to do the same even better even faster.

Social function decoupled from designated geographic places can fundamentally affect existing social structures. Since wearables are personalised and context-sensitive, the addition of social position in effect parallels the subject-position of witnessing that is important and essential in face-to-face relations (see **Chapter 3.3**). Thus, they can effectively extend subject-position and further minimise the limitation of geographic location. This is also supported by Caroline Nevejan's work: "the notion of authenticity is changing… One can be as authentic [on] *Facebook* [or *LinkedIn* or an official email] as on a piece of land for 80 years" (Nevejan and Brazier, 2012).

If wearables were purely visual adornments, one could worry that wearables with the stigma of social function essentially point to a caste-like stratification. However, given their electronic 'informational' form that goes beyond mere ornamentation, the principal investigator argues that this scenario is less likely.

Note here that the social function may be professional occupation, but not necessarily. Social function may also correspond to personal interests and other voluntary roles. Secondly a social function is not a static definition; indeed the electronic nature supports the reality of fluid roles that networked

individuals have in their various networks. That is to say, a social function could be dynamic. What happens when social function is mobile with the individual?

A *Facebook* profile increasingly serves as a universal digital persona to login, 'Like' and comment on many websites even outside the scope of *Facebook*. In addition to the convenience of converging login information, this trend also aligns general online activity with what is socially accepted on Facebook (a social cyberspace). In a move that mirrors online reality, the homogenisation of social function across multiple physical settings serves to decrease the anonymity that modern cities unwittingly encourage. A wearable that has the secondary function of social status allows fluid cycling of subject-position of the individual across their diverse roles in various merging realities, while remaining coherent in totality.

Just as the Internet blurs work and life because it is common to both, a common fluid subject-position facilitates witnessing by coalescing addressability (yet another pillar of witnessing; see **Chapter 3.3**). Wellman writes that networked individualism means "the person has become the portal" (Wellman, Boase and Chen, 2002); with wearables connoting social function, the person also becomes a place. In a century where telecommuting is being explored as a sustainable dynamic for professions, social function decoupled from a physical place to the individual accelerates this transition. Moreover, a dynamic allocation of social position is capable of facilitating emergent social order in large groups, which could have certain useful applications.

It would be very interesting to see what other kinds of novel applications this layer of information can add to everyday living, though it is clear witnessing could be enhanced significantly in this way.

BOND as a techno-social accessory

Specifically, some insights stand out that can inform the development of *BOND*. Firstly the Internet thus far allows presence to be established mainly through words, and it is "words that act" ("Words that act", accessed August 2014). This is less true now and going forward. The Internet and its diverse applications (especially specialised mobile apps) allow people to establish

presence through various multimedia. Online gamers perceive each other's competitive actions without necessarily speaking. Even social networks allow interactions that are relatively non-committal – consider the *Facebook* 'Like' button, or *Twitter*'s 'Tweet this' button, establishing quanta of presence conveniently (see **Chapter 4.2** for elaboration). In the case of *BOND Touch*, tactility allows a new way to establish a quantum of presence with minimal effort.

This can be interpreted as an advantage based on Barry Wellman's results, on the usage patterns of couples. Couples are seen to prefer intimate means of communication, and like to keep in touch even during working hours. *BOND Touch* provides an easy means to reach out and keep in touch, even when time is of the essence and doesn't permit lengthier interactions. On the other hand, in some cases like *toque*s in Portugal, lengthier interactions are unnecessary, and a product like *BOND Touch* provides the necessary shortcut. A missed call as a signal is interpreted as a simple touch.

BOND's chic jewellery approach attempts to mirror the value proposition of traditional jewellery. Traditional jewellery enhances subject-position through the display of valuable ornamentation. The product design of *BOND* contributes to the ornamentation, but where is the value? The value comes from 'digital valuables' - passwords, personal health and social security information, friend connections, causes etc. These are in fact the same contents that make the mobile phone extremely valuable to a networked individual.

Moreover, digital sociologist David Banks poses the interesting design paradigm of affordances that are visible to (and for) others around the networked individual, lending a sense of transparency to the wearable ("Improving the wearable", 2014). This information, visualised properly, can also add social value even in their unspoken communication.

Considering that the medium of clothing extends the skin, the comparable wearable media similarly should be designed with the social traits that clothing imparts on top of functionality - traits of adornment, expression of individuality, symbolic of profession (uniform). As such, wearables gives their user material form to their merging identities and real-life affordances using digital valuables, in a way that is compatible with the goals of the *BOND* platform.

3.3 Wearables and witnessing

In the final section of the literature review, the philosophy of witnessing is discussed, taking cues from Kelly Oliver's work on the same. These are contextualised in the perspective of modern multi-actor systems highlighting the need for witnessing in achieving a share future.

Caroline Nevejan's Witnessed Presence is introduced, and the dimensions of the *YUTPA* framework (*being with You in Unity of Time, Place and Action*) are summarised. The *YUTPA* framework is the main analysis framework to validate witnessed presence in *BOND*, so this summary informs the formulation and theoretical backing of interview questions.

Witnessing in multi-actor systems

The world of today is no longer agglomerations of geographically and culturally isolated populations. It is a "global village" where the planetary flow of information is even faster than face-to-face transmission allows (McLuhan, 1964); we live in an "Internet Galaxy" of interconnected telecommunications (Castells, 2001). Even from an everyday perspective, lifestyles and social structures have changed (Wellman, Kennedy, Smith et al., 2008).

From a policy analysis perspective, it is this complexity that leads to wicked problems highlighted by Rittel and Weber (1973). As they explain, problems in socio-technical systems are inherently "wicked", in that there is no definitive convergence in knowledge (science) nor values (policy). The planning of actions in socio-technical systems is now mandatorily done at a systems and networks level, with expanded boundaries beyond individual problems. However, as the size and scope of the considered system increases, the difficulty of planning too increases, due to multiple stakeholders each with different priorities co-interacting in an intricately balanced system where any change by any actor dynamically causes ripple effects in the domains of other actors (ibid).

If complexity of analysis of information were the only bottleneck, a scientific approach assisted with the aid of powerful processing technology could whittle

down that task. However, a purely technocratic approach would not be able to shed light on a solution or even a solution space, for the simple reason that deciding and agreeing on values in a multi-actor system (MAS) is not an optimisation problem (Rittel and Webber, 1973).

Values are deeply personal, subjective based on the context and position of the holder, and more importantly, mostly unknown until the opportunity or necessity to reflect on a value presents itself. Add to this further the very real dynamics of power, socioeconomic inequality, and the tension between bottom-lines and benevolence. Current work on MAS design focuses on functionality, structure and behaviour of the system towards its intended goals, but very little on interactions between human beings and systems (Nevejan and Brazier, 2011). What results is a complex socio-technical problem in which not all stakeholders have equal say, responsibilities or exposure to consequences.

Witnessing as a normative basis for ethics

Caroline Nevejan's Witnessed Presence work builds on the theory of witnessing as elucidated by Kelly Oliver (2001). Indeed, not only does witnessing serve as a theoretical basis for this work, it also serves as a primary methodology wherein witness testimony is obtained through interviews with academics and artists (Nevejan, 2012). To elaborate on the theory of witnessing and thus justify its use as a research methodology in this thesis work, this section is a primer to the concepts of witnessing and testimony, dealing primarily with the theoretical approach of Kelly Oliver.

Kelly Oliver considers witnessing in its full and double meaning, both that of being witness (as in eyewitness) and the political act of bearing witness (like testifying in court) (Oliver, 2004). She finds that it is the double meaning of witnessing that makes it a powerful alternative to recognition, providing a tension between mere historical facts and nuanced human experience (ibid). This tension constitutes infinite subjective response-ability and addressability as well as acute experience of subject-position in finite historical contexts (ibid).

Oliver begins her work on witnessing by giving the anecdote of historians and psychoanalysts both recording testimony from Holocaust survivors (Oliver, 2004). In it, a survivor reports on an instance of rebellion within a

concentration camp, and claims four chimneys went up in flames. The historians dismissed her testimony on the factual grounds that only one chimney was destroyed in that particular rebellion. The psychoanalysts on the other hand were fascinated with her testimony, because the recounting of the incident expressed the reassuring hope of resistance in that camp that night. The contrast between the two viewpoints sheds light on the difference between objective observation and subjective experience, and between recognition of the familiar and witnessing the unfamiliar (Oliver, 2004).

Central to approaching Oliver is to understand her fundamental method and premise: that sincere testimony is a way of building subjectivity of an *othered/*alienated individual, and that testimony of an experience is not merely evidence for raising visibility or demanding recognition but also an invitation for a "pathos beyond recognition" (Oliver, 2004). The act of testimony of oppressed *others* demand retribution and compassion alongside recognition (ibid). In rethinking the theories of otherness and self-consciousness, Kelly Oliver tries to ground "the normative force of ethical obligation" to others (Bergo, 2003).

Challenging theories of recognition

While dealing with this domain of philosophical anthropology, there is often an abstract treatment of extreme terms like *master*, *slave*, *oppressor* and *oppressed*, inspired by Hegel's original lord-bondsman dialectic that establishes the emergence of realised self-consciousness, i.e. gaining self-recognition through the recognition of, and recognition by, an *Other* (Duquette, accessed 2014). While such terms may apply organically to historical instances such as the Holocaust, they were originally intended to generically serve as placeholders describing power relations in social structure, so as to meaningfully discuss the implications. That power relations in general affect empathy is a hypothesis that is increasingly validated by studies in experimental psychology (Benderev, 2013; Hoegeveen, Izlicht and Obhi, 2014).

Specifically, recognition is the keyword that has to be clarified. To Kelly Oliver, recognition as an act is still derived from a fundamentally Hegelian master-slave dynamic wherein the dominant group deigns to confer recognition unto the demands of the oppressed group (Oliver, 2004). Moreover she holds that it is imbalanced power (and its abuse) itself that creates the need for the

oppressed to be recognised; that is to say, the need for recognition itself is a symptom of the pathology of oppression (Oliver, 2004). “To see oneself as a subject and to see other people as *the other* or objects not only alienates one from those around him but also enables the dehumanisation inherent in oppression and domination” (Oliver, 2004). So long as recognition remains the sole demand of the oppressed, it is self-defeating because the fundamental power relationship remains the same (Bergo, 2003).

Despite Hegel's premise of mutual recognition, there is almost always a naturally dominant recognised subject, and so the other must achieve subjectivity by other means, if at all (Bergo, 2003). Thus, pursuing recognition as an antidote to oppression is one small step, but not nearly enough to "bring forth an abiding sense of subjective agency" to the oppressed (ibid). This is to say that the sense of subjectivity (and therefore agency) an individual has, becomes extrinsically dependent on the extent of recognition, rather than being driven by intrinsic dignity.

Incisively she writes: “This sense of myself as a subject gives the impression that *I* am an individual who possesses a sovereign will, while this sense of my own subjectivity gives the impression that I have agency and that I can act in the world. To see other people as objects or *the other* denies them the sovereignty and agency of subjectivity. To see other people as objects or *the other* is to imagine them as unable to govern themselves as subjects” (Oliver, 2004; emphasis mine).

On top of that, recognition can be problematic in the multitude of social theories where that which is recognised is more often than not already familiar to the subject (Oliver, 2004). In fact, the etymology of the word *recognise* itself derives from Latin *recognoscere* which means "acknowledge, recall to mind, *know again*..." (Harper, accessed 2014; emphasis mine). This further disenfranchises the oppressed, whose worth is only validated by the extent of commonalities with the oppressors, that which was already known.

And finally, a successful campaign to raise awareness and achieve recognition is most commonly rewarded with legislation and enforcement of ‘rights’ for the oppressed. However, these regulations, which may serve as check-and-balance for ensuring rights of the oppressed, further reduce the oppressed to a

position of one judged (Bergo, 2003). The oppressed still has no agency for self-determination.

Consider a contemporary example: when some actors among many stakeholders in a mutual problem situation possess too little power to influence the discussion, it is possible they would experience the brunt of negative consequences due to decisions that are mostly advantageous to the more powerful stakeholders. Fishermen whose livelihoods are threatened by industrial pollution of their waters can indeed be held as oppressed, however unintentional the harm.

If said fishermen were to demand recognition of their existence and their condition, it would doubtless involve approaching the powerful stakeholders (in recognition of elevated power-position), justifying their right to be recognised (not only with the possibility of failure, but also the need for this justification to be in words and form *recognisable* to the privileged view of the powerful stakeholders), and requesting action from the powerful stakeholders (thus placing all agency in the hands of the powerful).

Just as the fishermen had no agency in the decisions that led to the oppression in the first place, even the best outcome in this struggle for recognition would still place ultimate agency in the hands of the dominant group, thus perpetuating the conditions that spawn oppression.

Witnessing in socio-technical systems

Similarly, a subordinate unable to communicate the gravity of an ethical dilemma to an unconcerned employer two continents away via a tele-conferencing screen is in fact limited by both geographic distance and power distance; the latter diminishes one's *subject-position*. From a connectivity perspective, a homeless individual with no access to the Internet is just as disadvantaged, especially given the societal trends of networked individualism; with no technology and therefore no network, the homeless person lacks both address and *addressability*. A video-screen can just as easily connect two friends over *Skype*, or a military drone operator with a potential victim; in the latter case, the victim has no sense of *response-ability* to the accusation or subsequent action, and likewise the drone operator has no addressability.

By generalising this example to the real-life workings and management of complex socio-technical systems, the principal investigator wishes to impress upon the reader the importance of extending this capacity to witness in our communications technologies, if not as an ethical imperative, then at least as a pre-emptive effort to provide "reparative justice" for disenfranchised segments of the population (Bergo, 2003). Such disenfranchisement in socio-technical systems may not only be institutional but also, dynamic and relative.

As seen, Oliver's nuanced definition of the double meaning of witnessing, to be witness and to bear witness, implying the three qualities of subject position, addressability and response-ability, are vitally important for relations and networks in modern socio-technical systems. In fact, some policy analysis methods like Visual Problem Appraisal already take video testimony to be an important part in communicating different frames of stakeholders despite long-held biases and power distance (Witteveen and Enserink, 2007). Sue Tait similarly comments that the function of modern journalism should be the facilitation of moral responsibility; it decouples the act of being (eye-)witness and bearing witness, extending the capacity to respond to a later time, at a later place and perhaps by a different person (or people) (Tait, 2011).

It is possible to implement witnessing and witnessed presence in human interactions across merging realities, in a systematic and granular manner. This is where Caroline Nevejan's work on Witnessed Presence, especially the *YUTPA* framework, comes to relevance. These points will be discussed in the following sub-section.

Witnessing one another

With modern telecommunications, the capacity for witnessing has only been amplified. Tweets from Palestine countered Israeli attempts to block information flow in the recent eruption of Israel-Gaza military actions (Hillel, 2014). The obfuscation algorithms of *WikiLeaks* allows whistle-blowers to share corporate and governmental secrets exposing violations of human rights and other transgressions ("About [WikiLeaks]", 2011). NGOs like Peter Gabriel's *WITNESS* provide oppressed groups with cameras and mobile phones to capture and upload video to document abuses ("A world of witnesses", 2008; "WITNESS -

petergabriel.com", accessed July 2014). The mobile phone is proposed in itself as a witnessing platform for human rights (echoing Steve Mann's *sousveillance*), healthcare issues like epidemics, and environmental monitoring from pollution to sustainable resource management (ibid).

On the other hand, networked individualism decreases shared experience due to personalised data streams (Castells, 2001). The 'filter bubble' phenomenon, exacerbated by social media algorithms, further decreases exposure to otherness by initiating a "spiral of silence" extending even into offline interactions (Perez, accessed August 2014).

How exactly can witnessing inform the design and development of communication spaces and communication technologies? Caroline Nevejan's Witnessed Presence operationalises witnessing into discrete dimensions allowing for systematic design of an interaction space. Witnessed Presence thus combines (tele)presence research with the philosophical underpinnings of witnessing.

Presence is defined as *being-there*, a psychological state or subjective perception of all experience of the world as mediated by human senses and complex perceptual processes, occurring in an instant-to-instant manner (International Society for Presence Research (ISPR), 2000). Presence research traditionally studies telepresence, namely the intentionally-designed *misperception* of a mediated experience such that the role of technology is overlooked to some degree (ibid). Presence is multi-dimensional, meaning there are different types of presence (ibid). Two notions of presence relevant to this thesis are co-presence and social presence.

Co-presence in a technology-mediated experience gives users the perception that "the people with whom [the users are] engaged in two-way communication [are] in the same physical location and environment when in fact they are in a different physical location" (ibid). For the scope of this thesis, co-presence is understood as the sense of being present around others with the possibility of mutually interacting with them. Social presence is similarly defined thus by ISPR: "Social presence... occurs when part or all of a person's perception fails to accurate acknowledge the role of technology that makes it appear that s/he is communicating with one or more people or entities" (ibid). So it can be simplified to mean the sense of interacting with others.

Nevejan's work on the other hand is centred on a *being-here* approach (personal communication, 2014). That is to say, her work is aimed towards enhancing presence in everyday experiences and personal interactions in the 'here' and 'now', rather than raising the level of immersion in virtual settings. Witnessed presence can be simplified as the sense of being present with another while engaged in a mutual interaction, with the implication that one accepts responsibility for his words and deeds, and the other person shares this responsibility as well (personal communication).

From an evolutionary perspective, presence is "the strive for well-being and survival" and performance of presence involves "steering towards one's own well-being and survival [as] the ultimate basis of ethics" (Nevejan and Brazier, 2012). From the context of witnessing, other people and social structures are necessary for an individual to perform presence (Nevejan and Brazier, 2012).

That is to say, "the capacity to be witness and bear witness to others is the essence of humanness" (Oliver, 2001). An action that is witnessed is a deed; in this transformation to a subjective narrative, a witness can take responsibility and intervene either by responding to the act there and then, or giving testimony afterwards (Nevejan and Brazier, 2012). "Both being witness and bearing witness include the possibility of what happens next" (ibid).

Witnessing (like presence) implies a sense of embodiment, "inscribing the body in the process" (Nevejan and Brazier, 2012). In modern socio-technical systems however, technology has transformed the nature of communications and interactions. Face-to-face, individuals interact in spatial dimensions through physical embodiment but online, this aspect is lost. (Computer) systems can observe and monitor, and even (inter)act and facilitate communication, but cannot perform witnessed presence (ibid). At best, algorithmic reality provides a third-person witness perspective, constructing a global view of the system and its participants (ibid).

Witnessed Presence incorporates presence to human relations and adds to presence design the dimension of interaction (ibid). Through interaction, two-way perception enables witnessing and being witnessed at the same time, necessarily establishing a connection (ibid). Caroline Nevejan emphasises connection is in effect made more transparent, which allows for judgement of

truth and emergence of trust (personal communication, 2014). As a word of caution though, it should be noted that a condition of intense correlation of presence and trust, that is to say "intense witnessing" may equally lead one to distrust (ibid).

It can be said wearables uniquely bridge biological and algorithmic realities, both of whose social dimensions are merging. As personal augmentation technologies, presence is one of the qualities wearables can be designed to enhance or provide affordances for; augmented situational awareness enhances presence, and conversely affordances minimise perturbations of presence. If wearables can augment presence, networked wearables can augment witnessed presence.

The YUTPA framework

Witnessed Presence details ways in which people establish presence and build clarity of trust (Nevejan and Brazier, 2012). Traditionally social structures were founded on groups sharing time, place and action with each other, but now the Internet and other communications technologies offer different time and place configurations for negotiating presence, but also raises new ways to relate and act (ibid). Nevejan's *YUTPA* framework (being with You in Unity of Time, Place and Action) depicts these new configurations in which interactions take place in the modern network society.

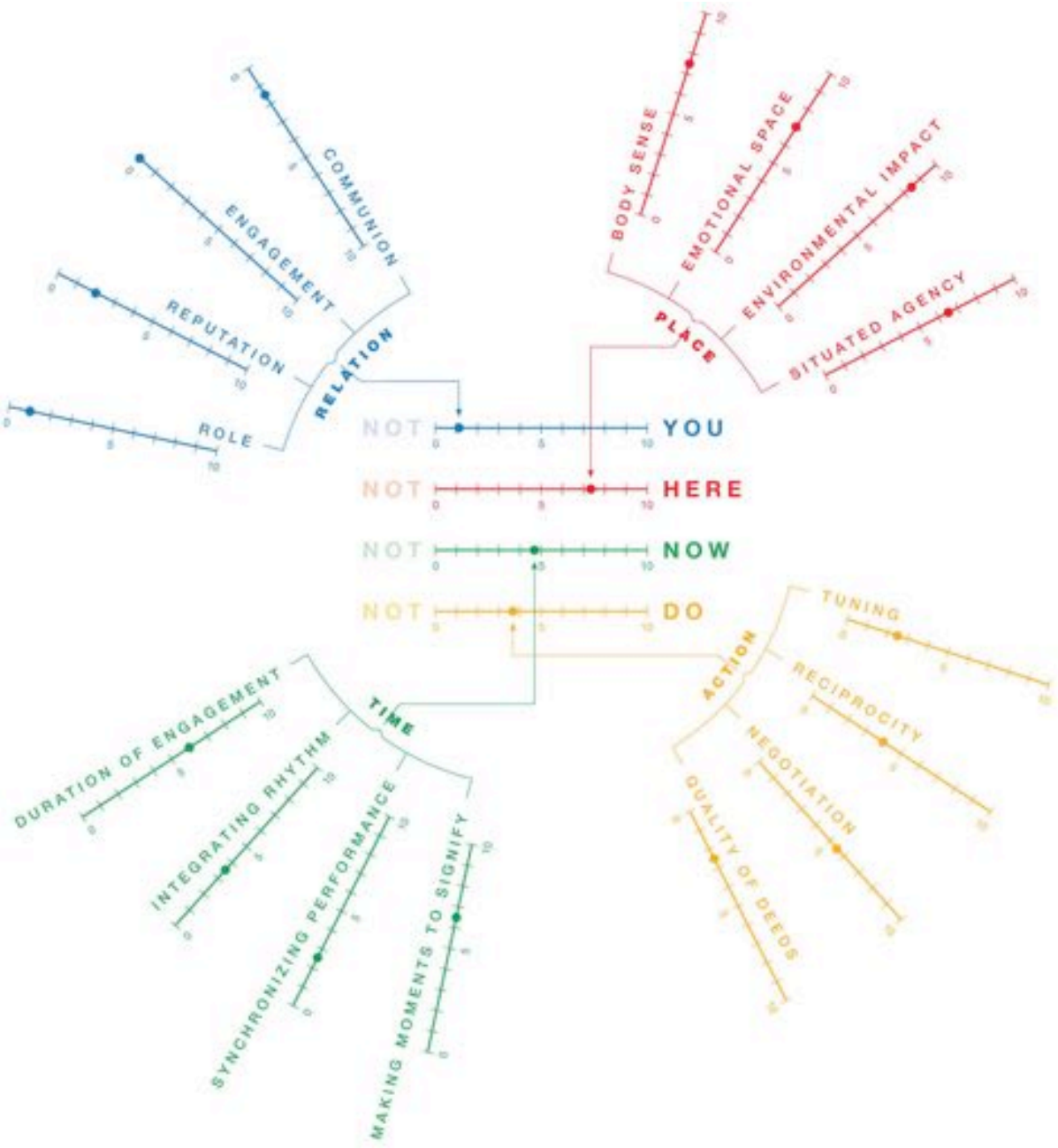
Different presence configurations allow different possibilities for trust to emerge, in turn influencing communication and knowledge construction deeply (ibid). "By designing granular interaction in 4 dimensions, reciprocity in witnessing obtains significance and the basis of establishing trust in a variety of presences emerges while human agency acquires potential" (Nevejan and Brazier, 2012).

In Figure 3, **Time** (Now-Not Now), **Place** (Here-Not Here) and **Relation** (You-Not You) are framed as 3 axes, and **Action** denoted by the spectrum of dark to light. On each axis, the extremes denote high and low levels of presence correlated with the level of presence in an interaction. The dark-light spectrum of Action is interpreted thus: in the dark extreme one cannot act in an interaction and vice versa for the light extreme.

Figure 3: Schematic representation of the YUTPA model
(Nevejan, 2007)

The individual dimensions of Time, Place, Action and Relation are further described by four sub-dimensions each. These parameters are illustrated in the figure below (Nevejan and Brazier, 2012).

Figure 4: YUTPA framework with its sub-dimensions



The following example comparing an email with a *Skype* call briefly illustrates how the *YUTPA* framework can meaningfully discuss interaction spaces.

In an email, Time is not shared as the message is asynchronous. Relation can vary, and the level of witnessed presence is correlated with the closeness of its participants and the contents of the communication. Place is typically not shared among sender and recipient. And finally, Action is negotiated by the 'quality' of words used in the communication.

In a *Skype* call, Time is shared as the communication is in real-time. Relation can vary, and the level of presence again depends on participants and the content. Place is typically not shared, but the particular format of mediated communication affords some witnessed presence through the addition of voice and video which is otherwise something that can only be experienced if participants are at the same place. As for Action, *Skype*'s format enhances subjective agency by allowing some degree of non-verbal communication leading to better tuning to each other's moods and facilitates quicker real-time negotiation, vastly increasing the level of witnessed presence.

The sub-dimensions of the *YUTPA* framework provide even more nuance with which to discuss and design interaction spaces, both online and offline. The following lists briefly detail these sub-dimensions.

YUTPA dimension: Time

Modern network societies to function increasingly on a 24/7 cycle, across time zones internationally. Time design is necessary because these new paradigms challenge "the human experience of time" (Nevejan and Brazier, 2012).

- **Duration of engagement**: Continued engagement over time substitutes the earlier reliability of fixed location. This is counterbalanced by the need for "empty time" as well as significant moments, to allow meaning to arise ("Being Here - Time", accessed August 2014).

- **Integrating rhythms**: Communications decoupled from real-time means that effort must be put into developing a shared rhythm of an

interaction, both with people and systems (ibid).

- **Synchronising performance**: Tuning of presence begins early in a face-to-face interaction and tacit knowledge is shared, allowing participants to judge and anticipate what-comes-next (ibid). In mediated communications, there are trade-offs depending on the format but these can be negotiated in various ways.

- **Making moments to signify**: Interactions with people and systems even over time add to creation of meaning and significance (ibid). By engineering special moments, shared experience emerges.

YUTPA dimension: Place

The network society has dissolved shared place as a necessity for communication, but locality is still a prime requisite for situated agency (Nevejan and Brazier, 2012).

