

OUT OF NETWORK

Technologies to Connect with Strangers

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Submitted to the Program in Media Arts and Sciences, School of Architecture and Planning, in partial fulfillment of the requirements of the degree of Master of Science in Media Arts and Sciences at the Massachusetts Institute of Technology, August 2014.

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ABSTRACT

Popular connective technologies are supposed to save us time and simplify our lives, but we are instead more overwhelmed and scattered than ever. These same technologies promised to help keep us close to our friends and loved ones, but instead we are becoming increasingly isolated. This is result of designing technology with the goal of interactions being efficient rather than interactions being meaningful. Predominant connective technologies do not adequately consider how small design choices shape our mental processes and affect our emotions.

In this thesis, I investigate how interfaces structure our thoughts and, as a result, behavior, and I examine how this power can be harnessed to improve mental and physical well-being. I focus in particular on how technology can influence perceived feelings of loneliness. Recent research shows that the subjective experience of loneliness, independent of objectively being alone, has astounding health consequences for a significant percentage of the population.

I introduce Lakoff's theory the embodied mind, which is the understanding the majority of thought is unconscious and experienced through the body, and I discuss how it can be used to design better interfaces. I summarize recent research that demonstrates the inextricable link between physical sensations in the body and feelings of loneliness and connection.

To explore these ideas, I designed and built two devices: the Empathy Box, a tabletop appliance inspired by *Do Androids Dream of Electric Sheep?* by Philip K. Dick; and the Empathy Amulet, a wearable device that fosters an unconscious sense of our connection to strangers. Both devices use shared physical warmth as a way to cultivate empathy and a novel sense of connection with anonymous others. With the understanding that the aesthetic qualities of a technology greatly influence its effectiveness, I conclude that the perspective of an artist, which is focused on combining aesthetics and context to make meaning, has an important role in the development of new technologies that interface with the self or that mediate relationships between people.

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The most daring thing is to create stable communities in which the terrible disease of loneliness can be cured.

—Kurt Vonnegut

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INTRODUCTION

With the invention of computers and the internet, we experienced an explosion of new connective technologies that promised to save us time so that we could better relax and enjoy life. Instead, people are overwhelmed and more distracted than ever. These same technologies were supposed to improve our relationships and help us keep in touch, and yet, people are increasingly isolated. This is the inadvertent result of designing technology with the goal of interactions being efficient rather than interactions being meaningful. When people's interactions with each other are mediated through a technology, mental narratives arise about themselves, the people on the other end, and the technology itself. Predominant connective technologies do not adequately take this into consideration in their design. In this thesis, I investigate how interfaces structure our thoughts and, as a result, behavior, and I examine how this power can be harnessed to improve mental and physical well-being.

I am especially interested in how technology can influence perceptions of the self and