- **Body sense**: The body is at the centre of individual experience and 'records it all' ("Being Here - Place", accessed August 2014). Thus the sense of embodiment is vital when discussing issues of an ethical nature (ibid).

- **Environmental interaction**: When people or groups interact, the environment of their interaction gives rise to unique configurations of spatio-temporal trajectories (ibid). These should be recognisable to one another for shared concepts and subsequently language to emerge (ibid).

- **Emotional space**: "Sensation, emotion and feelings greatly influence the sense of place" (ibid). Physical sensations inform the nature and construction of the place, emotions and feelings convey the mood of the place - both are aspects of sense of place (ibid).

- **Situated agency**: Participation in a situation must include the possibility to act (Nevejan, 2012). Technology offers new ways to act (ibid).

YUTPA dimension: Action

Action is inseparable from reciprocity and trust (Nevejan and Brazier, 2012). In theatre, *actions* and *activities* are different; *actions* affect identity and what happens next whereas *activities* are of no consequence (ibid). 'Trust sets the scene for possible actions to do' (ibid).

- **Tuning**: When two people meet, tacit tuning of "bodies, breath and movement" takes place ("Being Here - Action", accessed 2014). This information deeply influences the following interaction.

- **Negotiation**: Negotiation is a process in itself, whereby trust can emerge, via reputation, identity, connecting networks and technology infrastructure (ibid).

- **Reciprocity**: Give and take establishes a flow in a connection, generating a certain amount of trust as well (ibid).

- **Quality of deeds**: Only when there is a capacity to act can people take responsibility and exercise agency (ibid). The act itself conveys a sense of meaning, not just the outcome.

YUTPA dimension: Relation

A variety of concepts can help describe an individual in relation to others and oneself (Nevejan and Brazier, 2012). These notions subsequently drive the nature of interactions.

- **Role**: The instrumentality of a social position drives the weight and range of its allowed actions ("Being Here - Relation, accessed 2014). Online and offline, these roles affect performance of presence and development of trust (ibid).

- **Reputation**: Reputation is acquired among individuals in social structures, influencing the level of trust in interactions with each individual (ibid). Performance of presence is important in the building of

reputation.

- **Engagement**: Engagement is the level of active commitment and attention to an interaction (ibid). It is therefore a qualifying factor for authenticity (ibid).

- **Communion**: Being in a relation with another allows shared meaning, qualifies the relations and deeply influences presence and trust (ibid).

These granular aspects of Witnessed Presence can be used in the design and validation of design spaces. Nevejan's work finds that trends of system participation are changing the trade-offs involved in level of presence and trust (Nevejan and Brazier, 2012). There are a new range of possibilities to witness and bear witness and the YUTPA framework allows for granular and reciprocal design in and between the dimensions of Time, Place, Action and Relation, to enhance the level of presence and build clarity of trust (ibid).

In this work, the interaction space of *BOND Touch* is explored. Specifically, the YUTPA dimensions are used to structure a series of interview questions to open up conversation spaces about design considerations for later analysis.

Learnings for wearables

As we have seen, witnessing is a fundamental dynamic to human interactions. The *YUTPA* dimensions reveal that in face-to-face communications, many of these conditions are met by default due to shared spatio-temporal trajectories. However, in modern network societies with networked individuals, it is important to pre-emptively design elements of witnessed presence into socio-technical interactions. The principal investigator thus finds that networked wearables, under the design principle of *contextual embodied augmentation*, can theoretically be used to enhance witnessed presence.

Context-sensitivity can dynamically vary depending on Time, Place, Action and Relation; it is interesting here that context-sensitivity can now be granularly designed based on the persons involved, social function, physical environment and allowed actions on-demand. These are all parameters for affordances of

witnessing, and uniquely, wearables can implement them automatically on the basis of the user's social and spatio-temporal position.

Networked wearables can *augment* the level of witnessed presence by presenting relevant information that enriches an interaction space, or by designing affordances to enhance engagement in the experience.

Embodiment is a factor that offers the most potential to wearable electronics. By virtue of their form-factors, they directly or indirectly involve the user's body. Just as video allows a Skype call to be more immersive than a phone call, wearables involving the whole body could raise the level of presence significantly. Networked wearables allow then the body itself to be extended, perhaps allowing shared concepts of a physical variety to be generated easier.

These all seem possible but to what extent and how effective would the wearables be? Such questions can only be answered in time, with products and testers. The *BOND Touch* module however offers an uncanny window of opportunity to explore witnessed presence in networked wearables, because the module is being designed for one specific use-case: to connect an intimate couple using an electronic wearable. It was noted in the previous section that the trends of networked individualism suggest that intimate couples remain close, or feel even closer, despite (or because of) the increase in mediated interactions. As such, *BOND Touch* targets an interaction space where committed individuals can be said to witness and bear witness to one another, which is an ideal test-bed for the *YUTPA* framework.

Questions for BOND Touch

Based on the understanding of the *YUTPA* dimensions, the following questions were prepared for interviews with designers at *Kwamecorp*, each with varying levels of participation in the *BOND* project. The goal of each question is to open up a conversation space about the use-case and the design considerations that add affordances for that use-case.

YUTPA dimension: Time

- **Duration of engagement**: In addition to the time of engagement, there is also significance in time between engagements, empty time. How does *BOND Touch* facilitate empty time?

- **Integrating rhythms**: What is the rhythm of the *BOND Touch* interaction? How is this designed?

- **Synchronising performance**: Let's say you could choose to use *BOND Touch* with either of two equally close people. How would your communication through *BOND* be unique that way?

- **Making moments to signify**: Is a *BOND Touch* moment significant, or would you use it for significant things?

YUTPA dimension: Place

- **Body sense**: When you get a *touch* from your significant other, do you get a sense of 'being there' or the significant other 'being here' with you? What is the momentary level of immersion?

- **Emotional space**: When you send or get a *touch*, do you also send and receive a sense of emotional state? Do you share emotional space?

- **Environmental impact**: Does your location change how you perceive a *touch* - be it a friend's place, bar, workplace, or party? Or vice versa, does the vibration change how you feel about the location?

- **Situated agency**: You and your significant other are not in the same physical location. Maybe you're about to do an act that they may not like. You get a *touch*. Do you go through with the act?

YUTPA dimension: Action

- **Tuning**: How does a *touch* influence tuning between you and your significant other, even when you are apart?

- **Reciprocity**: How would you use *BOND Touch*? Is each interaction always one-sided, or does there need to be a response? Can technology mediate that response (like a 'Seen' message in chat)?

- **Negotiation:** How and when would you negotiate your use of *BOND Touch* with your significant other?

- **Quality of deeds**: How significant is a *touch*? Or how nuanced/sensitive would the module have to be for you to derive meaning from a *touch*?

YUTPA dimension: Relation

- **Role**: Imagine you get a *touch*. Who would the other person have to be for you to be comfortable getting the vibration?

- **Reputation**: You get a *touch* and a short while later, the sender is revealed. Does your impression of the other person change how you feel about the vibration?

- **Communion**: You get a *touch* from your significant other. How do you interpret it? Do you have a code, and if so, how do you make a code?

- **Engagement**: How involved do you want to be, how much would you use *BOND Touch*, on a day-to-day basis?

Some general questions are also devised based on Medium Theory, Networked Individualism and Witnessed Presence; these capture the designers' personal everyday experiences that attest to the influence of these phenomena. The questions are generally designed to prompt interviewees into reflection and testimony, essentially bearing witness and not speculating.

Other than serving as material to validate *BOND Touch* on the basis of the *YUTPA* framework, the exercise is also a workshop with each designer, to demonstrate the need for Witnessed Presence as a factor in user experience design. Indeed, during the course of the internship, additional *YUTPA* workshops were requested for a user survey during *LokLok*'s beta development.

And finally, the investigation hopes to extend Nevejan's work on Witnessed Presence, specifically by exploring the role of imagination in Witnessed Presence. Insights might be captured in the emerging themes of the interviews and conversations.

4. BOND: A Case-Study

This chapter will concern itself with the tabulation and analysis of the interviews (full transcripts in the **Appendix**) and *BOND*-specific research material acquired, contextualising them in terms of the themes discussed thus far, including Medium Theory, Networked Individualism and Witnessed Presence.

An ethnographic analysis of Kwamecorp details their corporate culture and working style. A *BOND* design history is compiled, giving a chronological development of the product thus far, supported by anecdotes and observations by the designers themselves. Next a *YUTPA* analysis is performed, to arrive at a conclusion to what extent *BOND Touch* allows for witnessed presence in an intimate shared space.

And finally, some excerpts from the interviews are highlighted to add everyday testimony to the theoretical insights discussed in the previous chapter, contributing some material back to the body of work that helped to frame this thesis. Emerging themes from the interviews and subsequent analysis are also identified and discussed here.

4.1 An ethnography of Kwamecorp

Before reading about the product itself, it is of interest to understand something of the people who make *BOND*. This ethnographic reflection is not just an academic exercise, because it also serves to orientate the reader to the unique environment in which *BOND* is being developed. While making no claims as to the outcome of this effort, it can be nonetheless eye-opening to look at exactly how technology startups work, given their vanguard role in the introduction of new products and platforms into the world.

Introducing Actor-Network Theory

Actor-Network Theory (ANT) is the framework chosen for this ethnographic analysis. ANT is a sociological approach in Science, Technology and Society (STS) studies, codified by Bruno Latour, Michael Callon and John Law. It is a constructivist approach precisely because it considers both the material (interactions between real people and real things) and the semiotic (the meaning and significance of these interactions in practice) (Law, 2009).

Consider this simplistic example: the boss of a company can only run the company if all employees actually turn up for work day after day. Without employees, the actor is no longer a boss in any sense of the word. The web of relations can host some invisible relations as well. For instance, the trains the employees take to get to work have to arrive and depart on time for the company to function. The roads that the boss drives on have to be maintained regularly, and managed to prevent and resolve traffic jams. Only when all these other nodes in the network work as expected, the boss is able to perform his tasks and make his decisions.

Note here that studying a system with ANT instantly converts single actors (for example the boss) into one node in a web of relations (boss of 15 people), wherein it can be said that the actions of that actor can only be performed successfully if the web of relations permits it to happen. What we refer to with the word society, is in fact the web of associations between those in it (Latour, 2005).

Also understand that the web of relations is not necessarily intentional, and so the arrangement of the network is only valid up to the point it is useful to each actor. As such, this network is a "limited form of ordering located in no larger overall order" (Law, 2009). The logic of symmetry would also suggest then that any one actor is in fact an actor-network, and abstracted enough, every actor-network can be approximated as a single actor (Latour, 2005).

An additional caveat of participating in this web is that every relation is necessarily a *translation*, which can be understood as a negotiated compromise between any two nodes (Law, 2009). The significance of defining an interaction as a translation is to highlight that in acting out any interaction, all in the web are influenced. In (re)defining the term social with the empirical observation of *translation*, ANT becomes in a sense the sociology of *translations*.

Latour justifies this in his seminal book 'Reassembling the Social', by harking back to the etymological root of the word social, namely the Latin *socius*, which means "to associate" (Latour, 1986). Thus social is not an abstract adjective that signifies the participation of multiple actors. Instead it is a material-semiotic adjective referring to the specific associations between each actor. As such, a system can be called social when its actors are associated in various ways, and in practice, these associations are repeated interactions, i.e. *translations*.

There are four significant moments in which *translation* is systematically achieved (Latour, 2005).

- First is *problematisation*, wherein each actor in a network operationalises the problem from their competency perspective, thus making themselves essential to any actor-network wishing to solve that problem. This typically creates a bottleneck in the process, the passage through which necessarily must involve this actor. As such, this bottleneck is referred to as an "obligatory point of passage".

- Bottlenecking the path to the solution is not enough, if this solution is one of many alternatives. As such, the actor must engage in *interessement*, where they engage and convince other actors that they are an efficient means to the solution and their terms are acceptable.

- All actors in the actor-network must accept their emergent roles in the web of relations proposed during *interessement*. This stage is called *enrollment*.

- When the socially legitimised web of relations has captured the majority of actors in a proposed actor-network, there is *mobilisation* in that the actor-network has crystallised and will function as long as these translations are continually performed.

In a linguistic turn of words, translation of one word to another is pointed out in some sense as a betrayal, a compromise, since no two words are exactly the same. In the same sense, *translation* in an actor-network is also a betrayal. An intuitive sense of this betrayal is captured in the anecdote of children passing a secret one after the other, the final message barely resembling the original. Each child essentially translates the message in their own unique way, or in other words, each betrays the message.

Most important, the mechanism of translation is only possible because of the "obligatory points of passage", wherein individual nodes become important, without whose action the process cannot continue. Actors typically leverage this influence to remain essential to the actor-network (Gonçalves & Figueiredo, 2010).

It is this aspect that makes the negotiated compromise tenuous in a sense; not every interaction may be favourable to every actor at all times and yet no actor is dispensable to achieve the final outcome. ANT thus emphasizes that these relations are dynamic, precarious even, and active in that they exist only when the *translations* are continually performed (Law, 2009).

Given our present-day existence in a socio-technical world, ANT famously treats even non-human factors as influences if their relations in the web are justified by material-semiotic significance in practice. After all, the constraints and requirements of nature and also our technologies also shape and direct the ways in which we work and interact. That is to say the material realities of our socio-technical world beget a material agency of all involved: man, machine and nature (“A Brief Summary of Actor-Network Theory”, 2011).

Consider how the use of a wi-fi router dictates the physical radius within which the signal could be obtained. In the same way the permission of a landlord dictates the physical radius within which users can be situated. Similarly inclement weather discourages the use of a beach for volleyball just as authority (and etiquette) prohibit the play of volleyball in a library. Or consider this: an artefact as simple as the humble lock and key, let alone advanced biometrics scanners, essentially substitutes the need for a human guard at the door, allowing only those with permission to enter, and exercising authority to refuse entry to others. In this construction, the lock-and-key artefact does not seem to have any less agency than the human guard.

The leap here, if any, is to not make a distinction between similar resultants simply because the origin is non-human. While technological artefacts (and nature, habits, traditions, superstitions, practices etc.) do not act with intention and motivation like human actors, they shape actions all the same, and hence in ANT's conception, are 'actants' in the network of relations that enable social processes (“Getting Wifi in a Park: a Tale of Materiality”, 2011). As such, the word actant is coined in ANT to discuss non-human influences in the same semiotic sense as human actors.

An exemplary case study using ANT followed the political and cultural history of the success of Portuguese imperialism. By identifying every actant, human and non-human, from sailors to ships, traders to navigational astrolabes, wind and currents to gifts and guns, John Law showed how all of them came together in a relational web that shaped each of its co-actants into a particular configuration that worked for 150 years (Law, 2009).

For example, the design of Portuguese ships itself had to evolve; the then-existing European paradigms – optimised for trade across the Mediterranean – had to change to be reliable for longer journeys up to and beyond India (Law, 1986). These new ships were larger and more fortified than their contemporaries, which normally would slow down travel, but endowed a significant defensive advantage for long-distance voyages in perilous waters (ibid).

The size of the Portuguese ships meant they could carry a lot of cargo (beneficial of course for trade volume), but also increased the stockpile of rations, allowing the ships to skip many pit-stops along the way, thus allowing

for faster voyages (ibid). Even the choice of sails allowed for more versatile sailing regardless of wind conditions. A surprisingly small crew could operate the vessels (ibid).

Only contingent on such long-distance capability, surprising efficiency and continued reliability of the ships voyage after voyage, could the Portuguese successfully extend their control to regions far removed from European waters. To disregard the obvious influence of ship design on Portuguese imperialism would be short-sighted. As such, the Portuguese trade empire was a complex actor-network whose success was owed to ship design, one actant among many other influences, both human and non-human.

For Bruno Latour, the Portuguese ships themselves symbolise a tangible artefact whose nature is referred to as "immutable mobile" (Law, 2009). The ships are immutable, constant and reliable for an appropriate amount of time. Moreover they are mobile, as they can travel anywhere in the network, providing a common interface between different nodes. It is the combination of both qualities that contributed to the success of the system.

In another paper, Latour charges that experimental data itself is the immutable mobile of the scientific endeavour; the final statistics and graphs become ultimate truth on which social reality is constructed, with little mention for the lab rats and the equipment from which these readings were compiled (Latour, 1986). The Gutenberg printing press, in another clear example, allowed ideas to be inscribed onto pages faster than ever before. These pages were mobile, retaining their original and unadulterated meaning (immutable) (Latour, 1986). As such the concept of the immutable mobile is easily identified from an ANT approach. The wider the intelligibility of an immutable mobile in a system, the more pervasive its effects on the actor-network.

Immutable mobiles are typically in a form that is easily readable, usable, combinable which contribute to their mobility, thus their scale and consequently their influence, and finally their fundamental reification into the basic workings of the network (Dickson, 2007). Immutable mobiles increasingly become the currency of information flow, and the scale and frequency of their transmission suggest the health of the actor-network.

As such, the salient aspects of ANT become obvious, as listed below (Law, 2009):

- *Semiotic relationality*: each actant meaningfully influences every other.
- *Heterogeneity*: actors are all different, human and non-human, simple and powerful.
- *Materiality*: actants are 'real' in that they exert material influence and beget material outcomes.
- *Precariousness*: the success of the network is contingent on each node functioning as expected continually, not once or once-in-a-while.
- *Power*: the configuration of the network can suggest where the power centres are located.
- *Space & scale*: ANT can help frame how new actants are enrolled into the actor-network.
- *Mechanistic explanation*: through ANT methodology, one can form a narrative of how the system works.

ANT places high value on an ethnographic method, i.e. fieldwork and observation, to identify the relations that influence the chosen actor (Dankert, 2010). After the identification, the outcomes of the system are analysed as effects (or phenomena) made possible by the web of relations (Law, 2009). This is a significant advantage with the ANT approach, essentially reframing the system like a machine with working (or not-working) components.

As seen in this particular example, the study combined sociology of science with political history. Other examples apply ANT meaningfully to study sociology of diverse systems and communities.

This has been a summary of ANT, and yet the principal investigator proposes the discussion so far does not yet justify the ANT as a methodology, as preferable, applicable or relevant compared to other methodologies. In a defence of ANT, John Law gives multiple examples of studies that bear similarity to ANT methodology, but also points out that neither their domain, their problem formalisation nor their outcomes are in any way similar (Law, 1997). He then suggests that ANT is valuable due to this very reason. ANT is specialisation-agnostic, in that it offers a common framework to study diverse systems. ANT has been used to study Louis Pasteur's scientific contributions to microbiology with the same framework as the earlier case study of the success

of Portuguese imperialism in history. This is possible because ANT's ethnographic method only pays attention to actual interactions present in practice, rather than intentions, expectations or other theoretical constructions. The ethnographic method thus allows for the empirical observations that ground ANT, thus rejecting accusations of purely intellectual hand-waving.

Recall the missed call case study in **Chapter 3.2**. Nothing in the technical specifications nor the expected usage is there a recognition that the missed call function itself can be a form of communication, like texting or talking. And even as forms of communication, they are different in usage depending on the culture that manifests them in practice. There is no obvious way to preconceive these usage patterns, except through ethnographic observation.

This is the strength of ANT's agnosticism. ANT can be applied in any socio-technical system with any number and type of actants to make sociological observations unfettered by system-specific terms and assumptions (Law, 1997). This is a distinct strength because discussing each system in new specialised jargon would only serve to dilute the sociological discussion about the system. ANT provides a universal inventory of terms that help to reframe the system in a way that is suitable for such a sociological discussion. The principal investigator posits that ANT allows a researcher to compare and contrast between diverse systems without getting lost in details otherwise irrelevant to a fruitful sociological discussion.

During the course of this thesis, the principal investigator spent 3 months in the Lisbon office of *Kwamecorp*, embedded in the heart of its operations. Based on a journal kept of the interactions and incidents during the time, the principal investigator will attempt to reconstruct the scene of ideation and development of this product for the reader. In this essay, the ethnographic observations of *Kwamecorp* will be shared, framing interactions and actants in the jargon of ANT where relevant, so as to elicit some interesting conclusions.

Specifically, the principal investigator would like to use ANT to suggest that an innovative product like *BOND* is a direct effect of actor-network environment of *Kwamecorp* itself. Given the ethnographic nature of the following essay, the principal investigator takes inspiration from the writing style of another notable ethnographic account, namely the account of the particular success of the Zimbabwean Bush Pump by Marianne de Laet and Annemarie Mol (2000).

A final disclaimer: the following section is written in a first person perspective. This is not just a cosmetic choice. It serves to emphasise the personal observations made at *Kwamecorp*. The first-person account is thus testimony that serves as the primary source from which the analysis and conclusion are made possible.

Actants and translations of Kwamecorp

I first came across *Kwamecorp* on a news article discussing *Fairphone*, a smartphone (made by the homonymous startup) whose circuits contain only ethically obtained rare earth metals. *Kwamecorp* had worked on the design of the user interface (UI) and user experience (UX) of the smartphone, which runs on *Google*'s *Android* OS. On their part, *Kwamecorp* had incorporated many innovative widgets and features in addition to the core usability, including a slider widget that turns on flight mode for a user-chosen period of time, as if encouraging the user that it's okay to turn off communications and disconnect at least for a while.

I was intrigued by the quirky nature of the widget, as well the noble aim of the phone. Impressed with what I had seen of the company so far, I decided to find out more. A quick link to the *Kwamecorp* corporate website showcased many other interesting projects, including a social network built around doing favours for others (*Impossible*), a cover-screen app that allows a small group to share an intuitive and intimate doodle-space (*LokLok*), a wireless radio made with a ceramic façade that blurs the divide between device and furniture (*Josiah*), and of course, the modular wearable *BOND* that is central in this thesis. One common theme between all these projects was a distinctive philosophy of human-friendly technology, which resonated strongly with me.

Given the impending endeavour of my thesis, I decided to drop a line to *Kwamecorp*, whose webpage popped a surprisingly open invitation for new clients and prospective candidates, asking if they were open to the possibility of myself working on a project with them. Within a week, I had received an email from the COO Christoph Dressel (Chris), with CEO Kwame Ferreira cc-ed, to schedule an interview on *Skype/Google* Hangouts. Soon enough, the interview came and went, with Christoph on the other end being not only open to the

idea but also enthusiastic about which projects I could work on. After signing an non-disclosure agreement (NDA), I was sent a handful of project briefs that I could possibly look into. There was certainly no shortage of innovative ideas on multiple fronts that the company was looking into. While recent developments meant they could not provide a stipend for my internship, Christoph graciously offered accommodation in Lisbon or San Francisco, depending on the project.

The first project we mutually decided would be interesting to work on was a *Bitcoin*-related pitch from a social innovation angle. Unfortunately the troubling volatility of *Bitcoin* in the following months forced that project into cold storage. In the meantime, I myself had taken quite a liking to the *BOND* pitch, and with permission, it was agreed that I could work on that product. The internship was official! Two months later, I found myself in Lisbon, hosted at the CFO Zumbi Ferreira's (aka Tupac, Kwame's brother) charming home in downtown Lisbon.

A Corporate Profile

Kwamecorp was founded in 2008 as an "innovation agency". Currently they have three offices, one each in the UK, Portugal and the USA, making them an international firm. The London studio serves the main business development office, situated in the trendy Soho district. There is a company-owned house in Palo Alto, close to a *Samsung* base, which is home-away-from-home for employees tasked to work on projects with this longstanding client.

In Lisbon itself, the bulk of the design and coding workforce are permanently located, headed by senior designer Pedro Cardoso and CTO Kim Hansen respectively. In all, the company is about 50 men strong. Kwame himself does not intend to grow a team larger than a hundred or so employees (personal communication). Given its age and size, I am tempted to call *Kwamecorp* an adolescent startup, successful and still growing.

Kwamecorp is first and foremost a new media consultancy, handling projects for diverse clients, multiple clients at a time, in and on different platforms. Among their list of clients are international brands like *Intel*, *BBC*, *Khan Academy* and *Samsung*. Having established a solid reputation for innovative work, the consultancy arm generates a constant stream of work to finish and deliver, with a reliable revenue stream. To the extent that the consultancy arm is the

breadwinner, it is a constant practical concern that fundamentally influences the workings and priorities of *Kwamecorp*. For example, the loss of a significant client led to major restructuring of in-house projects. *Kwamecorp*'s creative consultancy practice is therefore an actant; it captures and retains clients and provides steady work for the company. Clients engage the company specifically for their innovative deliverables and so *Kwamecorp* must continue to deliver innovation in(to) their consultancy.

They also have a foot in new ventures. With a small private capital fund, they incubate startups that have potential. They also invest in people, for example hosting and collaborating with a one-man industrial design startup in their London office. While ventures are inherently riskier as the founders are no doubt aware, the payoffs are greater. Naturally, ventures get special attention at *Kwamecorp*. The Ventures arm is an actant then; the success and failure of ventures has a direct bearing on the present and future fortunes of the company. In return, *Kwamecorp* must invest wisely but also commensurately to balance the risk and the rewards.

Kwamecorp advertise themselves as a social enterprise, in that they seek to empower people and communities through their work. In projects like *dream:st* for example, they leverage technology to match children in needy communities with local role models. And of course, the human-friendly technology theme behind their commercial work also gets attention in industry publications. Products like *Fairphone*, *Impossible*, *BOND*, and more recently *LokLok*, have been covered in the news and also gone viral several times on various social networks. This signature humanist philosophy, whose consistent influence is embedded in their work, is an actant as well. It differentiates them from other competitors, as long as they continue to place value in it in practice.

The company can be organisationally broken down into three dominant groups: the self-designated "circle of elders" who make the big company decisions, the design team and the coding team. There is of course a diffuse fourth group of people, who cover everything from business development, intellectual property and administration, a vital lubricant to the daily workings and creative output of the other teams. Each group, for the purposes of this analysis, is a major actant. Each has a vital role without whom *Kwamecorp* as an entity cannot perform.

To maintain its international exposure, the circle of elders and the business development team remain mobile. Christoph and Kwame are constantly flying around the world to represent the company at industry events. During the course of my internship alone, *Kwamecorp* had made a showing at Mobile World Congress in Barcelona, TEDxMonterey in California and the International Mobile Conference in Moscow, among others. Projects and collaborations come from international sources as well.

Kwamecorp operates, in an existential sense, as a “planetary business” (as they call themselves), friendly competition to other global design & technology studios. A typical small company might establish an office and operate solely within that region. *Kwamecorp* on the other hand participates in initiatives all over the world. Even multinational companies usually allow regional bases to act autonomously. *Kwamecorp* runs all its three offices as one ship, working on a single pipeline of projects. Thus their policy of running a "planetary business" is also an actant.

This is *Kwamecorp*'s corporate image from the outside. Before going forward, it would be good to comment on this exercise of designating actants thus far. From an academic perspective, it demonstrates how intangible policies can deeply influence a company. At the same time, it is clear that a policy is only as good as how it is implemented in daily practice. As such, I think it highlights successful practices from merely good intentions. In this case, *Kwamecorp*’s policies are clearly shown to be implemented in practice; they are not just exciting buzzwords on the corporate website. The effects of implementation are also made clear, adding real value to both the company and their projects. Identifying such intangible actants therefore is valuable to capture what the company is doing right, and perhaps improve in other desired areas.

Moving on, embedded as I was in *Kwamecorp*'s Lisbon office, let me also now detail what the organisation looks like from the inside.

The Lisbon office

Kwamecorp's Lisbon office is located in the Santos district, a stone's throw away from the waterfront and close to Portugal's parliament building. It is on

the third floor of a typical Lisbonian building where Rothschilds have also established their Portuguese office, and at least one other local startup.

The biggest room in the space is bright and airy, with wall-height windows taking advantage of Lisbon's balmy climate, drawing ample natural light and circulation. This is where most of the designers work. The walls are punctuated with visual design mock-ups of various projects, around which teams frequently huddle while discussing the next steps for each project. The designers themselves are generally soft-spoken, and very occupied with their work. Pedro currently leads the design team. He is less of a project manager though, functioning rather as a coach aligning personal needs and professional growth of the designers.

An almost-equal number of coders have taken up an adjacent room. They are mostly accomplished in Android development (Java), but also proficient in other languages as required by projects. The *Kwamecorp* coders like to be platform-agnostic. In this room, there are notably two whiteboards which serve as a shared to-do list keeping track of projects, progress and performance. On any given day, it would not be uncommon to hear raucous laughter from this room punctuating the silence of the design room. Kim leads the coding team, with a distinctive emphasis on ensuring everyone has a "creative and healthy lifestyle".

A small conference room sports white walls with a window that lets in soft light. Together with a driftwood table in the room, this room has all the elements for a rustic scene. The resident designers routinely take advantage of this ambience; to make concept images and official product posters, they combine strategic angles with *Photoshop* wizardry to achieve glamorous marketing materials with minimum expense.

There is also a *PlayStation* console in the room, and employees play on it when they can spare the time. Occasionally, someone might decide to give a lecture here to the rest of the team about interesting things they are working on. Whenever Kwame drops by, he organises Kwametalks to relate to employees the latest happenings across all the offices, and communicate the company decisions moving forward.

And of course, the conference room is sometimes used for video-conferencing and meetings as well. This operates on an ad hoc first-come first-served basis,

but the pantry doubles as a secondary option if the conference room is already taken.

The pantry is always well-stocked, with complimentary snacks, spreads, utensils and the all-important espresso machine. Nika Carvalho, the administrative secretary fondly referred to as the "office angel", ensures that there is an ample supply of fruits and chewing gum around the office. And finally there is a small room right next to the pantry, occupied by programmers working for Chris' other startup, *EAETech*. These programmers are sometimes drafted to help with select *Kwamecorp* projects as well.

The personalisation of the workplace by the employees extends throughout. Photoshopped posters of employees subsequently doodled on by other employees, an inexplicable altar to random canine memorabilia in the coders' room, *LokLok* doodles ranging from juvenile to masterful, among others. Surfboards also are a common sight lining the corridors between rooms, hinting at a group of avid surfers in the office.

Kwame encourages even more personalisation, insisting everyone make the workplace truly theirs. Most recently, one wall on a common corridor was painted with special magnetic chalkboard paint, as a communal place of communication. Doodles and in-jokes quickly appeared on the wall by the end of the week.

Being a new media agency, it is only natural that *Kwamecorp* enjoys an active digital presence as well. In addition to the corporate website, whose blog is regularly updated, *Kwamecorp* also has an active internal *Facebook* (*FB*) group. The *FB* group is accessible by the public, but only employees can post and share on it. And share they do on daily basis, be it design resources, tech headlines or editorials on consumer technology culture, among many other topics of interest. There is no strict policy on distractions like using *FB* or *Twitter* during work hours. As such, the discussions here happen both during the workday and after (and sometimes on weekends too). The community manager tracks the social network presence of various *Kwamecorp* projects, tracking statistics and sentiments when some posts go viral, and replying to the queries of prospective consumers.

During my time there, an awkwardly-posed profile picture of a colleague in Palo Alto quickly became the subject of a Lisbon office meme. The designers and coders, all mutual friends on FB, took turns to photoshop his silhouette into bizarre photographs found online, populating a new *Tumblr* blog with numerous entries within the span of a few days. What really stood out for me, a *Photoshop*-amateur myself, was their speed and familiarity with the software. What would have been a hour-long assignment for me was for them an effortless prank.

Since ANT theoretically allows even a technology to be termed an actant, it would be tempting of course to say design software like the Adobe suite would be definitely important actants in a new media agency. However, as illustrated in this example, there seems to be no sense of negotiation or compromise (read: *translation*) between my colleagues and their tools. They do not clash or compromise with their tools. Rather, the software are tamed, serving the will and whims of the *Kwamecorp* employees. So, counter-intuitively, software is not an influencing actant at *Kwamecorp*. This was a particularly eye-opening observation.

Humans of Kwamecorp

My colleagues at *Kwamecorp* were an eclectic bunch. Many of them have interdisciplinary interests, from indie game design to curating Portuguese street-art. One of the most skilled web coders I found out later, had finished a Masters in Fine Arts focusing on copyright issues in digital media for his thesis. Some employees are yet to graduate, but have secure positions within both coding and design teams, which I find heartening. Similar to my experience, everyone had been recruited personally by the circle of elders, not by a HR team.

Employees are constantly shuffling between the three *Kwamecorp* offices. Whether they were old-timers or relatively new, they were well-integrated into the team. An intern who joined around the same time that I did was already on assignment in Palo Alto, working with the *Samsung* consulting team by the time I left. When employees or even any of the elders arrive back in Lisbon, there are hugs all around, suggesting cosy sincere friendships on top of their

professional affiliations. Senior staff also go overseas on short notice to liaise with clients around the world.

Since the main business development happens in London, brothers Kwame & Tupac permanently reside there, with regular hops to Lisbon. Christoph on the other hand has settled in the USA, with occasional visits to the Lisbon office. (I use the word 'settled' very lightly here.) So Christoph and Tupac's long-time residences in Lisbon would otherwise be unoccupied, but even these are strategically repurposed to accommodate personal and professional guests, like myself and other nomadic employees, at no extra cost to the company. Such resourcefulness seems typical of a startup environment, lending credence to the assertion that *Kwamecorp* operates like an adolescent startup.

Their mobile lifestyle is definitely an investment. Firstly, the willingness to travel opens up opportunities beyond the local city. They regularly establish contact with celebrities and fellow entrepreneurs who also work on an international stage. Working for high-profile clients also populates the company contact list with influential names in fashion and industry. This extended network in turn generates more ideas, exposure and collaboration opportunities.

For example, a respected fashion designer (Eric van Buren Wright) and the design director of *Tiffany & Co* (Francesca Amfitheatrof) are now advisors on the *BOND* project, made possible only through such networking. The contact network of *Kwamecorp* is therefore an influential actant.

The mobility can also be a tradeoff. Chris, who is married, has moved with his wife from Lisbon to the USA, to respond to increasing business demands there. Even so, he travels a lot, and is away from home for long periods of time. In fact, it was during a separation like this that the idea for *BOND Touch* was born. Christoph and Kwame were having a conversation on Valentine's Day, and Chris, missing his wife, wondered out loud if it would be possible to be close to her in a way that *Skype*, email and chat could not offer.

The inevitability of BOND Touch

At this point, it comes to light from the narrative thus far, that the idea for *BOND* is a natural effect of the *Kwamecorp* actor-network system. Follow my logic.

The actants of *Kwamecorp*, highlighted above, each essential to the continued success and growth of the company, naturally demand the hectic nomadic lifestyle that separates Christoph from his wife. Furthermore, the nature of the industry in which *Kwamecorp* is embedded and experienced in, namely new media and consumer products, plays a big role. Recall the *BOND Touch* inception described in the previous paragraph. Perhaps two laymen from a different industry sharing the same conversation might not have recognised the potential it entailed.

Thirdly, the actor-network in this case acts in a way to generate more actants and opportunities, as manifested in the extended contact list. Such prospective actants are strategically and fluidly enrolled into the actor-network when a relevant project comes along, like *BOND Touch*. The fashion designer & design director who have joined the *BOND* team as advisors are examples of enrolled actors, and it is their participation that lends weight to the "fashion accessory" pitch given to potential investors.

Furthermore, I would to draw parallels between the success of a startup pitch with the four stages of *translation* discussed earlier; I posit here that the establishment of a new startup is in fact a *translation* process writ large.

Kwamecorp first *problematised* the need for a product like *BOND Touch* by automatically enrolling themselves in the proposed solution. They not only patented the potential idea, they also incorporated it into a larger company strategy around modular wearables, a space in which they already had a lot of interest. This is a betrayal of sorts, making the touch-based communication concept only accessible through the modular *BOND* platform. Just because it is a betrayal does not mean it is unfavourable, quite the contrary; only the betrayal helped *BOND Touch* as an idea survive when otherwise it may not have.

They engaged in a process of *interessement*, first internally tapping the ideas of employees and enrolling closest actors like the industrial designer whose startup they're incubating. Then a more public drive at *interessement*, first with a crowd-funding *Indiegogo* campaign, and subsequently pitches to venture capital investors. The *enrollment* process is ongoing, wherein various actors both within and outside *Kwamecorp*, are now committing resources to the real development of the product beyond just passing interest. Most recently, a South Korean electronics manufacturer has expressed interest in *BOND* production, with a potentially substantial sum and a number of engineers to work on the prototype.

And ultimately the mass production of *BOND Touch* units would be achieved in the *mobilisation* stage, when these actors (contractually) agree to ally on the *BOND* product, and these relations will hold as long as the *mobilisation* is continually performed. The outcome of the actor-network's continual interaction will be the *BOND* product.

All these factors coming together result in *BOND Touch* going from a passing idea to a business plan to a real-life product. In the open-source world, the logic that explains the incentive to develop new software is referred to as "scratching your own itch" (Raymond, 2000). This is clearly seen here: *Kwamecorp*'s (successful) workings in itself created an itch that is operationalised in a way *Kwamecorp* can (successfully) solve. The 'betrayal' implied in *translation* is seen in the conversion of the functional idea of technological intimacy to the business pitch of one of many functions in a fashionable modular wearable, courtesy of the actor-network and the intermediary *translations*.

Immutable Mobiles of Kwamecorp

So one can imagine a typical work-day at *Kwamecorp* is actually quite atypical. Work-timing is not exactly fixed, and employees come in anytime between 8 AM and 10.30 AM. Perhaps unsurprisingly, there is no fixed end to the workday either, so employees have the responsibility and freedom to manage their schedules.

Characteristic of Lisbon was the 2-hour long lunch break, where spontaneous groups of employees would retire either to the pantry or the many establishments within walking distance. What is especially refreshing is the complete lack of work-related talk during lunch breaks. Instead, conversations revolve around aspects of life in Lisbon, fun activities, recent surf experiences, among other things. This essentially makes group lunches a social outing rather than a professional one.

Of course work also gets done in *Kwamecorp*; their working style however is rather unique. In every working room therefore, there are ample rows of monitors. While employees can pick their favourite spots, flexible re-arrangement of sitting location is encouraged so everyone working on the same consulting project is next to each other.

In fact this flexibility also extends organisationally; the teams are not constant throughout any single project. The same project can have different employees working on it, alone or together, at various times. In fact, at times when the workload is heavy, even the "circle of elders" draft themselves to work on aspects of the design deliverables. I've never experienced such fluid teams in my experience.

Of course, there are a few drawbacks to such dilution. One programmer expressed moderate frustration that picking up after someone else's code is often a chore, sometimes leading to bugs further into development. However, the shuffling also allows multiple perspectives to converge on the same problem and the final outcome is more refined thanks to this attrition.

Kwame encourages in-house employees to pitch new ideas that the circle of elders may decide to support as a venture. Employees are promised some degree of profit-sharing from successful ventures. For now, there are a couple of high-profile ventures initiated by Kwame himself, as well as an app (*LokLok*) championed by an in-house senior UX designer. The *LokLok* team is generally small and fixed, with minimal shuffling. This is in line with LEAN startup principles, wherein the core team builds a prototype with minimum input. The subsequent validation of the prototype decides its priority iteratively.

So *Kwamecorp* has a design team and a coding team, but what exactly do they do? Well they are not seen as separate departments with different deliverables;

projects are not sequentially assembled in a conveyer belt fashion. Instead, designers, coders and yet others are drafted to projects together.

Specific to *Kwamecorp*, they implement a rapid prototyping cycle they call the VOID methodology - value oriented innovation design (Kwamecorp, 2013). They recognise their areas of expertise, namely UX/UI design, software engineering and validation. Instead of seeing these as sequential steps, they instead iterate in short cycles. In every iteration, they critically analyse the value the product brings to the user, design or modify accordingly, implement in code and validate if the value propositions have been successfully manifested.

It is interesting also to deconstruct the specialities of each area of expertise. UX designers first propose an underlying sentiment to elicit a certain emotional experience in every project. They also dabble in usability engineering; anticipating and easing the flow of the more important actions. Then they make wireframes and mock-ups of the process, validating where possible the ease of use and meaningful economy of user cognition. UI designers try to capture visually the desired essence of the emotional experience. They enhance the UX mock-ups with clear iconography and brand-specific flair.

Coders quickly deploy a stable backend of code architecture depending on the project, while designing the front-end to conform with the designed flow of UX interactions featuring the visuals provided by the UI design. For projects larger in scale and scope, there is a resident service designer who takes into the account the entire lifecycle of the product's interaction with the client, and designs affordances and interventions accordingly. The community manager is also in charge of user analytics, using various metrics to empirically validate the impact of the designed interactions.

UX, UI, coding, analytics: these are all important to a digital media experience in the way an architect, interior designer, contractor and standards inspector are equally vital to the aesthetic and functional experience of a space. The in-house VOID methodology seems at first glance to utilise every teams' expertise fully and equally. In practice however, it is a bit more complicated.

In ANT literature, Latour identifies the importance of immutable mobiles, as discussed in the introduction. Here I would like to propose that in the actor-network that is *Kwamecorp*, there are in fact two immutable mobiles: *Design*

and *Code*. Note here that I capitalise the two terms to distinguish project-specific immutable mobiles in the *Kwamecorp* actor-network from the universal generic meanings of the two words.

Clients engage *Kwamecorp* for tangible new media products. These products must be tangible, usable, deployable; that is to say, they must be delivered in working *Code*. But clients come specifically to *Kwamecorp*, as opposed to any other agency, because of the unique *Design* that *Kwamecorp* is capable of. In a way, this is similar to choosing a branded product.

For example, a branded shoe serves a tangible function (support, comfort, safety) but also delivers some unique value (design, R&D, social standing). *Kwamecorp* projects also serve tangible functions (*Code*) but also deliver unique value (*Design*).

Based on the summary of immutable mobiles earlier in this essay, it is clear that immutable mobiles contribute a stream of value within their actor-network. The frequency and scale of usage compounds the value, and these larger scales are achieved when the immutable mobiles are increasingly intelligible to more actors in the network. Their existence and use hint at the network conforming to a particular configuration, wherein unspoken affordances allow parties to simplify their continued interactions, greasing the wheels so to speak. Let me show you how *Design* and *Code* function as immutable mobiles.

Design as an immutable mobile

In the *Kwamecorp* actor-network, *Design* is used to designate the design elements of a specific project that are discussed and debated back and forth, between clients, designers and coders. *Design* elements could be the wireframes, or the workflow, the user interface, iconography and typography, among others.

These are functional, not purely ornamental; *Design* consists of specifically refined heuristics and practices that allow end-users to interact with a complex product in an intuitive manner, without disproportionate cognitive effort, and without the need to understand the backend of code. In this sense, *Design* bears a striking resemblance to the scientific endeavour as framed by ANT. Follow my logic.

Scientists hypothesise and run experiments in many different permutations of known and proven techniques. In these experiments, a great many apparatuses, and samples (say, laboratory mice) are used. The output is a condensed scientific paper, which is evaluated on the basis of its graphs and equations, figures and other numbers (scientific marks in ANT methodology) (Latour, 1986). In the end, these marks are what get disseminated in their convenient form. Peer-reviews confirm and validate the marks, and with increasing use and citation, these marks become reified in the network.

At *Kwamecorp*, designers behave a lot like scientists. New paradigms and innovations in human-computer interactions (HCI), interfaces, interaction flows are experimentally tested and validated. There are many tools, like A/B testing, conversion and tracking and others, that empirically quantify the effectiveness of designed interactions with the effect on user behaviour. These tools do this on a mass scale (thousands of users) in real-time. In the long run, only those paradigms with proven quantifiable effectiveness are retained.

In every project and between projects, design briefs of user experience and interaction are constantly debated and refined. The ethnographic study of other technology startups and their iterative design evolution is also a common, on-going reality in *Kwamecorp*. When approaching a new project, designers reuse and recombine best practices and past learnings generously, (re-)applying relevant tweaks using proven methods. The in-house VOID methodology, institutionalises fast and iterative prototyping to validate alignment with core design goals. These design briefs are therefore the marks from each project.

Recall I mentioned how the *Kwamecorp* team shares links on the *FB* group for design resources regularly. These links are actively used, a lot like citations among scientists. In a sense, this is how the practice of design evolves in this industry. Over time, some practices become reified, the new defaults on which future design elements are creatively remixed.

Based on these observations, I conclude that *Design* is in fact an immutable mobile. *Design* might not be easy to create, but it is definitely easier to communicate. In *Kwamecorp*, designers, coders and clients all interact with the *Design* intuitively, with no great difficulty. From the moment the visual mock-ups

are created, there may be a lot of debate on the specific details of implementation, but almost never on its inherent value.

Design is both highly visible (the aesthetics definitely help) and highly intelligible. *Design* is also extremely mobile in the actor-network. Therefore *Design* is a dominant immutable mobile in the *Kwamecorp* actor-network.

Code as an immutable mobile

Code is also an immutable mobile. This is an easier proposition to make, because the immutable mobility of *Code* is as familiar as that of the alphabet, of numerals, and scientific marks (Latour, 1986). In the parlance of immutable mobiles, *Code* reliably delivers the product between actants in the network and beyond. In *Kwamecorp* projects, the *Code* is very important. These products, end up being used by thousands or even millions of users, and so the *Code* must work reliably and remain secure. From a technical standpoint, the *Code* is of functional importance, without which the *Design* remains mere concept art.

However, the *Code* is also invisible to most actors other than the coding team. It is invisible because a compiled app is a black-box whose code cannot be seen. It is invisible because it is unintelligible to most actants in the network. While a client can debate *Design* from a visual mock-up, clients cannot argue the merits of one code framework over another, or appreciate the efficiency of clean *Code* if the compromise subjectively modifies the *Design*. Even designers within *Kwamecorp* do not speak or understand *Code*. So, even the validation of *Code* ultimately boils down to how much the final product resembles or deviates from the *Design*. *Code* is a largely invisible immutable mobile.

Wrestling for Visibility

Therefore, a finished *Kwamecorp* project is the final delivery of two immutable mobiles in one package, one highly visible and one rather invisible. How is this observation important? Based on my analysis, I propose that this is a potential bottleneck on innovation.

First, let us revisit the concept of *translation* when two actants interact. This is a creative betrayal, where something new enters the actor-network that neither party could achieve alone. At the interface of where the design and coding teams interact, is an area of translation in *Kwamecorp*, where creativity and innovation are translated into code and usage. As long as this key boundary remains intact, *Kwamecorp* products deliver what they promise.

However, when one of the immutable mobiles is more visible than the other, it becomes over time perhaps unintentionally, the more dominant immutable mobile. The dominant immutable mobile becomes the *de facto* currency of the actor-network, even though the other is just as vital to the final outcome. I'm tempted to say in *Kwamecorp* projects, *Design* sometimes oppresses *Code*.

I experienced this myself while volunteering on a side-project with a designer. As the designer, his visual mock-ups were approved, and reified, almost instantly - because they were visual, visible. As the coder, I found it hard to communicate certain technical concerns not least because the designer could not understand my code, but also because code is abstract, invisible. To the designer, my code may as well have been Greek prose, whose meaning however floral would have just looked like a random string of alien symbols. There was a loss in translation, or should I say, *translation*?

In practice, this leads to some sense of inequality. One programmer attested that the client he was working for was constantly adding and subtracting from the feature list within the span of hours, on a daily basis, leading to a constant re-edit of the same lines of *Code* over and over again. This was largely a one-way interaction, with the coder ultimately subject to the whims of the client.

On the other hand, I also witnessed designers and clients debating passionately about key aspects of the visual mock-ups, with two-way conversation. More often than not, the designers would win. Moreover, with the increasing involvement of designers in not just the initial mock-ups but also the lifecycle of the user experience, *Design* seems to derive an even more apparent superiority over *Code*.

The validation cycle of *Design* is necessarily different than that of *Code*. For *Design*, the initial mock-ups are fast and rough, and over time, they are refined and decorated at a deliberate pace of iteration. *Code* is different; engineering

the backend to support the basic usability and including scaffolding to support the visual façade and interaction flow makes the initial production slow. Once the base is ready though, iterative refinements are very fast, each a negligible change of already existing parameters.

However, the apparent visibility and dominance of *Design* in the actor-network forces *Code* to adopt the former's pace and timing. This, I believe, might compromise the integrity of *Code*.

From a more strategic perspective, since *Code* is invisible and unintelligible, it is hard for the actants to talk about *Code*. While designers easily share links to new techniques and paradigms they can try, coders with their specialist knowledge may be exposed to latest developments in software from a technical perspective. These cannot be shared or communicated easily. They cannot be championed easily, and so their ground-breaking adoption might be missed until such time they become so commonplace that designers notice them in common practice. This can stifle innovation hailing from a technical front.

There is such an inertia to entertaining change(s) in *Design* but almost no restraint in mandating change(s) in *Code*. Both are creative outputs that are equally important. So why is the *Code* subservient to the *Design*? Equally why is *Design* not as fluid as *Code*? When *Design* oppresses *Code*, the synergistic potential for radical innovation is vastly diminished. As a new media agency, it is in *Kwamecorp*'s best interest not to do so. I truly believe the *translation* is lesser for it.

Parting words

This essay is an effort to capture innovation processes in a contemporary new media agency. Actor-Network Theory is used as the framework on which analysis is done. Perhaps now, it would be good to review the advantages and disadvantages of ANT based on the case-study. Doing this serves a double function: the unique insights of the analysis are elucidated as well as the limitations, and secondly, this critical look adds some opinions to the on-going controversy around ANT (Latour, 2005; Sayes, 2014).

An ANT Retrospective

Delving into core ANT literature to prepare this essay was quite an entertaining experience; the readings were usually narrative-like in structure, and elaborated on a myriad of case studies from various sectors. On the other hand, the controversies of ANT also came to the forefront very quickly, primarily on the extent of agency ANT attributes to non-human actants. One of the more interesting objections came from the principal investigator's supervisor, who harboured scepticism for abstract intellectualising. The principal investigator personally experienced this in some ANT-based literature from recent years, which has such obfuscated terms in such frequency that it made the text extremely difficult to follow.

Firstly, the principal investigator posits that ANT adds an important avenue to advance Science and Technology Studies (STS). In his seminal article "Do Artifacts Have Politics?" (yes they do), Langdon Winner arrives at the following proposition: that technologies are "a way to build order in our world" (Winner, 1980). Even considering the social shaping of technology, or perhaps because of it, the particular order that technology imposes can be questioned - whose way, ordered for whom? This is not an isolated sentiment.

In a more contemporary example, Lawrence Lessig proposes that computer code in every sense is political; Code is Law (Lessig, 2009). By this he means that the digital rules that we encode and codify in our computers and on the Internet, allowing certain actions and others not, are akin to laws in cyberspace. Lessig thus argue that since Code is Law, the political sovereignty and integrity of cyberspace must be condensed into a sacrosanct Constitution, just like in real life.

These propositions lend credence at least to the importance of realising that technology is no longer neutral. From a policy analysis perspective, the principal investigator is tempted to suggest that technology is one way to implement a policy. The social shaping of technology then, is not a good reason to be complacent, but a call to be active in shaping it. If ANT's unique commentary on the agency of technology can raise awareness of this key point, then the principal investigator is quite supportive of the approach.

Speaking of raising awareness, intelligibility has been one distinct strength of the ANT approach, thanks in no small part to the ethnographic method. With this distinct focus on daily observations, there is a narrative quality in ANT literature that the principal investigator finds unusual. Perhaps history will decide if this style is acceptable for scholarship, but the principal investigator would like to propose here that in the short term, the narrative quality can help in communication.

During the course of this thesis, one of the prime motivations of the principal investigator was to explore how sociological insights could be used to improve a contemporary system, rather than just describe it. The first draft of this very essay was sent to *Kwamecorp*'s circle of elders; who not only liked it for its X-ray view, but also proposed to publish it internally for all the teams to read (personal communication). I doubt this would have been possible with a non-ethnographic approach. ANT itself adds minimal terminology, and in my analysis, these terms only helped to orientate the reader.

Now what comes out of an ANT analysis? What is the unique insight afforded by this method? The principal investigator would like to answer with two examples. The first example would be the identification of actants of the *Kwamecorp* actor-network. At least in the particular formulation of actants in this essay, almost none were individual actors. Instead entire teams, policies and technologies were termed as influential actants. So what, one may ask, if abstract constructions are given an abstract name?

But these are not abstract constructions! The teams and technologies are real; they are not the same among projects, or even within a single project, but their fluidity does not dissolve their importance (de Laet & Mol, 2000). The policies are not buzzwords, they are enacted. The profound value of the ethnographic method comes into play here. These are active processes implemented in daily practice. Designating them as actants in the parlance of ANT, is to highlight that they are continuously interacting within the actor-network. In short, in justifying certain things as actants, the principal investigator is in fact elaborating on the inner processes at the company - a description of how the company works.

As for the other example, in this case-study there were demonstrated to be two immutable mobiles in the same network, but the higher appreciation of one seemed to undermine the influence of the other. To an extent, the programmers at *Kwamecorp* are already aware that *Code* is not given as much authority to influence a project as *Design* is (personal communication). But without casting *Code* and *Design* as immutable mobiles, it would not have been easy to understand how *Design* has a significant influence - because it is more visible among the actants of the network, more intelligible.

In practice, company terminology would deem each new project as a single deliverable. Here, that single deliverable is decomposed into *Design* and *Code*. Again, designating *Design* and *Code* (with capitals) is not an abstract construction, but in fact a rather material one. These immutable mobiles are referring to the very real things that are the design and code deliverables of each project. And it is only in framing *Design* and *Code* as both immutable mobiles that the they can be comparatively analysed as two separate but equally important things, and the nature of their inequality can be put in words.

Therefore, this leads me to conclude that the state of use of an immutable mobile is like a qualitative key performance indicator (KPI), which reveals something of the network it is used in.

And finally, the principal investigator defends ANT primarily for its specialised study of *translations*. It becomes obvious, that without the notion of *translations*, ANT's terminology falls flat: from actants to immutable mobiles. Immutable mobiles are immutable and mobile despite the very many *translations*. Actants (or actors) enact *translations*. In their capacity to enact, non-humans have the agency of *translation*. The mechanism of *translation* therefore is ANT's primary contribution to social theory, not its terminology. The steps of *problematisation*, *interessement*, *enrolment* and *mobilisation* seem to have at least some explanatory power.

Ironically, it is this contribution that is also ANT's limitation. In emphasising *translations*, there is an implicit dehumanising functionality that is extended to all actants and immutable mobiles. Immutable mobiles are carriers of information. All actants have defined strengths and roles, and they are only identified when an observation of a *translation* involves them.

Furthermore, a larger discussion of values and motivations, among others, are not discussed at all. In that sense, ANT is a descriptive approach that can only shed light on how a network but not why. Lacking this larger notion of values, there is some additional credence to the observation earlier in the essay, that ANT reframes an entire socio-technical system as a machine. Social systems are not like machines, and they should not be either.

For example, the principal investigator earlier mentioned how the humanist philosophy of the company is an actant given its influence on all *Kwamecorp* projects. In one sense, it is true that company adds a special touch to its projects and likewise, some good intentions have to be betrayed due to business constraints. But in another sense, calling it an actant does not do justice to the company at all. Kwame is a creative leader, and designers at *Kwamecorp* are inspired, not mandated, to add that special touch. Thus, in this study using an ANT approach, the principal investigator has perhaps captured the workings of an innovation process, but it does not comment on the underlying values, ethics, judgements that drive these workings.

And so, we find that ANT is a descriptive methodology and not a prescriptive one, and this knowledge should inform the use of the theory. ANT can be insightful to identify translations in socio-technical systems, especially if non-human factors significantly influence outcomes. Knowledge of the translations allow them to be critically evaluated, and redesigned if need be, to fulfil the desired goals. However, ANT cannot provide any guidance as to the goals that socio-technical systems can or should be aiming for. Such value-judgements and prescription can only come from elsewhere.

Conclusion

In concluding this actor-network analysis of *Kwamecorp*, the principal investigator hopes the essay has achieved multiple objectives. Firstly, it is intended as a X-ray view of the workings of a new media startup, useful to those who might be interested to know what goes on behind the scenes. Secondly, it should have served as an primer to ANT with an illustrative case study. And finally, it is a demonstration of how a sociological commentary, which is typically done *post hoc*, can be used to actively improve a community.

On my part, I had the most memorable time at *Kwamecorp*, for which he would like to thank the circle of elders, as well as the great colleagues there. This essay is dedicated to their fine work and awesome spirit. Pardon the following recklessly informal shout-out but: rock on, *Kwamecorp*!

4.2 A design history of BOND

Based on the company's meticulous archives of various projects, the principal investigator spent considerable time combing through an entire twelve gigabyte collection of UX/UI briefs, business decks, concept renders and notes from validation of prototypes to compile material that captures the design trajectory of *BOND* from inception. This information is supported by testimony from the interviews with the designers.

The design history is intended to capture product evolutions and the various priorities pursued in different iterations at different points of time. Such a historical perspective allows one to grasp key intentions of the *BOND* platform, which will be necessary to apply insights and make recommendations in line with the goals of the product.

Initial explorations

Following the inception in February 2013, a market analysis of existing and announced wearables was done, and it was found that up to 96% of the existing products focused on a *quantified self* approach (Archive Documentation – 13). That is to say, a majority of the wearables currently in the market use sensors and data analysis algorithms to track and numerically represent user activities towards the goal of fitness improvements. Other products were smart-watches aspiring to recreate many of the simpler functionalities of smartphones, especially different kinds of notifications without the inconvenience of retrieving a mobile phone from a pocket.

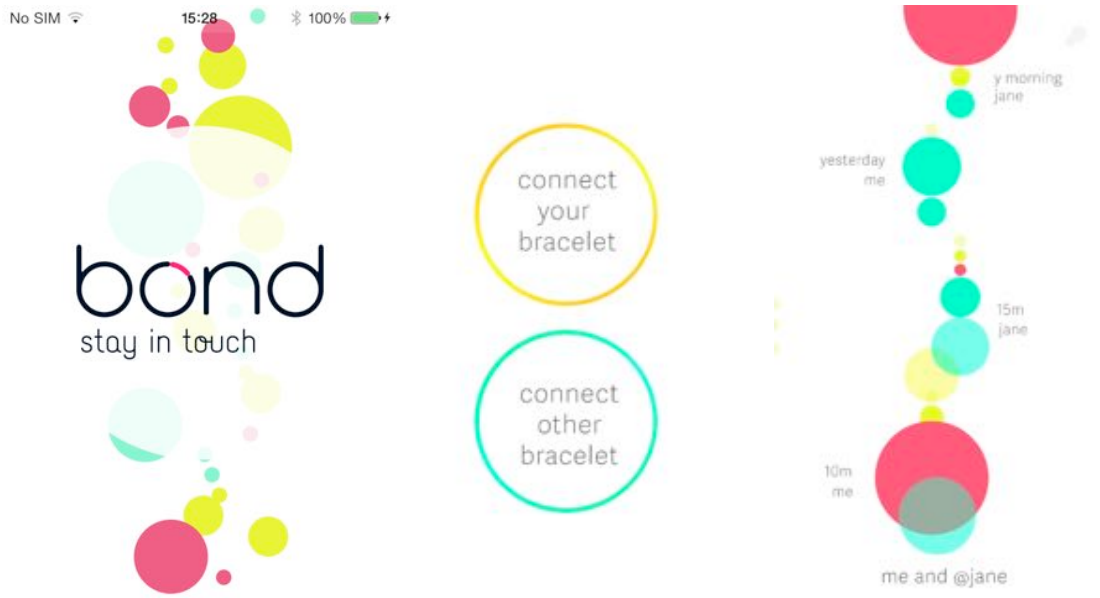
Even from the earliest stages, some aspects of the *BOND* project were already set in stone. It was to be a luxury item at a higher price-point rather than a mass consumer device (Archive Documentation – 13). The emphasis was to be on quality and timeless design, targeting a demographic of style-conscious techno-savvy couples. As a wearable, it was designed to be accessible in a wristwatch form-factor, but optionally as a pendant. As a stylish wearable, the underlying philosophy was to blur the line between jewellery and technology.

Figure 5: Early BOND concept renders

Kwamecorp, being itself experienced in UX/UI design, made a series of design briefs emphasising usability and experience (Archive Documentation – 19). The design goal was to achieve an intuitive and simple product, with an easy learning curve. The implementation of the signal and reception was to be outsourced to the user's smartphone instead of being a standalone device. Since *Kwamecorp* coders are experienced in mobile app development, harnessing known software and hardware features was an easy next step. This was also in line with one of the takeaways from the market analysis: wearables at least at the early stages should not compete with the smartphone, but rather, complement it (Archive Documentation – 11).

Similarly, there was also an emphasis on the user experience, beginning right out of the box (OOBE). The ease of activating and syncing the product pair with one another, and with their respective mobile phones was a key parameter to be optimised, so as to make the actions as seamless and pleasurable (Archive Documentation – 4).

The smartphone app that would act as the bridge for this communication was given a lot of design attention, with an emphasis on a clean and unique UI. The following are screenshots of early UI mockups (Archive Documentation - 27; circa July 2013).



The specificity of the *BOND Touch* interaction is of particular interest, both as a product concept and its academic implications explored in this thesis. Senior UX lead Joao Ferreira says the *Touch* module was seen as a way to "extend emotional connection through a digital-physical device" (interview with Joao, 2014). It was intentionally conceptualised to be exclusive as a one-to-one communication device. Joao emphasises "you know who is on the other side and you know they wanted to connect with you".

A storyboard concept for *BOND*-related advertising is very telling. It describes two children out of sight of one another playing with cups connected by a string. The first child speaks into his cup as the other strains to listen to the vibrations transmitted through the string through his cup. Unfortunately, the experiment is not perfect in practice, the string transmits nothing intelligible but still, the tugging of the string in itself is comforting and indicative of the other's presence. The second child momentarily abandons his cup in favour of some distraction, without informing the first. The lack of muffled sounds coming through the string puzzles the first child; but the wind blowing on the string somewhat resembles the tugging that was reassuring before and the first child smiles again.

BOND Touch's charm and validity as a communication medium in that sense is more akin to the tugging of the string (sense of presence) than the sounds from the cup (transmission of content). Pertinently, Community Manager Hugo Alves reminds that "BOND is not to replace cellphones, or FB messenger or

stuff like that. It's only another layer of communication" (interviews with Hugo, 2014).

Specifically, the syncing of *BOND Touch* and the smartphone was facilitated by low-energy *Bluetooth* signalling (Archive Documentation – 4). In short, a press of the *BOND Touch* device would signal the user's smartphone to send a message to the partner's smartphone which would then convey the message via the partner's *BOND Touch*.

There was some interest to further explore applications of the simple interaction of a wearable button. It was envisioned that *BOND Touch* could have coloured lighting that cycles through a spectrum the longer it is held down. In addition to adding a visual flourish, this concept was framed as a visual representation of mood, the exact hue then be recorded on the cellphone along with the exact time. This information, a quirky incarnation of the *quantified self* philosophy, was to allow users to have a mood timeline on-demand, and could be shared exclusively with the partner's smartphone. A logical extension of the mood feature was also to record the location at which the mood was registered. It was a design concept that held a lot of interest and underwent many changes (Archive Documentation – 27).

Figure 6: Mood tracking in BOND

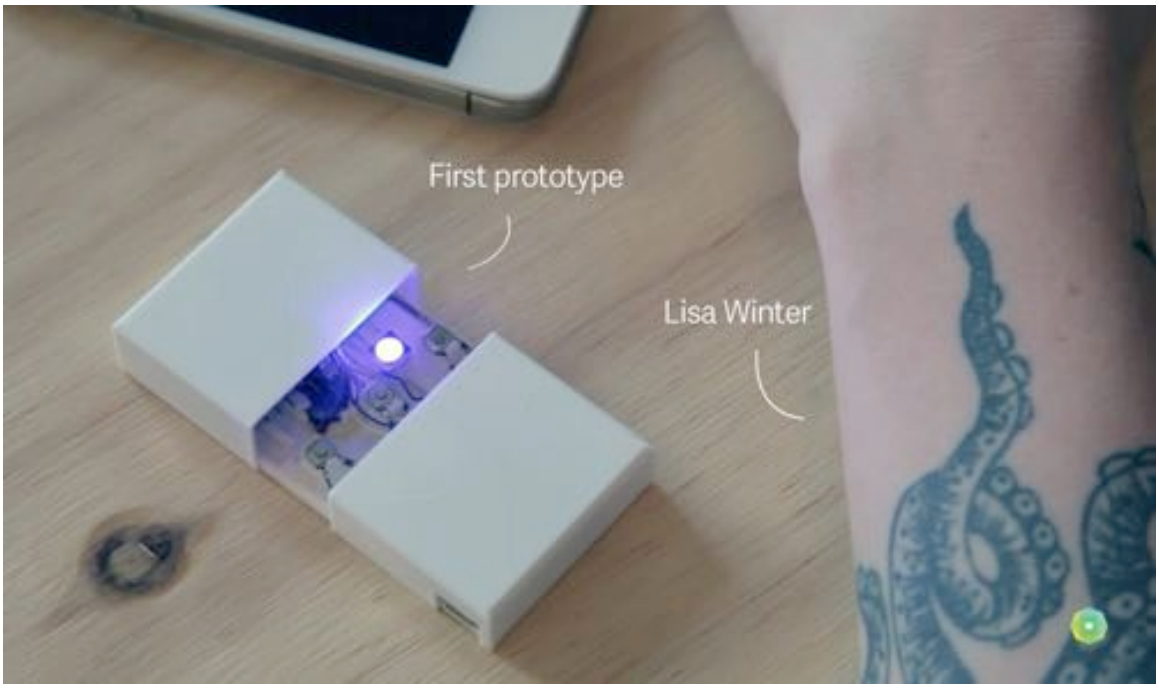
The possibility of multiple *BOND Touches* paired to a single smartphone was also explored, in what was a departure from the original one-to-one connection concept (Archive Documentation – 4). This feature was ultimately scrapped, but the principal investigator notes here the inception of modularity as a design paradigm into the *BOND* project.

Trials and errors

By September 2013, *Kwamecorp* was already experimenting with proof-of-concept prototypes. The prototyping of usability and technical feasibility were done independently. To test and fine-tune usability, designers and coders experimented with smartphones strapped to their wrists, operating a barebones app that signalled the on-board vibration mechanism when a button was pressed on-screen. The exact frequency and pressure of the vibrations were tested in different combinations to present a gentle and satisfying stimulus (personal communication with Chris, 2014).

One UX/UI designer, Dominik Seeger, attested: "We ran a couple of tests, with a phone itself, and we had quite a huge range of vibrations - they can be very soft and they can be hard jarring vibrations, the interval between vibrations can vary. There is a big range of vibration patterns you can create if you really wanted to. If this is possible, and people accept it, then you have a product that gives you a very big range of communication. If you only limit it to one kind of vibration, equal for everything, then it's only a alert to do something else" (interview with Dominik, 2014). But in the same interview, he also wondered if that entire range of vibrations should be accessible to the user as he was "not quite sure of the learning curve of the vibration" (ibid).

Technical feasibility studies explored hardware requirements establishing that *Bluetooth* connectivity between the device and a phone was indeed possible, and also the messaging connection between paired smartphones with minimal lag-time, raising confidence for the real-time communication aspect of the device (see snapshot below). The chipsets were gradually shrunk to close to the ideal wrist-module size (Archive Documentation – 35). The battery life of the device became a key concern at this point.



Meanwhile, the design of the module was crystallised with the help of an in-house industrial designer at the London office. Inspired in part by the ethical sourcing of raw materials in the *Fairphone* project, *Kwamecorp* opted to try wild rubber sourced from indigenous farmers in the Amazon. The translucent and lightly coloured material seemed inviting, lending *BOND* an organic feel that distinguished it from other 'shiny' technological devices.

By late October 2013, there was an increased urgency to hardware development due to the decision to crowdfund *BOND* on *Indiegogo*. The quirky emotional concept of the *BOND Touch* module was predicted to be a feature that users would love; moreover the stretch goals could be an opportunity to source ideas for future modules from the users themselves.

Alongside the crowdfunding campaign, *Kwamecorp* also began pitching privately to venture capital (VC) firms, whose reactions were very telling. While the *touch to stay in touch* pitch caught investors' attention at the outset, they were quick to question what else *BOND* could do. Senior UX lead Joao Ferreira noted that investors were not convinced the *Touch* module alone could attract a significant market. The takeaway message was "What can I write on the box?" This sort of feedback is a common theme for many startups pitching to VCs, and depending on many factors from potential disruptiveness of the product, to

comparative advantages in different market segments, new products are often "pivoted" to strategically address a different market or application than the one they were originally aimed at (Holle, accessed July 2013).

To address this, by mid-November 2013, modularity entered discussions in increasing frequency and seriousness. Multiple modules were envisioned on a single bracelet, each with different functionalities that users could mix and match – a customisable modular system (Archive Documentation – 33). Modularity increasingly made strategic sense, because it was clear that body real-estate for wearables were scarce (neck, wrists, upper arms and face at best), and so, a simple wearable would necessarily be replaced by others with multi-functionality (Archive Documentation – 11). On the other hand, research suggests that if an action takes more than two seconds even to initiate, usage is very much reduced. So, wearables with complex interactions might be cognitively demanding and thus not as popular.

Combining these two contrasting insights, *Kwamecorp* proposed modularity as the sweet spot of redundant simplicity and the friction of complexity; a multi-functional customisable bracelet of specialised modules could bring a lot of value to its users. This was a strategic re-invention of the *BOND* concept. The snapshots below capture the new business deck materials that put modularity front and center. In their marketing materials, the taglines for modularity were "think *LEGO* for wearables" and "hardware as apps" (Archive Documentation – 13).

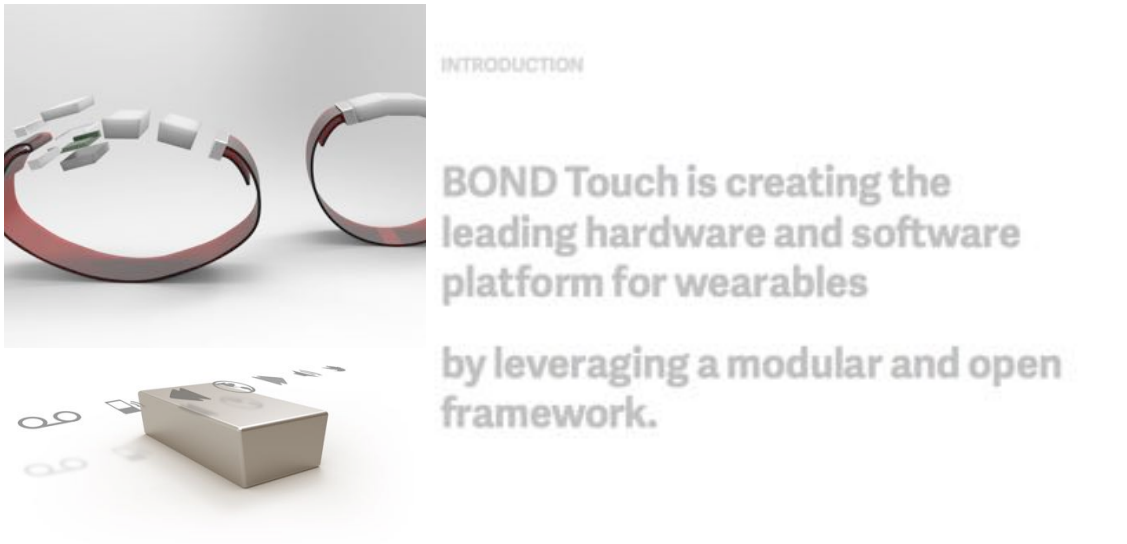
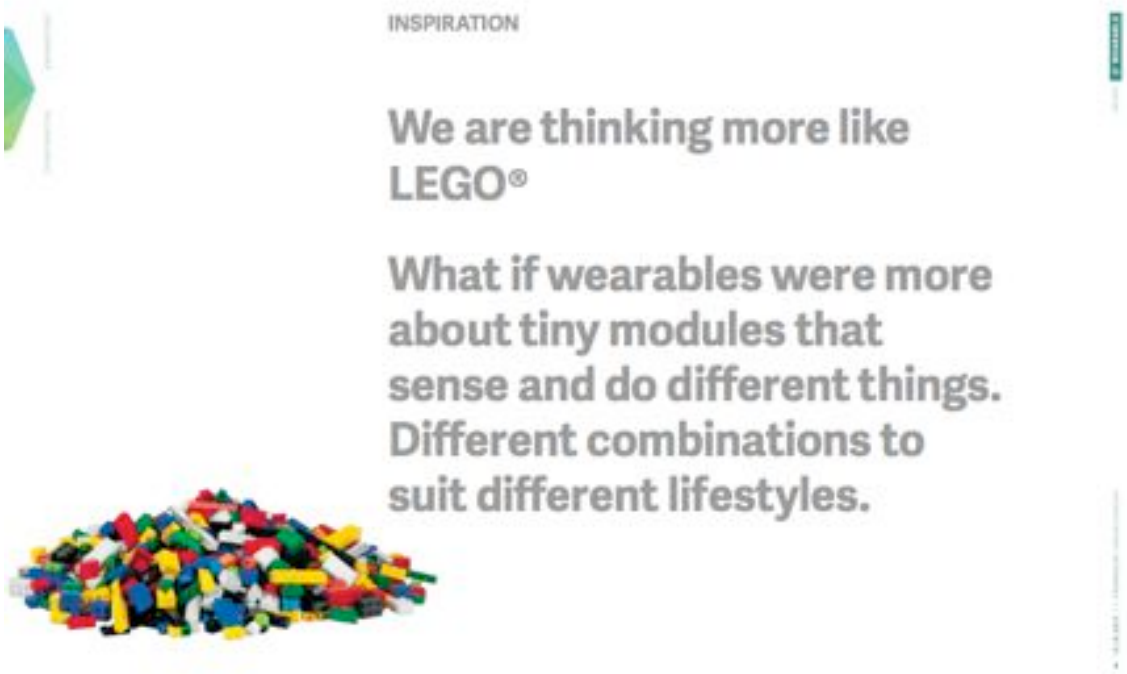
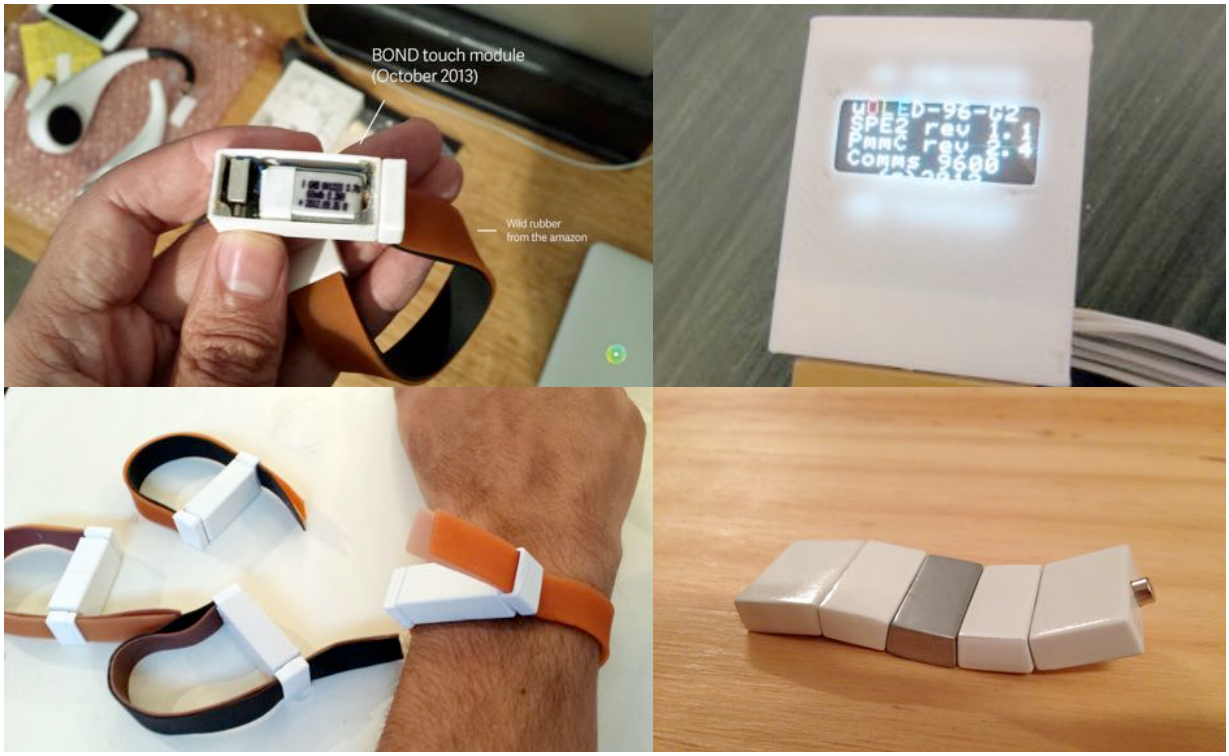


Figure 7: Modularity concept pitches



Exploring modularity further, a magnetic locking system was proposed to make possible easy connection of multiple modules. The ease-of-use was an important parameter to ensure traction among users. In a bid to add some centralised processing power for the different modules, a *Brain* module was proposed. Numerous ideas for modules were entertained, from battery modules to wireless payment modules. The distinctive *Kwamecorp* touch came back into

play; one functionality that was explored was a customisable notifications module, designed to prioritise and only relay the most important notifications from specified sources. Naturally a screen module was also in mind (see snapshots on next page).



All these new additions to the *BOND* concept were hastily translated to the crowdfunding marketing materials. In fact, the more well-known *Kickstarter* platform was not pursued only because there were too many prerequisites to fulfil within such a limited period of time.

The *Indiegogo* campaign unfortunately was not successful because the funding goal was not reached. The high price point of the device, at about US$200 per device, was definitely a contributing factor; pledgers of lower amounts would not receive an actual product, but just an acknowledgement for their support.

According to Joao (personal communication, 2014), the focus on the campaign was muddled, with exclusive focus on the one-to-one connection and not the other modules, thus not demonstrating the lifestyle compatibility of the product. On the other hand, even the advertising of *BOND Touch* was not as compelling. As such, the message of the campaign did not clearly illustrate the

benefits of modularity, nor did it crystallise the exciting potential of future wearables in a way that prospective donors could support.

Moreover, despite the noble intentions behind the choice of the wild rubber material, the offhand appearance of the device came across in the campaign video as plain and unattractive; this further did not satisfy the expectations that come with a high asking price. In retrospect, a more focused pitch with a supporting social media campaign, alongside the luck of good timing, could have tipped the odds in *Kwamecorp*'s favour.

A kind of rebirth

While *BOND* went back to the drawing board, modularity remained a core design paradigm since. One key strategy to support the modular approach has been to open up *BOND* to third party developers so the number of options for specialised modules are high enough that the "hardware as apps" store would be a viable revenue stream from the company. To that end, the official *BOND* website touts an e-shop as a feature. In this new *BOND* platform approach, the *Brain* module becomes the starter kit with a *BOND Touch* device. However users are free to purchase other specialised modules to augment their *BOND* devices as they please.

Embracing the modularity, *BOND*'s smartphone app was also reformulated to allow for modular operation, with different settings only visible if its corresponding module was present in the paired device. The UX of customising the modules was focused on intuitive action: the position of individual modules in relation to the *Brain* module would be preserved in the order of the different settings in the app (Archive Documentation - 33). The smartphone app would then also double as the shop-front for the *BOND* platform, teasing new modules with limited phone-based functionality to interest users.

The pivoting of *BOND* from a simple quirky device to a full-fledged consumer electronics platform makes business sense, but vastly increases the expertise and resources necessary to achieve that outcome.

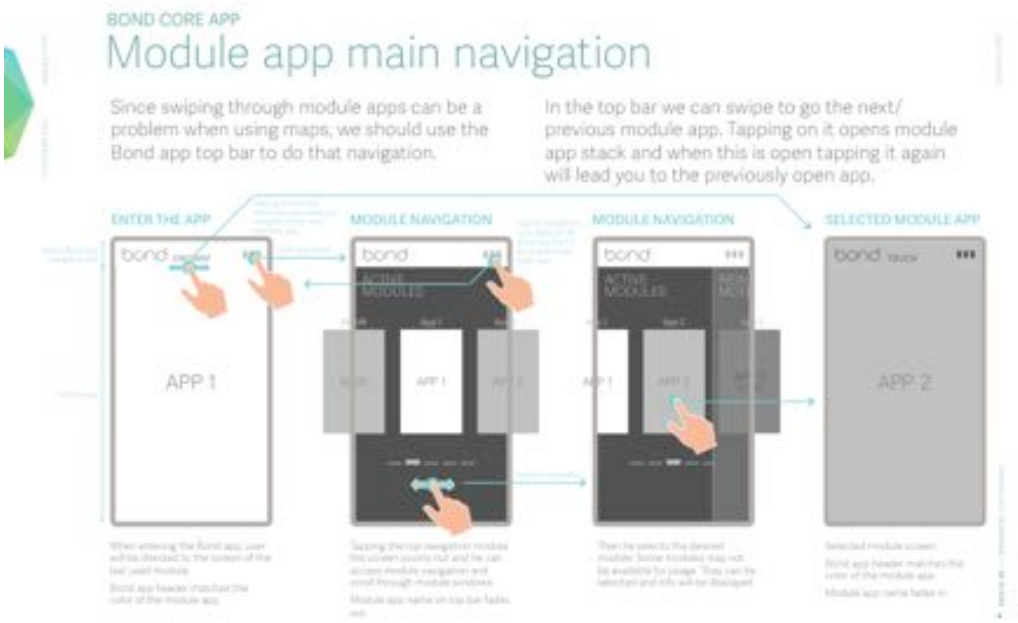


Figure 8: Explorations of modularity in UI

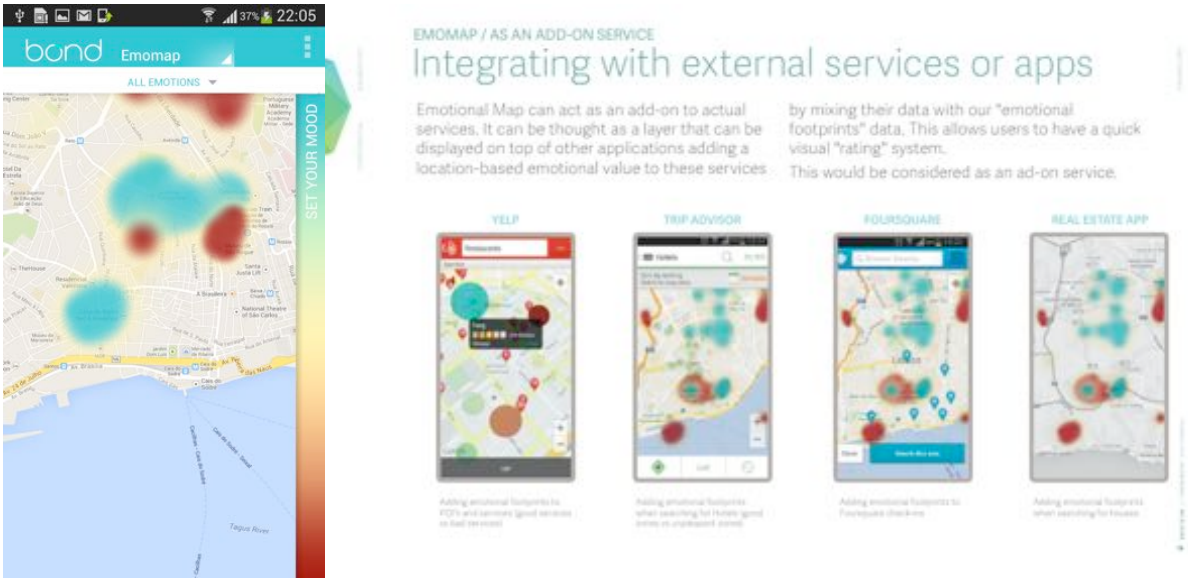
Hugo said, “What I really loved about BOND and that's my personal opinion, is that we should have stuck with the Touch module and no modularity. In the future, we can see. But the Touch thing, was the unique value proposition that we had. And when you go into the modular approach, you start competing with a lot of verticals. You start to compete with a lot of different verticals and that's really really hard, because you can do a lot of things, but you can't do a lot of things well at the same time. At least in the beginning” (interviews with Hugo, 2014).

Assets from the *Indiegogo* campaign were shared on social media and occasionally went viral in different regions. Hugo attested, “And you can see it from the *Tumblr* thing, that we had the viral post. It was because, only because of the Touch module. It was not because of the oh they're modular and I can add X or Y modules afterwards. It was because of the *Touch* thing” (ibid).

On the other hand, a modular wearable platform does have a potential for a sizeable market share. Senior design lead Pedro Cardoso believes wearables can bridge the last mile of interfacing with technology: his keywords being ubiquity and seamlessness (interview with Pedro, 2014). He continued, “One of the things I really love about the BOND concept is now that the modular

concept is here, it literally can create specific modules to communicate with specific things around you. This I found really disruptive, because suddenly I have something really simple really close to me that I can customise to daily actions. No it just seamlessly happens" (ibid).

Meanwhile, the emotion stream concept also came back with renewed enthusiasm. The inclusion of location data when capturing moods was expanded into a fully-fleshed EmoMap experience (Archive Documentation – 8). This stream of data was designed with public sharing in mind, thus allowing a map visualisation with a heat-map overlay reflected the overall mood of many users at various locations (Archive Documentation – 27). There was some enthusiasm for such an emotion stream to complement existing data steam, with potentially exciting applications (see snapshots below).



By December 2013, despite the opening up of *EmoMap* API to power a social layer on top of existing services, in-house validation rejected this feature eventually because it offered no compelling value. Users, even if initially compelled, were not motivated to continue recording an abstract data point like mood on a regular basis.

More pertinently, the *EmoMap* was also not very well-received by investors. Ultimately, the *EmoMap* feature was shelved from design considerations.

Several dummy models of the *BOND* platform were made to continue doing usability testing. The magnetic linkage between modules seemed to work as

expected, and the battery life was still a cause for concern (personal communication with Chris, 2014).

In January 2014, *PFSK* released an industry trend analysis called *The Future of Wearables* (Archive Documentation – 31). *BOND* was featured as a promising exemplar under the category of Connected Intimacy, which was defined as a class of devices that "create a continuous link between people, simulating closeness, changing the way we understand one another and enabling new forms of attention and care" (ibid).

Figure 9: BOND featured in The Future of Wearables (first from right)

At around this time, *Kwamecorp* also applied for an as-yet pending patent that is addressed: "Reconfigurable personal accessory and method of operation" (Archive Documentation – Patent). The specifications protect the core premises of *BOND*: a designer jewellery-like modular device that enables touch-based communication, among other things. While the wording of the patent adequately covers the *BOND* concept, Christoph feels that it is not a particularly strong patent in and of itself (personal communication).

As of March 2014, two contacts from another project delivered to *Tiffany's & Co* by *Kwamecorp* were brought into the fold: namely the design director at

Tiffany's as well as a well-known fashion designer (Eric van Buren Wright; see snapshot below) with an interest to enter the luxury-wearables sector. The latter was responsible for a major redesign of *BOND*, opting for a metallic band of modules mechanically connected by pressure balls (render and prototype in snapshots below).

During my internship, there was some interest by a South Korean manufacturer to mass-produce *BOND* platforms with a special focus on the South Korean market. At last contact (circa August 2014) Eric (the fashion designer) has officially joined the *BOND* team.

In retrospect

Looking back, the concept of *BOND* has come a long way, from a quirky emotional button-device to a modular smart watch with *Touch* as one of many modules.

In a sense, the *BOND* product has been moulded and transformed into something that is almost unrecognisable from the original concept. This is a metamorphosis of sorts, making the touch-based communication concept only accessible through the modular multi-functional *BOND* platform. Only this fluid change helped *BOND Touch* as an idea survive when otherwise it may not

have. All these factors coming together have resulted in *BOND* going from a passing idea to a business plan to a real-life product.

Iterative feature creep

However, there is also sufficient cause for reflection because the assets from the *Indiegogo* campaign, and also understandings gleaned from conversations with the designers, suggest that the crowdfunding space and the venture capital pitches were for entirely different audiences, and what attracts one is not always not what attracts the other. From the viral posts, it could be gleaned that many users appreciated the simplicity and emotionality of the *Touch* concept. However, it is understandable also why investors looking for disruptive ideas much prefer the modular wearable platform approach. The underlying design philosophy for each is slightly different and this should be taken into account.

The transformation has resulted in project goals that are more ambitious than the initial concept. Pedro observed, “It has been above all a learning process, because we never had someone really 100% focussed on the concept and really strong product designers thinking about the product, the outcome, the marketing and so on. So it's been kind of in and out of different knowledge and sensibilities” (interview with Pedro, 2014).

He continued that this confusion in some sense contributed to the strategy-creep: “And then we were pushing so much with this sustainable material that really compromises the high-end look of the product. And then it was too expensive to try all the electronics, so this took a lot of time and the project just drifted because we weren't really validating or pushing anything” (ibid). In retrospect, he concluded that for a complex undertaking like *BOND*, a significant investment and a dedicated team were both crucial to do justice to the effort.

The principal investigator agrees based on the analysis so far, that the numerous changes to the concept, while they have resulted in the refinement of an idea, have also radically increased the requirements to achieve that outcome. Perhaps it would be good to reconvene, recognise the new level of commitment and resources necessary to work on the present incarnation of

BOND and plan accordingly. There is only a blurred line between the fluidity of creative refinement and the feature creep that inevitably muddles project management.

Hugo also pointed out that the modular approach, while strategically sound, is also difficult to achieve (interviews with Hugo, 2014). First, there is the fact that designing wearables is pre-dominantly a hardware endeavour whereas *Kwamecorp* is more versed in software and user experience design. Secondly, each and every module in a modular approach is essentially a new vertical; each brings with it a different set of constraints, requirements and costs (ibid). So it would be hard for *Kwamecorp* to excel at every new vertical all at once.

So, despite the strategic advantage, the principal investigator recommends keeping modularity as a long-term goal, but focus on more feasible iterations in the short-term. On the other hand, for the wearable sector (unlike apps), *BOND Touch* as a single use wearable will be a tough product to market because as highlighted earlier, body real-estate is limited and any product would be quickly replaced if the product does not have broad everyday relevance to the user. A dilemma indeed.

The button is the message

A final insight gathered from the design history is that the *BOND Touch* module is in essence a button pre-programmed to interact with the mobile phone and send a certain kind of signal. Or one could put it this way: one of the functionalities/carrier-media found in *BOND* is the medium of a button. To freely explore this notion, McLuhan's quip "the medium is the message" is a useful probe. What is the message of a button-as-a-medium?

What is a (simple) button? At its core, it is a binary actuator intended for human intervention; an affordance that black-boxes complex mechanisms and/or machinery behind the simplicity of a whimsical "push of a button". Until now, button-as-a-medium is predominantly coupled with the machinery it actuates. Material buttons (coupled with machinery) have a single-access point, proximal to the geographic location of the machinery itself.

Imagine if button-as-a-medium is creatively decoupled from its machinery – a free-floating actuator, an interesting line of thought. In digital media, this is already the norm: social media sharing buttons are routinely embedded in websites outside of the service itself. Digital curation is a good example in democratic systems on popular websites moderated by multiple users interacting with common buttons accessible to all (for example up-votes on *Reddit* or the machine-learning 'Like' buttons on *Facebook*). What if this paradigm spills into the material realm?

What if material buttons could also be decoupled and operated remotely? An easy example would be the humble remote control that actuates an outcome on-press. In that sense, decoupled buttons become remote controllers to control the world itself, at the push of a button – a notion whose claim is even larger in scope going by the ubiquitous computing trend of embedded electronics and ambient information. This is equally exciting and troubling. On the one hand, these are new democratic ways to control or interact in (socio-technical) systems. On the other, there are potential security issues of untraceable buttons from afar controlling critical infrastructures in a malicious manner, no different from the ethical ambiguity of operating a combat drone.

One option to explore (at least for a hobbyist or technical audience) would be to provide a user-programmable wearable button. Essentially, the *Button* module (a pseudonym for clarity's sake) provides a wireless "trigger" for any potential application. Hugo mentioned the same, when he remarked offhand that *BOND*'s format of interaction reminded him of a new app/service called *Yo* (which only allows users to tap on a list of contacts to send one-way *yo*-s); *Yo*'s designers style it as "a single tap zero character communication tool" (Life Before Us [LLC], accessed September 2014). However, there are already certain hacks that allow *yo*-s to signal diverse digital actions, such as automated check-ins (IFTTT, accessed September 2014).

This sort of primordial media (as opposed to more prevalent multimedia) devices/services are making a resurgence. Consider *Tile*: a discreet smart-tile that can be attached to anything, functioning like a beacon that can be tracked via the Internet (Tile Inc., accessed September 2014). The earlier-mentioned *Yo* is also indicative of a budding trend in microinteractions (Life Before Us [LLC], accessed 2014; Starner, 2013). In a way, *BOND*'s original premise of digital *touch* is also a similarly primordial concept.

Button could offer all the advantages reasonably expected of contemporary networked wearables:

- *Button* is portable & mobile;
- supports microinteraction-friendly augmentation of agency;
- can be programmed to be context-sensitive;
- supports both material and digital customisation/personalisation;
- allows for intentional *cool* participation;
- and the interface and interaction are discreet.

Above all, its generic (ambiguous) signal is a distinct strength. It can activate anything and everything (given a broadly compatible API). In a sense, *Button* benefits from all the learning derived from the *BOND* venture so far, but is simple enough to be pursued at current time.

Such a *Button* would also equally straddle the line between wearables and IoT-'things'. The freedom from decoupling buttons from their machinery seems an area ripe with applications. The principal investigator would like to add that, from a sense of present offerings, most IoT-'things' and wearables track and give information, from health metrics to building occupancy data. Even smart-watches have taken the route of notifications. These increase agency by augmenting situational awareness. However, there are as-yet not many that offer extension of actuation. A digital *touch* can be more than just an intimate stroke; more complex machinery are now at one's disembodied fingertips.

In combination with existing open-source frameworks, rich service APIs and feeds offered by prominent online services (notably *IFTTT*; IFTTT, accessed 2014), the upcoming IoT ecosystem or even pre-set mobile functionalities, a multi-purpose user-programmable *Button* could be an interesting way to explore user behaviour and preferences with wearables in the short-term in the company of other enthusiasts, build contacts and gain experience, such that the next iterations of *BOND* platforms are even better for it.

Essentially, just as the *BOND*'s singular concept of digital *touch* is the primary vehicle of this thesis, thinking of modules as developer components for rapid-prototyping is a good direction to pivot. Wearable hardware is technically possible, but still at an infancy where not enough affordances exist for easy

development and broad deployment. However, if wearables are indeed going to be a trend, similar elemental components with pre-set APIs could make numerous affordances to the development process, speeding up testing and user behaviour research. Thus developer components are a potential business vertical in themselves, and should be explored.

And so, this concludes the design history of *BOND*, an effort to capture the inner workings of a product innovation process, balancing personal vision with technological, financial and market potential. The understanding of the evolution behind *BOND* clarifies the key design intentions behind the product.

In the next section, a detailed *YUTPA* analysis sheds light on how a product like the proposed *BOND* platform potentially facilitates witnessing in intimate shared space.

4.3 YUTPA analysis of BOND Touch

Before beginning the *YUTPA* analysis, it is important to consolidate some of the theory discussed earlier to contextualise the underlying premises of the analysis.

Witnessing among couples

Recalling the parameters of Barry Wellman's Social Network Approach used to describe social connections earlier in the literature study (Garton, Haythornthwaite and Wellman, 1997). A committed intimate couple could be framed according to that approach, as a multiplex tie of strong bi-directional relations with a significant amount of content-sharing.

What does this mean in practice? It means that couplings are one of the strongest connections available to individuals, especially in modern network societies. The level of dependence is commensurate with the level of trust among the two parties, especially because both are reasonably familiar with each other's personal actions and activities.

If one may assume couplings are relatively equal partnerships, then it can be said that both parties are equal in subject-position to one another. Given their mutual dependence and common goals, they are each equally addressable and response-able to the other. Subject-position, addressability and response-ability: the essential requisites for witnessing. It can thus be said that both parties in a hypothetical coupling witness and bear witness to one another.

Quantum of witnessed presence

Another interesting insight about *BOND Touch* itself that is an implicit assumption is that it facilitates an interaction between two people that is devoid of content. The principal investigator would like to revise this notion.

The device, regardless of the sensory novelty of tactility, essentially transmits a signal in real-time when one user voluntarily presses a button. The signal therefore, independent of added content, transmits the information that the other user is pressing the button at this time. As such the content of a *BOND* interaction, if anything at all, is an indication of presence itself.

Specifically, a *touch* is a voluntary extension of one's presence into a partner's embodied perception. When strangers stand waiting for a train not talking to one another, they are nevertheless aware of each other's presence either by sight or sound (or touch). This capacity to perceive presence without necessarily communicating content is not an explicit feature that exists in dominant communication media.

Be it an email, phone call or video chat, the format of the medium itself implicitly encourages the flow of content as a means to establish presence via text, voice or video. A phone call with no speaking voice on the other side, or an email with no subject or text would even be interpreted as a fault in the system.

So, in inventing a new media format where the constraint of no-content itself becomes the defining feature, *BOND Touch* allows the recognition and perception of presence in itself. The principal investigator is even tempted to term what is transmitted as a 'quantum of presence'. It is a quantum because it is discrete and minimal; and it is presence itself, not merely a signal or placeholder, because of the real-time intention that sends the signal and the impossibility to procrastinate or ignore the meaning of that signal. These two qualities in combination require the receiver to acknowledge and interpret the vibration there and then, the same way one would acknowledge the presence of another in a public place. In that sense, the concept of *Touch* really adds an interesting possibility for mediated interactions.

Now consider the premises of the *BOND* interaction: it is a one-to-one connection on an always-open channel, designed for couples who witness and bear witness to one another. Subject-position of the couple, as discussed earlier is equal, and this is not changed by the device. The fact that it is an always-open channel that is exclusive to the couple imparts constant addressability and response-ability to interactions with the device. And finally, given its use within a couple that is already witnessing one another's

interactions, *BOND* interactions too will be witnessed. Thus it can be said that the "quantum of presence" signal that *BOND* potentially enables is in fact a "quantum of witnessed presence". That is to say, a *BOND Touch* interaction is one of the simplest forms of Witnessed Presence interactions possible.

This notion of quanta of presence that the principal investigator is suggesting is not new. While discussing what the affordance of an explicit 'Like' button on *Facebook* added to communications that could not be achieved by manually typing into a comments box, Hugo replied, "First of all, with the button you're constrained. You can't do anything beyond liking... You can comment but that's the alternative that you're talking about. You can press or not press... So it's a binary decision. [But when] you ask someone to write something, you have a full space of possibilities... You can do so much things, and we don't like to make decisions. We want to make the simplest decision possible" (interviews with Hugo, 2014).

This then led the principal investigator to wonder aloud if a 'Like' button is actually an affordance to mass-produce a sentiment, in this case one of approval. Hugo agreed, saying "That's a good analogy. Yeah I look at it a bit like that... I hate to respond to comments [*note: generalise 'comments' to a wide variety of online interactions with weak ties*]. And I have that feeling that when people comment something, I'm expected to comment back. And I hate it. Most of the times I don't want to be there, commenting [on something trivial]... I like that people commented... But for me personally, I don't want to engage and a "Like" doesn't force you to engage. The "Like" is just a "Like" [*note: an interaction in itself*]" (ibid).

So especially on social networks where one is connected with hundreds of individuals (and potentially can be connected with exponentially more), these kind of affordances allow simple, light-weight sentiments - that is to say quanta of witnessed presence - to be mass-manufactured to manage the volume of such relations and interactions. Such quanta of presence are also compatible with the microinteraction design principle for wearables as recommended by Starner (Roggen et al., 2014).

Evaluating BOND with the YUTPA framework

The above-mentioned insights inform the context under which the interviews are evaluated in the *YUTPA* analysis. The following analysis is structured on the basis of the major *YUTPA* dimensions: Time, Place, Action and Relation. The interviewees, all designers at *Kwamecorp*, have had different degrees of involvement in the *BOND* project. Given that *BOND* is still in a conceptual prototyping stage, their insights are most influential at this point in product development. As such, their testimony sheds light on the design intentions behind the product.

YUTPA dimension: Time

One resoundingly unanimous opinion among the designers was that *BOND Touch* should be a real-time communication medium. Thus it is synchronous communication, where both parties are connected in real-time, not in their own respective clock-times. UI designer Dominik Seeger expressed this very strongly and succinctly, saying "So it's [already] very abstract, and has only one-way communication which has only one meaning. The medium is already reduced, and on top of this [if] the message is random or arbitrary [or not real-time in implementation], the net effect is that there is only one meaning left to you. It becomes a gimmick" (interview with Dominik, 2014).

As discussed earlier, the real-time aspect of the communication is one of the most crucial elements that allow presence as content in itself. Dominik agrees, saying "We had the same kind of impressions on *BOND*, being always present" (ibid).

Duration of engagement

Most designers also said *BOND* is being designed to be used on a daily basis, in an everyday context. UX designer Eduardo Ulrich said "It's simple enough to not require a lot of time and energy to interact" (interview with Eduardo, 2014). This simplicity is definitely a compelling factor.

On the other hand, it would seem that the touch-modality of the communication helps to discourage over-use of the medium. Aside from the novelty, tactility engages personal space actively. Hugo commented, "If you thought of me twenty times a day, or at least you thought of me twenty times a day and every time you thought of me you thought you should send me a touch? Weird… if she sent me a message every time she thinks of me, I'll be like, stop it please?" (interviews with Hugo, 2014).

This is a good thing then; the touch-modality inherently encourages empty time, punctuations in interactions that allow both parties to disengage, reflect and create meaning about the relation and interactions (Nevejan, 2012).

Integrating rhythms

Despite the reduced content of the medium, *Touch* allows partners to integrate their temporal rhythms in two main ways. The first step is even deciding to wear the *BOND* wearable with a *Touch* module. Given that the *Touch* module's specifications are known - namely that it is a one-to-one connection and that it is always open - both partners wearing *BOND* are already ensuring that communication *can* happen. A contemporary equivalent would be that connecting via Skype is only possible if both parties are logged in on Skype at the same time.

BOND is designed to be instantaneous and on-demand at the exact moment. Dominik continues, "Not only real-time, but also not stored and replayed either. Because [the communication] loses its transience, its sexiness. It's part of what makes it very appealing and beautiful" (interview with Dominik, 2014). The "sexiness" Dominik refers to is a sense of urgency due to its transience - blink and you might miss it - which recreates one quality of speech in physical presence.

The second aspect of temporal integration of rhythm derives from the simplicity of the *BOND* signal - the communication becomes binary. Because there is only one kind of *touch*, the absence of *touch* in an always-open one-to-one channel is also a form of communication. Since the product is anticipated to be used in everyday contexts, over time, a general rhythm of *touches* and periods of non-*touching* constitute a daily routine that both partners become implicitly

aware of. This sense of routine among partners is also an integration of rhythm among partners wearing *BOND*.

Interestingly, this routine itself can become a second layer of meaning. Senior UX designer Guillermo Landin said, "So yeah the rhythm, whatever interval you establish in your relationship, would become the standard. And if you deviate from the standard, it would gain meaning. And if you maintain that standard, it would have a different meaning" (interview with Guillermo, 2014).

Synchronising performance

Both individual *touches* and the larger routine of *touches* allows partners to synchronise in real-time. How so? Since a *touch* is in real-time, and partners are implicitly aware of each other's routines, getting a *touch* would remind a user of their partner at-this-time, not a memory of their partner nor an expectation of them. A *touch* is therefore a pointer to the physical spatio-temporal situation of the partner.

Guillermo agreed saying, "[When I get a *touch*] I would probably imagine what the other person is doing at the moment they sent the vibration. And I imagine what they're going to be doing when I send one over there. I feel connected without feeling that person is with me or that I'm with them, but I feel at that moment, wherever we are, we're both focused on doing the same thing for each other" (interview with Guillermo, 2014).

For a wordless communication medium, this amount of information is surprising. It allows synchronisation to an extent because the partner (and not a thought or memory of the partner) enters the real-time embodied experience of the other; back into the "mind's eye" as it were, while not detracting (too much) attention from the current action or environment. In this sense, *BOND Touch* can be said to *augment* the user's experience with another's presence, in the same way *Google Glass* might augment a real-world object with floating contextual information.

Now can the synchronisation be improved? Most designers agreed that more sensitive touch modality (that can transmit pressure and perhaps even direction of touch, among other things) would definitely improve the explicit emotional content of a *touch*. Such sensitivity would give rise to a lot of nuance.

Guillermo argued, "It comes back to nuance right? If you want to have these differences in performance, you need to have nuance… Other than that, other than the Boolean true-or-false [signal], if there's no nuance, I'm not sure if performance would be an issue. I might be saying "I hate you" or "I love you so much" and it all comes out the same way on the other side" (interview with Guillermo, 2014).

On the other hand, the corresponding rise in definition would make the device a *hot* medium, which has been established as less preferable for an everyday wearable where the device would primarily augment and not distract the user. So there is a direct correlation to be made between how complex a *touch* can be and how much cognitive effort goes into interpreting that *touch*; to the extent that the *touch* becomes 'hypnotic' as McLuhan suggests, detracting the user from reality.

Another important aspect the principal investigator would like to point out is the importance of telepresence immersion in the *BOND* interaction, however momentary. The interaction should be as simple to execute and seamless when received, with the technology "getting out of the way". As discussed earlier, technology functions as a "third wheel". The more complex the requisite action, or the more cognitive effort its interface requires, the more the technology's role in that interaction will become obvious.

To preserve the intimacy between a couple in a *BOND* interaction, this "third wheel" should become invisible. Many commonplace affordances of modern communications where technology becomes a social mediator - like automated messages before voicemail, or auto-replies to emails or even the "Seen" status message in chat - should be intentionally dropped to achieve this invisibility.

Hugo agreed with this sentiment; when asked whether the *Touch* device itself should be designed to promote *touches*, he said, "I think this kind of close relationships are not prone to gamification style kind of interventions… If you start giving extrinsic rewards for something that by nature is intrinsic, you're starting to dilute that intrinsic nature" (interviews with Hugo, 2014).

Guillermo also concurred, "Honestly it comes back to the people forming a connection even with, or especially with, this limited form of communication. I don't think a button or a light or the device itself should be in any part of

that communication…. It's the third wheel. It would be awkward" (interview with Guillermo, 2014).

Technology is not even welcome as a "third wheel", let alone as a "third witness", to facilitate *BOND* interactions, let alone encourage more of it. This invisibility allows users to misperceive or effectively forget the role of *BOND* as an intermediary in their communication.

The converse (complete opacity as the "third wheel") would make *BOND* no different from a vibrating pager. When interacting with a pager, even when a page is from a loved one, the reception of a vibration is not emotional because the role of the pager as an intermediary is explicit. The pager is perceived as the source of the vibration, and the other party is the cause. In *BOND* however, if affordances allow the device to effectively recede from recognition, then the cause and the source of vibration are both perceived as the other party, thus instantly adding a layer of emotion to the vibration itself. Dominik commented, "We try to eliminate so many layers of communication with this device, introducing an almost caveman concept" (interview with Dominik, 2014).

Eduardo attested to the same notion: "I would always picture it like that. If somebody would touch it and my hand vibrates, I'm not imagining oh yeah she's just touching her wrist. That's not what it means, it means something completely different. It will either be I wonder what the other's doing, or me looking at the time to figure out the other's schedule" (interview with Eduardo, 2014). So (telepresence) immersion is a concept that is surprisingly relevant to *BOND*, despite the extremely short time-span of the experience.

Making moments to signify

When asked if a *touch* constituted a deed, or a significant action that would be distinctly remembered, the answer was unanimous: no. Given that *BOND* is designed for everyday use and *touches* would inevitably integrate into daily routines, an individual *touch* would be as insignificant as clicking 'Like' on *Facebook*.

Design lead Pedro Cardoso commented, "As I see it, to make sense to have a gadget like *BOND*, it has to be as seamless as possible. The less I think about it the better" (interview with Pedro, 2014).

Eduardo did suggest the possibility that the random occurrences of a *BOND touch*, on rare occasions, might correspond with an event thus amplifying the significance of that memory (interview with Eduardo). The designers also agreed that if *BOND* were more nuanced, the capacity for significance would increase dramatically. As such, *BOND Touch* interactions do not really constitute special moments in themselves.

YUTPA Dimension: Place

In Witnessed Presence, the dimension of Place is typically used to validate the influence of physical setting on interactions.

The premise of *BOND* is that the communication channel is always open, and this enhances sense of presence. In most other communication over mediated technologies, the act of communication itself, and perhaps witnessing, is only realised when both users deliberately take action to allow the communication. A phone call is only possible if the sender dials the number, and more importantly if the receiver decides to pick up the phone. In *BOND*, the premise of the communication medium removes this privilege from either partner, tolerating unannounced 'intrusion' at any time.

Hugo said, "I think it's important to be able to schedule some downtime and not be invaded, let's call it that. But at the same time, if you think of the promise behind *BOND*, it's only for those you really care about. So I don't have any downtime for my girlfriend…" (interviews with Hugo, 2014).

Alongside the open channel that allows witnessing to take place spontaneously, *BOND*'s touch-modality influences the experience greatly as well. Hugo expressed this very clearly: "Because touch implies closeness. I can hear a sound from far away, I can see something really far away, but you can't feel something from far away. Unless technology. Yeah, it's the one sense that implies that someone's near you. And [*BOND*] would allow them to be near me

without being near me so it's that personal space thing at the same time" (interviews with Hugo, 2014).

In totality, the combination of real-time sense of presence with tactile sensation constitute a limited but visceral intervention to perception of place and time. This is something unique to *BOND* as a communication medium at the moment, and is recommended to be an important element in marketing and publicity.

Body sense

Body sense is one of the novel sub-dimensions that *BOND* can uniquely address different from most communication media before it. As mentioned earlier, a *touch* transmits a quantum of presence, and can be modulated to a limited extent by frequency and duration of pressing the button which gives a proportionally long vibration (interview with Joao, 2014).

Eduardo attested the transmission of presence was indeed a possibility with *BOND*, despite the lack of clear content. He said, "So it's presence basically… So I guess in the end, just feeling a little buzz that yeah she's there for me and I'm here for her. That's the thing that *BOND* gives" (interview with Eduardo, 2014). He continued, comparing a *touch* to the equivalent of a "personal psychological hug", thus justifying why communication via the *BOND* medium (given its premise of one-to-one exclusivity) is of a fundamentally different nature to other communications over mediated avenues (ibid). Given that the *touch* occurs in real-time, the sense of sharing presence with a partner could be understood to be a sense of co-presence (International Society for Presence Research, 2000).

As explored earlier, the designers generally agreed that increased sensitivity would enhance the nuance, and one must assume that body sense would be enhanced as well. However, the high definition of touch would in turn make the device a *hot* medium (McLuhan, 1964; discussed in **Chapter 3.1**).

In the case of *BOND Touch*, *hotness* diminishes creative participation in the interaction, which seems like an undesired tradeoff because the sense of intimacy that comes with a *touch* is itself a function of user imagination attributing meaning to the disembodied signal. So the *Touch* module is recommended explicitly to be designed as a *cool* medium.

Perhaps the most interesting aspect of *BOND* is the unspoken link between bodily contact and intimacy. Hugo observed, "I wouldn't want a Meryl Streep *touch* [whom he likes as an actress]. So it's a sexualised thing. I would interpret a Monica Bellucci *touch* as a flirt, and that's why I would allow it" (interviews with Hugo, 2014). Indeed this aspect of sexualised intimacy, while not of sole importance, plays a big role in the interpretation of a *touch*.

The principal investigator proposes that this also contributes to body sense; specifically, the *embodiment* extension of *BOND Touch* is amplified in perception and value, due to the intrinsic correspondence of touch and sexuality.

Emotional space

BOND was always seen as a means to "extend… emotional connection through [a] digital-physical device" (interview with Joao, 2014). This extension of connection via touch, given its (culturally) sexualised nature, helps two *BOND* users share an emotional space.

Guillermo stressed that *BOND* does not so much create a space for new emotional connections to be made; rather it offers a new avenue for emotional expression in an already existing relationship. He said, "I wouldn't associate [a *touch*] with what I'm doing right now, or even what the other person is doing . But I would associate it with the type of relationship we have" (interview with Guillermo, 2014).

The precondition of already-existing emotional intimacy is seen to be very important. Eduardo commented, "Even though the vibration is transmitted by touch on the other end, I will always interpret it through my emotions, and not through the physicality of it" (interview with Eduardo, 2014). This suggests that a *Touch* device would be a *cold* medium as-is, because it inherently triggers emotional interpretation.

On the other hand, it is perhaps this emotional intimacy that provides affordances for the ambiguity of a *touch* communication. Dominik commented, "The thing with *BOND* is it brings intimacy, but it's still very detached, neutral. There's no voice, image, nothing written. Very very reduced information" (interview with Dominik, 2014). He later added, "It's just a tickle, always a tickle

and so always equal. It can mean anything and everything. The only thing it means with certainty is this person is thinking of you, because when she does the touch one way or another [she's] thinking of you... it can be fondly or not" (ibid). As such, a *touch* is ambiguous in itself, unless the user "fills in" context and meaning based on the state of the relationship between the two parties.

Environmental impact

Given that *BOND* is a wearable, and its potential context in a fluid network society, mobility is a key characteristic of the interaction. That is to say, the potential environments in which *BOND Touch* interactions will be initiated cannot be anticipated in advance. As such, environmental impact is not a design aspect that can be optimised.

However, when asked if the present location would change the way a *touch* is interpreted or conversely, whether a *touch* would change the way the present location is perceived, most designers indicated that could be a possibility. Hugo elucidated that it was not so much the location that would influence perception as much as state of mind; the latter happens to be influenced by location to some extent.

He said, "I think of course the vibration would depend on my location to the extent that my location conditions my mood and my state of mind. Because I can be here at the office and be stressed out or I can be extremely relaxed. So it's not the office that's going to condition how I interpret the vibration. It's my state of mind, within the office... If the location affects your mood, the location affects your interpretation" (interviews with Hugo, 2014).

Situated agency

Normally, the physical presence of another, and the possibility for another in close proximity to act in response to one's action, powerfully condition an individual's behaviour in a given situation. This sense of witnessed presence in physical proximity contributes to ethical behaviour.

This is where the advantage of a *BOND* interaction as a real-time intervention comes into sharp focus. The principal investigator questioned the designers if a

touch at the right time would make them think or act differently about something they were about to do, given that activity would be frowned upon by their partner. All the designers unanimously agreed that indeed a vibration from the device would immediately make them pause and reflect on the act (and their partner's wishes), if nothing else.

Dominik said, "Yes of course, maybe *BOND* can prevent me from lighting up my cigarette - by getting me conscious... It would alert my consciousness and it would make me reflect on the thing that I'm doing that I maybe shouldn't be doing" (interview with Dominik, 2014).

Guillermo agreed, saying "It would have to be very extreme to actually make me stop... but it would probably change the way I'm thinking about it. It would remind me of what the other person doesn't like. I'm not saying I would act differently, but I would feel very differently about the way I acted" (interview with Guillermo, 2014).

And Hugo explained, "It might not be like she's here [beside me], but she's back in my mental space. Because if she were [physically] there, things would be completely different. What I'm saying is, a vibration might restrain behaviours" (interviews with Hugo, 2014).

As such, the principal investigator concludes that situated agency is definitely an aspect that *BOND* powerfully influences in a way that contemporary media do not. And in giving rise to this sense of ethical reflection and consequent deliberate action, *BOND Touch* lends its support to one of the core benefits of witnessed presence interactions: ethical behaviour.

YUTPA Dimension: Action

The simplicity of *Touch* means it is an interaction that is completed in a heartbeat. As most of the designers agreed, the tacit understanding behind *BOND* is that there is an entire media ecology for other means of communications besides it, and these are in no way threatened by the *BOND* concept. Hugo confirmed, "I don't believe *BOND* will be used in some kind of high level conversation [even if a code is invented]. For that we have other tools and other ways of communicating" (interviews with Hugo, 2014). This is to

say, that not only is the default *BOND* interaction a short one, it also will never be longer or more effortful because the format in itself promises quickly diminishing returns.

So contrary to most other communication media that extend agency despite not sharing place, the *BOND* concept allows the sharing of place to an extent, but at the cost of limited agency. Still, the dimension of Action can be useful to shed light on certain aspects of intimacy from a Witnessed Presence perspective.

Tuning

In physical presence, even strangers mutually tune their tone and demeanour dynamically as they interact with different people (Nevejan and Brazier, 2012). On the other hand, this is still possible but harder in mediated presence. *BOND* is no exception.

Firstly, since the interaction itself happens spontaneously (an unannounced tolerated intrusion as it were), and is over so quickly, the *touch* in itself does not contribute significant information to either party on the mood or situation of the other. Despite intimacy, if one partner is presently in joy or pain, the *touch* alone cannot transmit this knowledge to the other. So tuning purely via *touch* is not likely.

However, the routine of *touches* and periods of non-communication would allow partners to recall one another in the "mind's eye" in an embodied sense throughout the day, remaining aware of each other's spatio-temporal trajectories. Guillermo insisted that this aspect is an important part of tuning as well; he said, "What I think would be interesting here, as we communicate and we're in different contexts and situations, would be for me to realise she acknowledges that I'm in a different context, and I would do the same thing… So we have to be in tune with each other but not [necessarily] in the same situation. We just need to acknowledge that the other person is in a different situation" (interview with Guillermo, 2014).

So tuning is possible to a limited extent, but as an emergent phenomenon from the routine of daily use.

Reciprocity

Reciprocity is another aspect of Witnessed Presence that is perhaps irrelevant in a *BOND* interaction. The simplicity of *Touch* does not support complex interaction that demand a flow of content, or a give-and-take dynamic. In practice, this means reciprocity does not have to be a design concern for *BOND*.

The implications of this are interesting. Most designers agreed that a *touch* would not be a deed. Guillermo expressed this strongly, "A *BOND* interaction is not a big deal. Holding hands, touching, hugging and caressing: all of these do have meaning but it's not that memorable because it happens all the time. So I don't see a situation where two people wearing *BOND* constantly find every single *BOND* interaction a distinct memory... Yeah, it doesn't mean the other person went through a sacrifice to get to you" (interview with Guillermo, 2014).

Moreover, most designers agreed that a *touch* when received did not necessitate a response. Guillermo differed in opinion, saying "I mean it's so easy to do this, it doesn't require much effort... I think it would be rude. I don't think I would be comfortable receiving a vibration and just looking at it... The lack of response should be understood on the other side, as a message in itself" (ibid).

Hugo, on the other hand, was not as convinced: "I would rather not. But if it was a [explicit] feature, I would probably do it... If the product has a thing that you have to dismiss the vibration, of course you're going to do it. Or else you know what the other person is going to say" (interviews with Hugo, 2014). Hugo's comments are reminiscent of the earlier discussion on synchronising performance; it was argued that technology in this interaction should not become invisible to raise the sense of immersion, and therefore the level of connection. If an explicit button or interface forced users to acknowledge, then the role of *BOND* as the "third wheel" in the interaction would become very obvious.

The sheer simplicity of the interaction is at the root of this sentiment. As such, neither explicit acknowledgement or reciprocal *touches* in response to one are deemed necessary, or at least reciprocity is not explicitly encouraged or designed to be mandatory. The possibility remains open for users to self-decide

if *touches* are reciprocated, but that would be governed by the state of the relationship and not required by the device itself.

Negotiation

The format of communication media greatly influence subsequent communications made through those media (interview with Joao, 2014). Given that the content of *BOND* communications is a quantum of presence, there is inherently no information present that can be disputed or need be negotiated.

The ambiguity of the communication format plays a part. Guillermo attested, "If I wanted to transmit a very specific meaning, I would probably use my phone. This is for that part of communication less about specific meaning, things you really can't say in a phone call or a written message" (interview with Guillermo, 2014).

Most of the designers tacitly acknowledged they expected a code to emerge between two parties engaging in communications over *BOND*, different and specific to each couple. Hugo said, "...some kind of code would emerge organically... I think it would probably grow out of usage rather than sitting together and defining some kind of rules" (interview with Hugo, 2014).

These codes could possibly allow for quick negotiations or signals in the context of everyday co-ordination, but it is unlikely that *Touch* interactions can achieve any more without more complexity and nuance in the transmissions.

Quality of deeds

As established so far, *touches* are not deeds and so their significance is quite reduced. Guillermo suggested that this could in fact be a blessing in disguise: "But one thing that I think about *BOND*, that is something quite elegant and quite appealing is that you don't have all these entities and lights and meanings and notifications and options. It's all one interaction and you don't need to think about the rules. I would do pretty much anything to avoid having a "Seen" light or an option where you terminate a conversation and all that. The fact that it's super simple is a feature" (interview with Guillermo, 2014).

On the other hand, even a non-deed can be meaningful without being significant. The code that each couple establishes could in fact be negotiated to be meaningful signals. Pedro commented, "Or if it's something more daily, like 3 tickles, that means I'll get the kids, so it will be interpreted as an action and therefore I have to remember it" (interview with Pedro, 2014). Hugo compared *touches* in that sense to the communicative ability of missed calls (seen earlier in Chapter 3).

On the other hand, there is something to be said for the unspoken assumptions that go behind the interpretation of a touch. Some of these assumptions are essentially the premises of *Touch*: namely it is a one-to-one connection probably reserved for a close partner. If one were to receive multiple missed calls from an unfamiliar number, there would a certain unease due to so much missing information. Conversely, if multiple missed calls came from a partner, one begins to worry along an entirely different arc, because of assumptions "filling in" to construct plausible reasoning.

Other assumptions might stem from the routines specific to each couple, that is, familiarity with the spatio-temporal rhythms of the other. For example, if one party who regularly sends *touches* has not done so for two days, the partner might begin to worry.

The inconspicuousness of the action of pressing a button on a wrist is relatively discreet, and so, is unlikely to invite scrutiny or disapproval as some other wearables like *Google Glass* have (Honan, 2013). We have seen that *BOND* primitively extends the emotional aspect of touch. It may also extend touch functionally. Hugo commented that his foreseeable use-case would be that of getting attention: "Or sometimes, I'm with my girlfriend and we're going down the street and I see someone with really weird clothes, I squeeze her hand just a bit so she notices there's something she has to see. I would do the same in some social settings" (interviews with Hugo, 2014).

And finally, the correlation of *touch* with emotionality deserves some mention. Guillermo added, "The emotional side of [*BOND*] is a great opportunity. Because nowadays technology has given us all these ways to communicate content, and some of these can possibly convey emotion, but not many ways to communicate emotion alone specifically" (interview with Guillermo, 2014).

Hugo corroborated touch as an important aspect of intimacy when he mentioned that a lot of interest for *BOND Touch* when it went viral was among a community who were in long-distance relationships and that title was in itself a core part of their identity (interviews with Hugo, 2014). One can question, given all the various means and media that individuals have at their disposal to communicate with one another, what *BOND Touch* offers that is uniquely compelling to this group of distant partners. The logical conclusion would be that there is an aspect of embodiment to intimacy and closeness that existing communication media cannot bridge. *Touch* therefore can be said to extend embodiment itself.

As such, the principal investigator concludes that despite the relative simplicity of a *BOND* interaction, or rather because of it, *touches* can be fluidly used in a variety of contexts where simple signals are sufficient. It would be very interesting to see how this "quantum of presence" format, and avenues for emotional communication fit into contemporary media ecology.

YUTPA Dimension: Relation

When it comes to the premise of *BOND*, the dimension of Relation is more or less predefined due to the specificity of qualities that define an intimate couple. It was noted earlier that the intimacy and familiarity of the relationship provides affordances to complement or tolerate the inherent ambiguity of a *touch*. It has also been observed that intimacy suggests a sensual/sexual aspect (more so given the touch-modality of *Touch*) which deeply amplifies the emotional perception of a *touch*. So these factors play a large role in influencing the *BOND* experience from a Relation perspective.

The artificial constraint of the product as a one-to-one communication channel in this case is partly responsible for the immediate conflation of touch with intimacy.

Role

The exclusivity of the *BOND* platform is then not just selecting an arbitrary market demographic of intimate couples; touch-modality for communication seems to imply that it is best utilised among such partners. The designers

unanimously agreed that they would only be comfortable receiving a *touch* from loved ones, if not specific persons.

Hugo expressed this best, "It's more of choosing, of allowing someone to do it. And since it's not even a choice, I can't choose to not receive a *touch*, because it [just] happens. That's a great power I would give someone" (interviews with Hugo, 2014).

He added, "No [even] if a friend, a girl friend of mine gives me a *touch*, what am I supposed to interpret from that? So that need for interpretation requires that I feel extremely comfortable with the person I share the space with" (ibid).

Perhaps this is true (only) for the moment because the sense of touch has been minimally engaged in contemporary media ecology and so, we do not as yet have a language (or even heuristics) for what sophisticated touch-based communication can be like.

Reputation

Since the target audience for *BOND* is an intimate couple, reputation seems a non-issue as both partners are ideally equal in power and subject-position in the interaction.

Communion

From the understanding of communion (or shared meaning), the influence of intimacy as an affordance for ambiguity becomes clearer. Dominik commented: "I mean, if I want to communicate with someone at work, then I really have to say something to this person. So there's content importance which I don't think *BOND* is able to build that bridge… Why should I tickle my co-worker just to ambiguously let him know something is wrong?" (interview with Dominik, 2014). Thus it becomes clear that ambiguous communication is counter-productive in a non-intimate setting because there is no common basis (or not enough shared meaning) to "fill in" and create a reasonable interpretation.

Here the principal investigator would like to propose that it is not the case that intimacy makes ambiguous communication very clear, but rather, intimacy is

more forgiving of errors in interpretation. That is to say, intimacy allows for shared meaning to be negotiated by trial-and-error. Guillermo agreed, saying "A lot of the time in the beginning I wouldn't know what the vibration means, and the person on the other side wouldn't either. And we would be kind of talking without understanding each other. I guess it would be a trial-and-error thing… over time you figure out… and I think it would adjust as you do it and you get a response, you would learn" (interview with Guillermo, 2014).

Other than the fact that increased sensitivity or nuance in *BOND* would make the device *hot*, there is also a trade-off between the complexity of the message that can be sent and the amount of effort required to make an interpretation. Dominik was sceptical, saying, "To be honest, I don't know if I would be willing to do the work. To be creative every time I want to transmit something" (interview with Dominik, 2014).

Eduardo added an interesting psychological perspective to the meaning derived from an otherwise ambiguous tactile signal. He said, "Humans are trained to detect patterns in everything they look at and involve themselves in. You look at static, TV static… and you'll see patterns… You look at the clouds and you start seeing faces because you're always projecting something. And those things that you're projecting will depend on if you're happy or sad. So therefore a bunch of vibrations will immediately have to have some sort of meaning. Otherwise they're just disruptive. And if you can't have that meaning, then it will be useless to you so that you don't waste time adding any meaning to those vibrations… Because otherwise it's just going to be something there, and it's buzzing and you don't have any meaning towards it. What's the point? Why would you have it?" (interview with Eduardo, 2014).

While the designers unanimously agreed that couples would inevitably create their own special codes with which to communicate, Pedro added that some preset interactions should also be included for less imaginative users to kick-start their familiarity with the device (interview with Pedro, 2014).

Overall, *BOND* relies on the premise of intimacy to bridge much of the shared meaning required for crude touch-based communication; but as seen here, the same premise also provides many affordances and opportunities for experimental exploration.

Engagement

Designers unanimously agreed that *BOND* was designed for daily use (in line with the notion of a consumer wearable). Guillermo commented that both its simplicity and tactility added value: "I would want to wear it all the time, because having it and not using it, for me, adds a lot of value as well… One of the things I like the most is the fact that you can have an exclusive channel. I have to feel close to my girlfriend. We have to communicate in some way throughout the day. And I think phone calls are a bit too much because I don't want to interrupt her and say hi when I really have nothing else to say. I just don't want to go through the whole day without any contact, so phone calls are a bit too much. Even text messages are so literal. Basically I want to do the equivalent of a wave and a smile and you can't really achieve that [with existing communication media]" (interview with Guillermo, 2014).

Eduardo added, "I think the advantage of it is that it doesn't demand too much attention from you… This is just a buzz, I don't even have to stop what I'm doing, I don't have a screen [to check]. I felt it, I know it, I'll reply [probably via other communication media]. I'll feel it, think about it, and then interact with it as I see fit" (interview with Eduardo, 2014).

As such, the design intention for *BOND* is to intentionally minimise the time and effort necessary for each individual interaction. The engagement experienced with the device thus becomes apparent only over long-term use, not in each individual interaction, which is in line with the seamlessness that wearables require.

Discussion

In closing the *YUTPA* analysis of *BOND*, it would be good to revisit *BOND*'s performance across the dimensions of Time, Place, Action and Relation.

It was seen firstly, as a synchronous communication medium but without traditional content, *BOND* becomes capable of transmitting a 'quantum of presence'. The analogy of strangers in physical proximity acknowledging each other's presence without actually speaking or interacting with one another is apt; this is one aspect that can perhaps be translated to mediated communications in multi-actor systems.

For example, 'trolling' and 'cyber-bullying' cause much harm to their victims; a recent *Google Science Fair* project called *Rethink* has shown promising results when hurtful messages were read out loud, and even given a rating for potential offensiveness, before the user hit the 'Send' button (Khaw, accessed July 2014). There was a drastic reduction in the number of offensive messages sent when the *Rethink* algorithm was activated (ibid). This case is an implementation of technology acting as a "third witness" in interactions, intervening before a hurtful act is committed (Nevejan and Brazier, 2012).

The principal investigator posits that this concept of 'passive' presence may also include other users. In *Google Docs*, during a collaborative work session, every user can see every other user logged in and even 'feel' their presence because of the multiple coloured cursors indicating the actions of the other users. This is distinct from both social presence and co-presence in that there need not be any explicit interaction between users (International Society for Presence Research, 2000).

Imagine if one were on a webpage, and gets information of how many others are also viewing the webpage (a feature still present in web forums), and occasionally gets glimpses of other users' actions. Mentally, it would create the impression of a public place with multiple presences, something the Internet is currently lacking. This could have some relevance to the larger effort of creating socio-technical systems which also encourage ethical behaviour.

With respect to Time, *BOND* is designed to be used on a daily basis; as a daily use wearable, the interaction is explicitly designed to be simple, and not only that, the touch-modality of the medium naturally encourages periods of non-engagement (empty time) between interactions. Users are able to be in rhythm through individual interactions and the larger routine in communication. They are able to synchronise their performance to an extent, through an augmentation of one's embodied experience with the other's presence.

The success of such intimate synchronisation depends in part on the level of immersion afforded by the product, for which the device should designed with affordances to "get out of the way". However, the daily use and sheer simplicity of individual interactions does not lend *BOND* moments to be

significant in and of themselves; they may at best augment external circumstances in rare occasions to become more significant than usual.

BOND's touch-modality plays a big role in the sense of Place because the sense of touch is biologically associated with proximity. As such, a *touch* is equivalent to a real-time intervention in space and time. In addition, touch is also culturally associated with (sexual) intimacy, and so the intended target demographic of committed couples is perhaps the best choice at the moment. A *touch* is always interpreted emotionally, but then again, the signal itself is neutral and much of the emotional significance is "filled in" by each user based on the state of their relationship. This is in line with the preference to design a *cold* medium.

But of course, users are not actually sharing physical space most of the time, and given the mobility of networked individuals it would be impossible to anticipate all possible environments in which *BOND* may be used. So, environmental impact is not a great design concern. However, given *BOND* provides a means for real-time intervention and presence augmentation suggests that the device enhances some level of situated agency - causing users to reflect and behave differently.

As an act, an individual *BOND* interaction is designed to be simple, with the full knowledge that it does not displace any other communication media for the sharing of content. Given the content-ambiguity and simplicity of the interaction, Action is somewhat constrained. While *touches* can help synchronise partners, tuning is not as easy because the present mood cannot be communicated through an ambiguous *touch*. Whether the partner is happy or sad, a *touch* would not communicate this to the other.

Reciprocity is also not explicitly designed in *BOND* because implementing that necessity would in turn make the device an obvious "third wheel" in any given communication. Users may negotiate their use of the device uniquely among themselves. Negotiation of meanings and codes happens over time similar to the emergence of pidgin language among speakers of different languages.

And finally, the 'quantum of presence' possibility allowed by *BOND* is seen to be an interesting addition to current media ecology, for it may be fluidly enrolled in a wide variety of applications owing to its simplicity.

In the dimension of Relation, *BOND*'s tactility plays a big role in amplifying the emotional aspect of communication. The conflation of touch and (sexual) intimacy pairs nicely with the imposed constraint of exclusive one-to-one communications, effectively forcing users to choose their desired partner, thus contributing to the emotional quality of a simple vibration. On the other hand, reputation is a relative non-issue among couples and so not a big influence on *BOND*.

Shared meaning is achieved because the intimacy of the relationship is conducive to trial-and-error in interpretation. And finally, the design focus on simplicity and seamlessness reduces the focus on individual interactions as opportunities for engagement, thus relegating a sense of engagement to emergent routines rather than individual *touches*.

Overall, there is sufficient evidence to suggest that *BOND Touch*, in its present form, already meets several requirements for successful witnessed presence interactions, given the *a priori* premise that it will be used by committed intimate couples in one-to-one connections. Tactility especially is seen to contribute key influence in heightening the emotional charge of the interactions.

As such, the research question "*Can witnessed presence be designed in a system of networked tactile wearables used in shared intimate space?*" has been answered, with a resounding yes. More specifically, the principal investigator agrees with Caroline Nevejan's suggestion that *BOND* in fact enhances co-presence with one's partner, thus facilitating witnessed presence (personal communication).

4.4 Emerging themes

Through the interviews, several soundbites by the designers bore witness to the everyday occurrence of phenomena discussed in the literature section, namely: Medium Theory, Networked Individualism and Witnessed Presence. These observations, coming from career designers who make their living designing new media products in response to these trends, can be insightful, combining everyday experience with professional opinion. These excerpts are highlighted in this section to add testimony in support of the theory.

Additionally, new themes stood out from the interviews which deserve elaboration, and possibly, exploration in future work in this field. Most notably, the role of imagination in witnessed presence interactions is expanded on, based on insights from the interviews, potentially contributing to Caroline Nevejan's *YUTPA* framework. These emerging themes are also discussed here.

Re-visiting Medium Theory

If Medium Theory could be condensed and explained one line, McLuhan's quip "the medium is the message" does this very well (McLuhan, 1964). Guillermo attested to this, commenting on the abundance of communication media in everyday life that "You could argue that at a personal level I still talk to the same people on a daily basis as I did before this era. Could be but, the mind-set knowing there's absolutely no limits, that I can talk to anybody in the world as long as they have *Facebook* or email or whatever? That is a huge difference in my mentality" (interview with Guillermo, 2014).

Dominik pointed to the downside of media use, the aforementioned Maslow's hammer phenomenon: "At least in my profession as a designer, there are several ways to approach a concept, or a solution or an idea but because of comfort, and safe zone and a timing, people (including myself) go directly to the machines. Which many times I think is, it's [not] wrong but it's not really necessary... So this is something I feel sometimes, and I feel the need to break out of that" (interview with Dominik, 2014).

Affordances and media

The principal investigator would like to add a hypothesis here for the mechanism of the transition of tools to media. McLuhan defines media and elucidates their effects, but there is not an explanation for *how* tools become media (McLuhan, 1964). Based on the immersion in the design environment during this work, the design concept of affordances seems to be an illustrative metaphor (Soegaard, accessed August 2014).

During a design process, a user's task is critically analysed, identifying the points of friction in completing that interaction. A designer then tries to smooth these rough edges, thereby making affordances for the completion of a task. These affordances allow the user to complete said task even faster with less 'irritation'. This is what tools do, enhance and amplify means to achieve a certain task. As use-cases become more and more complex, just as many affordances make achieving the task an even smoother process. Any other tool that can achieve the exact outcome must also compete with the numerous affordances in the incumbent tool to present a viable, let alone desirable, alternative.

Eduardo summarised the process thus: "So it comes with every technology I think. There's a novelty and you're trying to figure out where it fits in. There's a point you become a mature user and you know what the pros and cons are, and it has a space in your head that you learnt how to use it. And then that's how it goes" (interview with Eduardo, 2014). The many affordances that make a tool easier and faster to use also render it essential and non-trivial for that very function. The tool becomes the *de facto* solution for its function, a specialised Maslow's hammer.

Hugo agreed, saying "We're constantly recalibrating around technology" (interviews with Hugo, 2014). Pertinently he added, "Successful technologies are those which piggyback on our motivations and not those that go against our motivations" (ibid). The principal investigator would like to point out here that maturity with a technology is equal parts the user adapting to the technology as well as the technology adapting to the user. The latter is in the form of affordances. Hugo's suggestion that technologies "piggyback" on our motivations

is also very telling; affordances allow for easier symbiosis between user and device.

This gradual entrenchment of affordances is therefore the momentum that drives the process of tools becoming media. Media maturity is also a 'media inertia' of sorts, a homeostasis of sense-ratios previously stimulated by the same technology, in line with McLuhan's idea of 'narcosis' or numbing to dominant media (McLuhan, 1964).

Testimony on networked individualism

Living in a generation where entire generations of technological advances happen within the lifetime of an individual, several designers pointed out, themselves having grown up pre-Internet, that many social practices are different, dying or dead. One easy example was the household landline phone and how the etiquette of its use demanded that no calls would be made after a certain time of the night. Dominik reflected, "I remember when I was calling the girlfriend's house, and you had to talk first to her parents because you were talking on a fixed line, and there was only one access point to the whole family. But nowadays you have an access point to each person and the old situation has vanished" (interview with Dominik, 2014).

The everyday experience of networked individualism may be so entrenched that it may not be obvious the magnitude of cultural and societal shifts it has entailed. Joao gave a telling example: "At the beginning, I have to tell you I was sceptical of all this and valued my privacy above all. But right now, I find friends on the street that I haven't seen in the last 5-7 years and they tell me, "Your daughter's all grown up!" They've never even seen her, but… have they been spying on me? But no, they saw it on *Facebook*… I just embrace it. I'm willing to share whatever, but it's more for me than for others… I have nothing to hide, why should I hide this?" (interview with Joao, 2014).

Earlier he had commented, "With this new powerful Internet… scaling up, you felt the need to create this privacy, and started dividing things into groups. Even with people that you trust, you just felt the need to start dividing your friends, family, close friends, not-so-close friends, your acquaintances… And

that's actually a way of digital-social stratification. We naturally started doing this" (ibid).

Both of these observations attest to the recognition of the larger social circles (of acquaintance at least) and the more defined groups of relations that modern communication media have enabled. It is indeed a novel experience to be known by others even before personal introduction and to verbally define what each and every acquaintance means to an individual. Perhaps these are correlated, in that an individual's participation in larger (and more synchronous than before) social circles necessarily demand the 'stratification' Joao speaks of - a kind of modulation of presence out of sheer necessity.

Eduardo agreed, saying "Because that's the social aspect I guess. You always have various groups of friends in real life... friends, family, all these different groups. You don't interact with them all at the same time physically. It's impossible... [The] Internet allows you to choose, interact with all groups and meet even new people at a certain level at the same time. I can be talking to my cousin and my best friend and guys from work at the same time. And my mind will have to separate and treat each of them completely differently... And that would never happen [in real life], you don't have that physical capacity. The Internet and technology in general allows that" (interview with Eduardo, 2014).

Guillermo recalled being amazed by the notion of instant and constant connectivity. He said, "...I started using *Yahoo! Messenger* as the first messaging app I really related to, talking to friends of mine who were both abroad and in Portugal itself. When I started building that little list of contacts and you had more than one that was online at a time, oh man I was actually connected to people and that felt amazing. Because you don't really have to start a phone call anymore. People are just there, and you can see them and just say hi" (interview with Guillermo, 2014).

He continued later, "I think one of the biggest differences technology has brought into our world is the ability to communicate with a thousand people at the same time... The fact that you can get feedback from a thousand or even a million people, you have that possibility at your disposal. Before, that was inconceivable. Before you could only communicate with the people you were physically with, or maybe a bunch of people you talked to on the phone only.

But you wouldn't communicate with a hundred people in a single day like you do now" (ibid).

Pedro commented, "All the channels we evolved to communicate, which now bring us real-time communication, real-time awareness of either friends and family… Or with the world, connection with the world… Again, the relation [and] the mind-set of people to receive any sort of communication from family, friends, or the world, it doesn't have to happen in a specific place at a specific time. It can happen anywhere" (interview with Pedro, 2014).

From these comments, the practice of meaningful missed calls (see **Chapter 3.2**), affordances like *Facebook* 'Like's, and other quanta of presence communications are justified as sheer necessities for establishing and maintaining communications with such large personal networks, given this background context. Despite their reduced "mass-manufactured" generic nature, they are instrumental affordances for mass communication.

It seems that despite the cognitive complexity of interacting with such an increased number of people on a daily basis, there are some definite benefits to be derived from numerous connections. Dominik reminisced, "One nice thing is that *Facebook*… brought for me for example is that I found people… Found them again, or at least I know what they're doing and where they are [thanks to] technology. I'd lost this trace for many years. It's a mixture of nostalgia and memory-refreshing moments. Of course you had your history with someone at a certain point and you connect to that person again. You see a little bit of his life… it's like a feeling of happiness almost, for you" (interview with Dominik, 2014).

The principal investigator is compelled to agree. The gradual but unceasing refinement of communication technologies, at a broad stroke, tries to make the concept of "6 degrees of separation" a reality. From letters to telegraphs, telephones and their telephone books, to now *Facebook* as a digital interactive rolodex, the goal of global connectivity - McLuhan's "global village" - is closer now than ever before (McLuhan, 1964).

Pedro on the other hand was not as impressed. When asked of his underlying assumptions in designing new media products for social networks, he said "One is to see, that voyeurism that we get using [these] communications… Observing

what other people are doing. They expose themselves and I like to watch them… And the other thing is to drive more connections. Who do you know that I can know also. Because [of] this [existing] trend, their relations are transparent. You can see who I'm connected with…" (interview with Pedro, 2014).

Dominik also expressed doubt, saying "I don't know if I really feel empathy for these people or not [among *Facebook* contacts], because I didn't talk to them for a long time… there are too many people… I know many of them, I remember most of them, but they're not really my friends. I just get glimpses of their life…" (interview with Dominik, 2014).

Hugo on the other hand felt this was more for personal support than for (humble) bragging. He said, "Because it's not in our nature [to be isolated and private]. We want to show our lives and we want to see our friends' lives. We want feedback on our lives, that's what comments and likes are. It's feedback on what you're doing, what you're saying, what you're thinking" (interviews with Hugo, 2014).

Eduardo summarised the advantages of modern communications best, saying "So I guess in the end, you could interact with various groups… at the same time… we always preferred the fastest way to communicate… [Technology has not changed the definition of intimacy or friendship], but it has allowed me to do different things. It gets you that closeness because you know that other person is there with you at that time. It doesn't matter where they are in the world right?" (interview with Eduardo, 2014). He continued later, "…but all [the different social networks] have different ways of communicating so you'll probably have each group of friends in a different way… [the social networks] are juggling themselves and I don't think one is more important than the other" (ibid).

Specifically he pointed out that despite the different social networks and the different means of communication, it was not the case that the social networks determine the kind of relationship with the other person. He said "Oh it's per person, not per channel… I mean I can have a personal conversation on whatever medium I choose… I wouldn't change the medium of communication to fit [the relation]" (ibid).

Despite these ever-increasing social circles with different levels of familiarity in merging realities, Hugo defended these new forms of 'weak' ties that technology enables, saying "Those were the kind of interactions… that if *Facebook* didn't exist, those interactions would never exist… So [the argument] "oh we're not having real conversation" isn't valid; they wouldn't exist at all [if it were not for technology]" (interview with Hugo, 2014).

In all, networked individualism is *bona fide* cultural and societal shift that is not just important for academic discussion. To recognise the new state of society, and design technologies accordingly (perhaps prescriptively) is increasingly essential.

Thoughts on Witnessed Presence

The negotiation of trust among people remains vitally important in modern socio-technical multi-actor systems. Dominik recounted, "I remember something that Christoph told me… It's about the perception of media and what media says to you. Christoph came from East Germany to West Germany, shortly before the [Berlin] Wall broke down. Anyway, they got at home a letter and this letter said they had won a million German marks [*note: marks were the German currency at the time*]. It was spam. It was one of those schemes [*note: similar to modern emails about Nigerian inheritances*]… This happened to them, but via letter. They got super excited, started to read it. For half an hour, they were in complete ecstasy, their whole family thinking it was incredible! Why? Because in the system they were living in, there was no [such thing as] faulty communication via mail… something in your mailbox was something official. And suddenly an experience like this, a concept like this…" (interview with Dominik, 2014).

Eduardo contextualised the same issue in day-to-day socialising: "The amount of information you get off a person [in physical presence] right off the bat is astounding… in 2 minutes I can judge a lot from a person and based on that I'll see common points or not… Personal communication is not just a name and what the other person says. It's so much more information…" (interview with Eduardo, 2014). He continued, "Whereas online, based on a picture or on a name, the information is so narrowed down that it's pathetic. And you don't know if it's real or not. It can be a lie in person…" (ibid).

These statements indicate that social interactions have not only evolved beyond person-to-person communications, and now include person-to-systems and person-to-person-via-systems interactions as well. So far, these new avenues have naturally evolved ways in which trust is negotiated. The theory of Witnessed Presence makes this aspect of system design more explicit, and more amenable to engineer affordances and interventions to facilitate the building of trust.

Ambient witnessing

One of the insights that stood out most for the principal investigator during the course of this research was that a witnessed presence interaction is not always one that is an explicit directed give-and-take action. The example of strangers waiting for a train, acknowledging each other's presence without necessarily communicating, is an apt one. Neither is initiating an explicit interaction (even though presence and response are being negotiated), and neither is the intended recipient for the negotiated presence and response.

The same occurs in a crowded place; each and every person in a public place is modulating presence in response to one's surroundings even without explicit interactions. These are distinctly not instances of co-presence or social presence because there is no explicit interaction (or even intent of interaction) between parties. Yet, there is witnessing involved.

As such, witnessed presence is not only relevant in a one-to-one setting but also in one-to-many or one-to-systems contexts. As Nevejan suggests, various formats for one-to-many and one-to-systems interactions in physical presence have traditionally been established in practice by social contract and interfaces with civil institutions (personal communication). These have not translated (yet) to populations in cyberspaces.

Joao's statement of long-lost acquaintances commenting about his daughter whom they've never even seen, based solely on information gleaned from *Facebook* updates, is very telling (interview with Joao, 2014; quoted in previous sub-section). He asked "I'm willing to share whatever, but it's more for me than for others... I have nothing to hide, why should I hide this?" (ibid).

This suggests that a new generation of online interactions are based on a "broadcast model" as Kwame Ferreira ventured to comment (personal communication). In a way, the principal investigator equates this sentiment of "broadcast communication" or otherwise sharing information online, to presenting oneself in public. There is a lot of information to be gleaned from one's attire, demeanour, devices and acquaintances in physical presence; this information, as discussed in the previous paragraph, does not only come into play in one-to-one interactions but profoundly affects the impression and response to the individual by all surrounding persons. From Joao's statement, perhaps it can be said that status updates (and selfies) on online social networks are this category of *non-directed ambient witnessing*, which similarly affects how others will react to the posting individual at present and in future.

From anonymity to addressability

This line of reasoning also introduces a discussion of addressability and its opposite, anonymity. The anonymity-addressability spectrum in this context refers to the level of addressability/response-ability an individual affords to another. Joao's later comment makes this point clear; he said "What are you willing to share? What are you willing to give up? How much are you willing to overlap with the other person? That has to happen, otherwise it would be two strangers living in the same house" (ibid). So in any witnessed presence interaction, there can be said to be a dynamic negotiation along the anonymity-addressability spectrum. The more trust there is in the witnessed presence interaction, the more accessible each party makes themselves to the other. Conversely, the less trust there is, individuals prefer to be more private and reserved with one another.

Guillermo agreed, saying his choice of whom to share a *BOND Touch* connection with would depend on a sense of symmetry; he described this symmetry as such: "Someone very very close, who is as interested in talking to me as I am with them" (interview with Guillermo, 2014). So in the negotiation of anonymity-addressability in a given witnessed interaction between two individuals (say A and B), there can be said to be up to four settings of privacy, namely:

- How much A trusts B (how addressable/response-able A is to B)
- How much trust A expects from B
  (how addressable/response-able A expects B to be)
- How much B trusts A
- How much trust B expects from A

Here, Nevejan says that from the personal perspective the *YUTPA* framework provides, there is a implicit distinction made in the Relation dimension between an *other* being recognised as "you" or "it" (personal communication). That is to say, "you" is one with subjective agency – because one individual can only be in a Relation with another if one recognises the other as an individual – while "it" is an *other* one is not in Relation with, and "it" is just information.

In the case of *BOND*, these privacy settings may be largely unspoken but easy to negotiate among already-intimate partners. However, it is significantly harder to negotiate between strangers and systems. Joao exclaimed "*Google* transformed search engines all over. They found a way for you to get content relevant for you [from an exponentially growing list of websites and resources]. If you think of that, it's almost a privacy invasion in itself" (interview with Joao, 2014). It is true how uncanny it is that an *Amazon* recommendation engine can suggest products one might like as well as or even better than a good friend might.

Looking at this from a anonymity-addressability angle, is it really the case that web-savvy users of *Google* or *Amazon* trust either of these two companies (or systems in academic parlance) more than their own friends? If not, how is one to feel that such systems have so much access to not just user-generated documents, but the users, their lives and personal details too? How addressable/response-able are these systems to their users, and is this level of accessibility commensurate with the influence and information they have of those users?

Dominik attributed some appreciation for the apparent neutrality of technology as a "third witness"; speaking of online date-matching algorithms, he said "I mean, it happens a lot with dating apps and profile-matching. I would have to trust the algorithm of course. I don't [trust the person]. I don't but I could, I could on the second step. Technology's always for me the first step, the second step is confirming and then [there is] trust. First there isn't trust. I don't

trust right [away]... But it's a first step that can be tolerated" (interview with Dominik, 2014). However, as he mentioned, the requisite "trust in the algorithm" is essentially trust in the system, and so there should be transparent ways to negotiate this trust. As-is, the principal investigator posits that the anonymity-addressability settings of individuals in online systems are highly asymmetric.

Public and private (cyber)spaces

Non-directed ambient witnessing is witnessing still, and this is only possible in a public space. Here, a public space is defined *a priori* through social convention and norms; it is not simply any place with multiple persons present. For example, a city square remains a public space even when crowded at peak hours and when completely empty in the middle of the night. Similarly, one's home remains a private residence whether one is alone or enjoying the company of friends. These *a priori* definitions of what is public or private are part of the unspoken social contract.

Hugo put this into context brilliantly, saying "Of course nowadays when people say to you 'oh I don't have *Facebook*", that says a lot. That says a lot because it also depends on how many other people are using it. If someone comes to me and says 'I don't use *Weibo* (Chinese social network)', I'm not surprised. Nobody uses *Weibo* in Portugal so it's not communicating anything through not using *Weibo*. It's always relating to the social norms that you might or not be communicating something" (interviews with Hugo, 2014). Indeed what Hugo refers to as "communicating something" is in fact the level of addressability/response-ability the individual willingly (or unwittingly) allows, given the context of social norms or contemporary media ecology.

An understanding of the social norms – among these, *a* priori private-public space designations - is essential, the principal investigator would like to argue, because they allow individuals to modulate their presence and behave accordingly. Specifically, the principal investigator is referring to the *a priori* designation of the environment (not the negotiation of trust with the other party) itself. In the YUTPA framework, some sense of such environmental negotiation is captured in the sub-dimensions of environmental impact, tuning and body sense. However, unlike the one-to-one interaction space of the *YUTPA* model, directed broadly at the ambient surrounding systems and people.

Online however, the lines of privacy and publicity are very blurred. This is where the implications of non-directed ambient witnessing become apparent, especially in the digital context. Does a *Facebook Wall* count as a public space or a private space? Is a web page public and if so, are its resources on the server also public? Freshly relevant, does infringement of personal data extracted from password-protected cloud storage count as data burglary (from an individual) or data(bank) robbery (from an institution)?

An alternative consideration would be to re-visit the digital privacy debate in contemporary society. On the one hand, the right to personal data protection and privacy is important; but on the other, over-protective doctrines to data privacy in effect prevent public cyberspaces from emerging.

Not all digital cyberspaces are equal, and these too should enter the lexicon of social norms on what is private and what is public (cyber)space, so that individuals can choose to modulate their presence accordingly. Digital service designers are essential in this regard to conceive of affordances that communicate the privacy-publicity aspect of a cyberspace to its users. Service designers on the other hand should explore the private-public spectrum to precisely design the service interactions among users and with the system itself. Privacy *and* publicity are both essential to digital living, just as in offline living.

Exploring imagination in communication

The *YUTPA* framework already features the dimensions of Time, Place, Action and Relation, with corresponding sub-dimensions, each granularly describing aspects of witnessed presence interactions. Caroline Nevejan is still exploring other aspects of witnessed presence, among them the role of imagination in interaction and creation of new meaning (personal communication, 2014). From the analysis of the interviews, the following insights are free explorations relating to imagination.

Constructing mutual relevance

Both Joao and Pedro, as senior designers, were quite insistent on the importance of relevance in communication. Pedro said "Even if I didn't talk to [acquaintances] for three months. I don't know anything about their lives for the past three months and in ten minutes they tell me about it, it's more relevant to me than over those three months, looking over their posts on *Facebook* and understand what they're doing. Of course in the conversation you're going to miss a lot of things that happened in [their] life, but you will probably talk about the more relevant thing[s] and the rest is just noise... This is what's meaningful in our relation, because we don't need to tell each other everything" (interview with Pedro, 2014).

In a way, this relates to the earlier discussion of "broadcast models" of communication. A broadcast is generic, a personal conversation is specifically catered to be relevant to one another. The onus is on the speaker to craft one's sentences in such a way that the listener is compelled to pay attention - which means speaking very differently to a businessman or scientist than to a villager or a child. Here, it can also be seen that *a priori* knowledge of the other plays a significant role in designing relevant communications, which in turn is reminiscent of how the intimacy of partners serves to nullify the disadvantages of ambiguity in a *BOND Touch* communication. Relevance allows shared meaning to emerge. So relevance is an aspect of a witnessed presence encounter, and it is in turn a function of imagination.

Gravity and friction of (inter)action

Speaking of significance, the gravity (or friction) of the act itself seems to influence how one thinks about the act; and in turn this personal meaning plays an important role in modulating presence in the interaction appropriately.

When asked if receiving a *touch* would be a significant moment, Guillermo commented, "A BOND interaction is not a big deal. Holding hands, touching, hugging, caressing: all of these do have meaning but [they're] not that memorable. Because it happens all the time. So I don't see a situation where two people wearing *BOND* constantly [finding] every single *BOND* interaction a

distinct memory... Yeah it doesn't mean the other person went through a sacrifice to get through to you..." (interview with Guillermo, 2014). Note here that a prejudgement of the simplistic format of interaction (or friction) profoundly influences the perceived significance (or gravity) of the act.

In Witnessed Presence, there is a distinction between *activities* and *actions*. Both involve exercised agency, but the former does not have weight and does not advance the narrative. Doing household chores is an *activity*, but the chores (and their memory) are ultimately forgettable. Attending a graduation ceremony is an *action*, significant and poignant.

Completing a student survey would be done very differently, with a very different mind-set (and level of presence) than filling up an official annual tax form. The act itself is informed with *a priori* knowledge: in this case, the consequences of failure to complete the tax form (correctly) are severe. And this knowledge affects how the act is undertaken.

The friction of an act can also affect how the act is perceived and presence is modulated accordingly. Applying this to an extreme socio-political example, engaging in face-to-face combat *demands* more presence than flying a bullet-proof drone from afar. In both, the outcome might be the same but the friction of the act is exponentially reduced in the latter case. One can see why the reduction of friction via affordances is not always the best course of action. Perhaps there is a requisite amount of friction certain actions *deserve*, or at least symmetric friction among both parties, in social contexts.

Thus, the difference between an *activity* and *action* is the gravity of the occasion and/or the friction of the act itself. So, *action* and *activity* are useful terms in describing certain aspects of Witnessed Presence. Imagination plays a role in the perception of the act, filling in *a priori* information to contextualise relative importance and modulating presence accordingly. However, the principal investigator would like to suggest this can be an explicit design parameter of witnessed presence interaction as well - to incorporate the requisite amount of significance to an (inter)action by means of experience/interface grammar. In essence, this is to openly question if significance can be explicitly engineered.

The principal investigator would like to propose one solution: the concept of ritual for modern civilisation. Rituals are symbolic pre-determined sequences of

action, complex in that their physicality is accompanied by poignant meaning. Their symbolic nature means they are not only focused on functionality but instead introduce a certain friction to that encounter. The undertaking and dutiful completion of the ritual in itself attributes a certain gravity to the act, and communicates a dedication and discipline to deeper underlying principles.

For example, a surgeon recognises contamination as a possibility, and allowing contamination is not only irresponsible but also disrespectful to the patient. So an entire sterile operating room environment is created. Tools are sterilised thoroughly. The surgeon only steps in when one has scrubbed in, worn the necessary uniform, adorned fresh masks and gloves. Only after this entire ritual is the functional act of operating on the patient begun. The investigator suspects if the ritual itself does not also modulate presence and state of mind to an appropriate condition.

The ritual may seem a mere *activity* compared to the consequential *action* that follows, but in this case, the *activity* confers significance and legitimacy to the *action*, beyond mere functionality. The principal investigator would like to argue that in social interactions (especially those with more widespread and long-term consequences), there should be explicit design of ritualistic *activities* as well, which serve to symbolically elevate the significance of the following social (or socio-technical) interactions.

Witnessing pre/post-interaction

The notions of anticipation and reflection also play an role in the significance of a witnessed presence interaction. Hinting at anticipation, Guillermo said of organising meet-ups: “There’s no preparation needed [now]. Before, you would have to coordinate it if you wanted to meet physically… It was something I knew that is *that* is the commitment and I would always honour that… I would implicitly commit to it… Yeah it has to do with routine…” (interview with Guillermo, 2014).

Consider the difference between preparing for an interview beforehand, or being put in a situation where one must give an impromptu audition. The presence of mind of the former is likely very different than the latter. Regardless of the content or format of the interaction, *a priori* knowledge and mental preparation

allows individuals to negotiate the significance of an interaction, the nuanced role they wish to portray, the actions they would like to perform and prepare accordingly. This is intent prior to the interaction itself. So anticipation can be said to be an aspect of witnessed presence design. In designing affordances and interventions for witnessed presence in socio-technical systems, anticipation could be one design parameter to be addressed.

In Witnessed Presence theory, Nevejan refers to empty time as important moments of punctuation in a witnessed presence engagement over time where reflection occurs and shared meaning emerges (Nevejan, 2012). Eduardo quipped about reflection saying "It's the way we interpret things. Because online, they'll stay there if you don't pay attention to them and you can always look at them whenever... Whereas in real-life, [if you don't catch it at the right time] you will never have seen it... Urgency, if it requires immediate action I would never use [social media]..." (interview with Eduardo, 2014).

From this, the investigator would like to suggest that empty time is not a simple state of non-engagement, but rather a spectrum of urgency. The more urgently (sustained) response is needed, the less empty time there is for reflection, and thus interactions become purely reactive. Here again, lesser urgency (or more empty time) allows for more nuanced, deliberate response. Perhaps the earlier mentioned possibility of ritual *activities* (before, during or after the interaction) are conducive to increase anticipation and reflection too.

5. Conclusion

Wearables indeed are held to have a lot of promise as one component of the coming paradigm of pervasive and ubiquitous computing (Wei, 2014). In combination with advances in the Internet of Things category, consumers are on the verge of new socio-technical ecosystems that blur the distinctions between the online and the offline world. Both in everyday lives and in specialised applications, for both consumer and professional markets, wearables can radically enhance workflows by providing pointed affordances further synergising the man-machine complex.

Wearables are still in their infancy and while their potential is recognised, the initial offerings in consumer markets have not been as disruptive as the hype would suggest. I was naturally drawn to this curious puzzle, because it promised to be a multidisciplinary effort at the intersection of technology, policy, culture and business.

Motivations and contributions

In this work, there were three underlying motivations which informed the research approach and analysis perspectives.

Firstly from a policy analysis perspective, I argue that new media technologies, especially mass-use consumer technologies, are not only prevalent but also profoundly influential. From operating systems to mobile devices, online trading platforms to personal data on cloud services, these are core to the normal functioning of modern societies. These devices and services are used by untold millions, integrated into essential social and economic processes and the

cascade effects of their failure could be comparable to a large-scale infrastructure breakdown.

As such, just as there are mandated policy requirements like (social) impact assessment for social goods like critical infrastructure, ethically ambiguous technologies or hazardous industrial processes, there is a need for sound technology policy to govern and guide (consumer) technologies and services too. These new media can also be pre-emptively and perhaps prescriptively designed to be more socially conscious. Wearables, as a newcomer on the verge of mass deployment, are considered in this work to demonstrate how new media can be studied and assessed.

Secondly, the knowledge of the impact and influence of new media and their network effects in modern socio-technical systems prompts the need for (trans)humanist design philosophies to support their development and deployment. In this thesis, I propose the use of sociological theories, notions and insights as a possibility to meet this need. Sociology is usually a descriptive *post-hoc* endeavour, but here, I attempted to use knowledge from this domain to pro-actively contribute to the development of a new technology product.

Thirdly, given the vanguard role that such startups have on the debut and diffusion of disruptive new technologies, it is of interest from a Science and Technology Studies (STS) perspective to study this unique microcosm, namely the whos, hows and whys of new technology development. I had the distinct privilege to conduct my research with an exciting new media company, *Kwamecorp*. The case-study revolved around the on-going development of a new wearable module, *BOND Touch*. This work provided commentary on the people and the product, in turn opening a brief window into the background workings of a contemporary innovation process.

To carry this out, the research effort included a comprehensive literature review of Medium Theory (McLuhan, 1964), Networked Individualism (Wellman, Boase and Chen, 2002), and Witnessed Presence (Nevejan and Brazier, 2012), along with related works. This was coupled with on-site case-study of a novel wearable currently in development at *Kwamecorp*. An analysis of the company, the development trajectory of the product and interviews and conversations with the designers were major research material, on the basis of which extent

of witnessed presence in *BOND* is evaluated. The analysis yielded certain emerging themes that are also discussed here.

This has been an ambitious undertaking, and while I have endeavoured to do justice to combine ideas and references from multiple domains, the work is by no means exhaustive. Specifically, a larger portion of presence research was not consulted as it was beyond the scope of the thesis, though still useful to this general subject area. Secondly, due to time constraints, only nine interviews were conducted with six *Kwamecorp* designers. In retrospect, it would have been very interesting to also interview software developers at *Kwamecorp*, and at least one female contributor to have a less gender-biased discussion.

I was only able to participate to a limited extent for about three months in the on-going development of *BOND*. Both the design history and the ethnographic commentary could be richer if the study window had been longer.

Findings and recommendations

As discussed in Research Design (see **Chapter 2**), the main research question was, "**Can witnessed presence be designed in a system of networked wearables used in shared intimate space**?" Before this question could be answered, the following host of sub-questions guided the arc of the research process. Let us revisit them one by one.

What are the essential qualities of the wearable medium?

In light of the exponential pace of technological innovation and adoption in modern societies, where major technologies like the mobile phone and social media have become influential drivers of economy and culture within the span of a generation, it is important for new technologies to be designed with requisite foresight. Marshall McLuhan's Medium Theory was employed for this very reason, to elucidate the essential characteristics of the wearable medium that may be extended and specialised in years to come (McLuhan, 1964; see **Chapter 3.1**).

Wearables are understood to be a new medium; indeed they 'enhance and escalate the human's *being-in-the-world* in totality'; Steve Mann, with his almost four-decade history with *WearComp*, attests that with daily use and long-term adaptation, wearables may function as "true extension[s] of mind and body" (Mann, 1998; Slunecko and Hengl, 2006).

McLuhan devised open-ended probes to bring to light qualities of media: his four Laws of Media (McLuhan, 1975). These questions were applied on wearables and the following findings were reported.

So, wearables in their mobility and portability can be imagined as technological organs on the skin of a modern human being. Wearables can function as intelligent context-sensitive affordances that reduce the time between intention and action, "keeping users in the flow" (Starner, 2013). And of course, wearables can augment reality (especially visually), enhancing situational awareness on-demand. These applications increase agency. Ultimately, these condensed into the design mantra for wearables: *contextual embodied augmentation*.

A novel suggestion brought to light from this research suggests that wearables (and the IoT category too) can also increasingly serve to enable actuation capabilities; think wireless buttons. Imagine remote controls owned by everyone that signal and control common facilities giving rise to mobile, quantum forms of democratic interactions. On the other hand, such systems would also need to be secure to prevent malicious exploits.

Given the increasing portion of life and love negotiated in the online world, networked wearables retrieve a balance to embodiment across merging realities; digital stimuli too can be "affective" in real-time on the person of the user. There is something to be said for the uncertainty of continued biological integrity of the human animal given how custom wearable enhancements may profoundly re-equilibrate sense-ratios and faculties of its user (McLuhan, 1964).

Wearables are recommended to consider *hotness* and *coldness* of media when developing applications, with the larger goal being "calm" and "user-centering" technology that allows information to flow from centre to *periphery* and back gracefully (McLuhan, 1964; Weiser and Brown, 2014). *Hot* applications are generally for tracking indicators and notifications, specialised for easy cognition

and quick calls to action. On the other hand, a spectrum of *coldness* is recommended for creative or communicative functions, to encourage reflection and deliberate response.

The haptic dimension of wearables gives access to touch modality for kinaesthetic stimuli. Given the profound connection of sense of touch with embodiment, new applications could take advantage of this avenue for non-visual, non-verbal communication, while taking care not to over-stimulate (the equivalent of being blinded in too-intense lighting). Intimate communication of an emotional nature is a ripe possibility.

From a sociological perspective, just like digital avatars are pointers to a person's persona, settings and preferences, wearables in their physical-digital form retrieve this paradigm for the material world, becoming material "avatars" of their user, with interesting applications. For example, support for a social cause online can now remind the user on-the-spot in a timely manner if certain actions/purchases in the material world would be counter to that cause.

Since wearables represent the condensation of expertise/ability into a repetitive technology, they can provide specialised affordances not just for experts, but also non-experts. Carrying these wearable affordances from designated places of work to the public spaces in between, essentially dissolves the notion of geographically-bounded social position. Specialised-function wearables that travel with users would make portable some degree of their social position as well. This in turn could facilitate the emergence of dynamic and meaningful groups when needed.

Speaking of social position, one source of friction that should be an important design consideration for wearables is that the affordances may fundamentally change the 'silhouettes' of certain activities. For example, a photograph taken with *Glass* no longer required the characteristic pose that using a camera would require. So these aspects should be designed, where possible, to be transparent to both the user and others around the user (Banks, 2014).

And finally, wearables share some qualities of the technology of clothing and jewellery; namely they are worn or they adorn. Like clothing, it is recommended that wearables be customisable both visually and functionally. The value of wearables-as-jewellery (additionally) comes from the rich digital information

captured in the wearables, be it personal health data, passwords or other similar information. These are not just passively stored; wearables can make use of such data to provide personalised affordances in both online and offline worlds.

How do networked technologies connect people?

The design of consumer electronics should also take into account the sociological state of communities in contemporary culture (see **Chapter 3.2**). Manuel Castells' work on the cultural role of the Internet, and Barry Wellman's descriptions of the transformations that contemporary communications media have wrought on communities were brought in, to contextualise the social role of networked wearables in this environment (Castells, 2001; Rainie and Wellman, 2012).

The Internet is presently a dominant medium of our culture, with which a unprecedented amount of (multi)media can be accessed, and on the basis of which yet other media are continually developed. So it is fair to say it has fundamentally influenced our postmodern culture across almost every domain of human activity. Equally, the Internet is instrumental in extending mundane everyday life as well, "in all its dimensions and modalities" (Castells, 2001).

The hypertext paradigm allows for communication via multiple channels and means, both synchronously and asynchronously. Asynchronous communication gives individuals the freedom to respond at will acknowledging the possibility of communication across different time zones. Synchronous communication is the trump card of the Internet, allowing hundreds and thousands of people to connect, interact and communicate *coherently* in a single (cyber)space at any one time.

From an individual's perspective, the Internet is increasingly not a common space but a personal dimension. Each user views, processes and participates in unique streams of information necessarily making each one's experience distinct (Castells, 2001). Given the rising dominance of online interactions in everyday life, more individualised experiences also mean less shared experiences with others in the community, which in turn leads to less cohesion due to the lack of shared meaning (ibid).

From a community perspective, modern communities are not close-knit groups, but loose networks of interpersonal ties – these are termed as network societies (Wellman, Boase and Chen, 2002). Rather than being limited to local groups, individuals interact in multiple sets of overlapping relationships (ibid). The Internet neither "increases/decreases" community, but instead extends into daily life, blurring distinctions between online and offline interactions, with computer-mediated communication (and relationships) being as significant as offline interactions (ibid).

Individuals in network societies (typically owning mobile personal computing devices) are no longer tied to geographic points of access or reception; "The person has become the portal" (ibid). The rise in the number of connections has somewhat eroded strict definitions of the word "friend"; but equally, the freedom to connect with whoever, whenever, wherever has given rise to confirmed "glocalisation" of personal networks (ibid).

Among intimates, communication technologies are also drafted to enable a sense of connectedness throughout the day (Wellman, Kennedy, Smith et al., 2008). Families connected by modern communication technologies seem to find their families closer now than was possible before. Couples especially use mobile phones to "touch base" and co-ordinate daily activities (ibid).

How can digital connections be enhanced?

As modern socio-technical systems grow more complex, the opportunities for person-to-person and person-to-system interactions proliferate, increasingly mediated by technology. Meanwhile, the proper functioning of the social order is driven by fundamental ethical obligations; however these norms are challenged by new paradigms of mediated communication. Caroline Nevejan's theory of Witnessed Presence was explored in this study as one possible basis to better design (online) interactions where the negotiation of truth and trust are not obfuscated (Nevejan and Brazier, 2012). Witnessed Presence combines aspects of presence design research with witnessing to enhance ethical obligation in key interactions (ibid; see **Chapter 3.3**).

Kelly Oliver's work on witnessing establishes witnessing in its full and double meaning – to be witness and to bear witness – as a means of increasing the subjective agency of interacting parties (Oliver, 2001). Witnessing, as an alternative to recognition theory, transcends inherent power differences, and compels parties to go beyond mutual commonalities and embrace mutual *otherness* (ibid). The key aspects of witnessing are social position, addressability and response-ability (ibid).

In physical presence, pre-requisites of witnessing (namely eye-witnessing and the ability to intervene in real-time) inherently exist but these aspects do not seamlessly translate to online interactions (Nevejan, 2012). Mediated communications in socio-technical systems then, especially when the subject being discussed has ethical implications, can and should incorporate mechanisms to facilitate witnessing (ibid).

Presence design is predominantly directed towards enhancing (social) immersion in virtual reality settings through the designed 'invisibility' of technology in mediated interactions (International Society for Presence Research, 2000). Witnessed Presence however applies aspects of presence design with a *being-here* approach, improving interactions in the here and now (Nevejan, 2007). Specifically, Nevejan's work provides a granular scorecard to evaluate extent of reciprocity in (mediated) interactions; this is called the *YUTPA* (being with You in Unity of Time, Place and Action) framework (Nevejan and Brazier, 2012). With this framework, interactions can be designed in pointed ways to improve the necessary aspects of communication in a given interaction.

How is BOND designed to create meaningful connections?

The ethnographic study of *Kwamecorp* (see **Chapter 4.1**) highlighted the free-and-easy, friendly and mobile workplace culture of new media startups; its role in promoting creativity and innovation is an easy case to make.

Specifically, *Kwamecorp*'s motto of socially conscious innovation for better living is not just a corporate sound-bite but indeed makes its way into daily, sustained and mindful practice. Key points suggested that the open-source logic of "scratch your own itch" equally applies to ideation of new media use-cases (Raymond, 2000).

Moreover, from an Actor-Network Theory perspective, it was noted that workplace culture profoundly influences the workings and output of a company; that *creative betrayal* emerges from the very friction between different teams and interfaces – for example at *Kwamecorp*, software are so tamed to the will of the designers that there are no compromises necessary – and such problem-solving improvisations contribute to innovation as well; and that there is a danger of broadly intelligible outputs becoming more dominating and influential than specialised outputs with lower intelligibility, and this can be undesirable in cases where both kinds of outputs are equally important to the quality of the deliverables (Law, 2009).

The design history of *BOND* (see **Chapter 4.2**) clearly reflects a humanist seed in the original idea for the product, and this was further pursued in initial attempts to incorporate sustainable fair-trade materials in its manufacture as well. Even when the trajectory was drastically re-aligned, the concept design still tries to incorporate a user-centered design approach, revolving around seamlessness and ubiquity (interview with Pedro, 2014).

The takeaways from the design history were that strategic pivoting (which are very common in the startup world) are sometimes essential for interesting ideas to survive the requirements of technical and economic feasibility. However, the kind of features that attract consumers may not always be the kind of features that investors are eager to support. In the case of *BOND*, strategic pivoting from a single-purpose quirky product to a multi-purpose modular platform introduced a lot of feature creep that is currently straining the company's resources.

The modular approach indeed is a strategic move with respect to wearables given limited and precious body real-estate, and in this regard, *Kwamecorp* should be commended for this insight. On the other hand, each module with its own specialised functionality is in fact a complete vertical by itself, with a different market, and different components and expertise needed for industry-standard reliability. So the modular approach, while a strong prospect, is also an extremely challenging one.

I recommend that *Kwamecorp* re-establish a level-headed approach, balancing ambition, capability and resources in this regard. On the other hand, since

wearables are in their early stages, targeting wearable components and APIs for developers to rapidly prototype and test wearables is a meaningful business vertical to pursue, which still incorporates all learnings derived from the development of *BOND* so far.

Can BOND interactions be mapped on the YUTPA framework?

Nine formal interviews were conducted with six *Kwamecorp* designers on a range of topics from the design trajectory of *BOND* to questions evaluating extent of witnessed presence. (Interview transcripts are found in **Appendix.**) The *YUTPA* framework is used both to design interview questions and analyse the transcripts (See **Chapter 4.3**).

For the purposes of clarity, the functionality of the *BOND Touch* module is described here in detail: it occurs in a pair of *exclusively-synced* modules that if one is pressed, the other 'tickles' its user through *haptic vibration*. The connection is enabled by mobile protocols, and remains an *always-open* easy channel for *non-visual non-verbal communication*. Also, it is important to keep in mind that *BOND* is only adding one new avenue to communicate, but assumes that traditional means of communication occur alongside at the same frequency as before.

Firstly, it is justified that intimate couples in modern network societies are highly addressable, response-able and equal in subject-position to one another, and so, they do witness one another. Secondly, the signal enabled by the "content-less" *Touch* module, in actuality transmits the real-time volition of the partner to establish contact – that is to say, the signal transmits a quantum of presence.

The following are the findings from mapping *BOND* interactions on the *YUTPA* framework.

YUTPA dimension: Time

For its goal of achieving intimacy, *BOND* should become 'invisible' as the 'third wheel' – that is to say, it should not replicate the pager; this is achieved by real-time push of signals with no history, instead capturing the blink-and-you-

miss-it transience of speech. This is a crucial component for *BOND* to effectively transmit the presence of the partner.

The touch-modality inherently encouraging short, infrequent signals with lots of empty-time, which further enhances personal reflection of the significance of their bond (and of course *BOND*). In combination with intimate knowledge of their partner's activities, a *touch* allows partners to integrate their rhythms, both via momentary *touches* and by the larger temporal pattern of *touches*. In turn, this allows partners to synchronise their performance, with a momentary augmentation of the other's presence in each other's embodied experience.

A lower daily frequency of *touches* is essential for *BOND* as it implies that each interaction remains a wearable-recommended microinteraction (Roggen et al., 2014); moreover it serves to amplify the significance of occasional *touches*.

YUTPA dimension: Place

Here, intimate partners wearing BOND is in itself implicit permission granted one another to welcoming the 'intrusion' of personal space by the other. In combination with the real-time transmission of presence-as-content, the end-result is a technology-mediated experience of the partner being just nearby 'in the other room'. In that sense, *BOND* viscerally enhances a sense of co-presence in a shared place (International Society for Presence Research, 2014).

A *touch* transmits a quantum of presence, a 'quantity' that can be varied by the local frequency and duration of the signal. Give the association of touch with intimacy, one designer suggested a *touch* would be like getting a 'psychological hug' (interview with Eduardo, 2014). Increased nuance – either through sensitivity of haptics or complexity of signal – might increase immersion, but also cognitive load of interpretation and *hotness* of the signal. As such, increased nuance is actively discouraged for *BOND*. Intimacy is also rooted in emotion, so a *BOND* signal can affect a user emotionally. Intimacy is also a key requirement for *BOND*, because intimate knowledge of the other is essential for the otherwise ambiguous content of a *touch*.

Most significantly, designers reported that the augmentation of presence at crucial moments could potentially avert them from an action that the partner might not approve of. This means a *touch* preserves at least some sense of

real-time intervention. Granted, the change in behaviour due to a *BOND touch* is not comparable to behaviour in the other's physical presence.

YUTPA dimension: Action

BOND interactions are by design microinteractions, so the friction to act is minimised, but so too is the gravity (or significance) of the act. While individual *touches* do not allow for extensive tuning among partners, the larger pattern of *touches* over time facilities limited tuning of partners through sharing of spatio-temporal trajectories (informed by other means of communication of course).

Direct reciprocity is almost non-existent in *BOND* because ambiguous microinteractions offer quickly diminishing returns in back-and-forth communication. So while *BOND* is a two-way channel, it inherently encourages only one-way communication per microinteraction. For similar reasons, *BOND* is not capable of complex negotiations; on the other hand, designers (and comments from interested consumers) unanimously suggest that elementary codes would emerge, serving as meaningful signals, with use over time by trial-and-error. Here, the patience for and possibility of trial-and-error is only afforded by the existing intimacy between partners.

The primordial nature of *BOND*'s kinaesthetic signal, in combination with the intuitive and apt gesture to effect that signal, *BOND* is seen to viscerally extend the sense of intimate touch across geographic distance. Based on the virality of *BOND*'s mention among an online community who identified very strongly with their long-distance relationships, one can reasonably argue that a *BOND touch* is in fact an extension of embodiment itself. The simplicity of *touches* denies it inherent significance, but this is a feature, because *touches* can be employed fluidly across a wide variety of situations.

YUTPA dimension: Relation

In a *BOND* interaction, the role of participants is necessarily established prior by their relationship itself. The existing intimacy of these partners is what is organically extended by *BOND*. Almost all the designers agreed an ambiguous *touch* would only be welcome if it came from very close loved ones; and would

be 'weird' and ambiguous otherwise. This is interpreted as a suggestion for deep trust in the other.

While every *touch* is meaningful to both partners, it might not quite have the same meaning to each. The amount of meaning could perhaps be increased with more nuance. As mentioned earlier, this would also increase the cognitive load and the *hotness*, which in turn is neither a microinteraction nor encouraging of reflection and deliberate response.

The sense of engagement is high despite the microinteractions or perhaps because of it. Indicative of networked individualism, both partners – with extensive personal networks and personal lives – are already dealing with the amount of communication typical of modern living. A *touch* is in effect an affordance to "mass-manufacture" a sentiment, not unlike the simplicity of a *Facebook* 'Like'. This allows partners to be in touch without necessarily communicating content for conscious reception and reciprocation.

Does BOND permit witnessed presence between intimate partners?

In conclusion, it is seen that *BOND* facilitates a great extent of witnessing among intimate couples, despite the ambiguity haptic micro-signal. Despite its likely one-way give-or-take mode of communication at any one time, the quantum of witnessed presence allowed by the affordance of microinteractions is a powerful addition to the '*inventory of means*' with which to communicate with close and loved ones.

Specifically, *BOND* greatly enhances co-presence, the sense of the partner being just nearby 'in the other room', which in turn facilitates witnessing in the interaction.

One final question

So, now we can answer the main research question: **can witnessed presence can be designed in a system of networked wearables used in shared intimate space?**

Based on the analysis so far, I think yes, wearables *can* facilitate witnessed presence interactions, especially among intimate partners. There are some caveats.

Firstly it is hard to imagine that these interactions can be long and nuanced because it does not align with microinteraction principle for wearables, and equally, microinteractions do not seem capable of complex reciprocity or negotiation during an interaction. So wearables can go some of the distance, but cannot be the primary facilitator for witnessing.

Secondly, given that modern couples are already spoilt for choice when choosing avenues to establish contact, it seems unnecessary for a connective wearable device to be a highly communicative one. On the other hand, the notion of quanta of presence seems a very interesting area to explore for many kinds of applications, especially relevant given the sheer frequency and opportunities of connections.

Future work and implications

Under Emerging Themes (see **Chapter 4.4**), interesting testimony from the experienced designers were compiled in support of the literature and, some emerging themes were captured.

Extending Witnessed Presence

Here, I argue that there is a phenomenon of ambient witnessing (the sense of being in public with/without interactions with others). It was observed that addressability was a spectrum that ranges from full accountability to complete anonymity. Surprisingly, both extremes and points in between are useful and important depending on the extent of privacy that each demands for oneself and from the other. Highly asymmetric configurations of these privacy settings can be troubling.

Carrying this thought further, I suggest that it is important to establish norms of private and public cyberspaces as well, and online services be designed accordingly, as these fundamentally allow for (socially established) default

values for the modulation and performance of presence. Essentially, one may not necessarily have to feel 'alone' on the Internet and the web (and applications) can be designed to give the impression of being public (cyber)spaces. So it is clear the Witnessed Presence is an area that is worth exploring further, especially in terms of one-to-many and one-to-systems interactions.

Furthermore, the role of imagination in witnessing also revealed that there are important *a priori* considerations that fundamentally affect the quality of witnessed presence interactions. Namely, prior acquaintance assists in the possibility to easily construct mutual relevance, the gravity and friction of an action profoundly affect the perceived significance of an action, and the role of anticipation (of a future interaction) and reflection post-interaction both also affect the significance of the event and the precise way in which presence is performed during the (next) interaction.

All these are interesting trails that deserve to be explored, thus extending Witnessed Presence theory holistically.

Technology as policy

Furthermore, a meta-theme that stood out towards the end of the analysis was the important role that design intentions play in the implementation and consequent patterns of use of a technology.

To give a simple example, consider the example of buying tickets for a train journey. Depending on whether the tickets are only sold over-the-counter, or smartcards and automated gates are implemented, the behaviour of passengers arriving to take the trains – and the very notion of punctuality – can be very different indeed. The former option, I argue, is equivalent to mandating via policy that all passengers arrive early to the train station.

This also links to an earlier assertion on how rituals (with appropriate gravity and friction) can help increase the level of (mindful) presence in an action. User interfaces of deployed technology can be designed to an extent to implement some sense of ritual.

So it can be seen that the implementation of a particular configuration of technology is equivalent to the implementation of a policy. I am inspired by Lawrence Lessig's "Code is Law" to say then that "Technology is Policy" (Lessig, 2009).

The implications of this could be profound indeed. Entire social behaviours, at various levels of group hierarchy, could be better designed along socially desirable lines by the pre-emptive pro-active deployment of technology. And this too, might be a timely intervention for modern civilisation.

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Appendix

In the interests of document portability, the transcripts from the interviews with *Kwamecorp* designers are found exclusively as a separate file at the TU Delft Repository, which can be accessed here: http://repository.tudelft.nl/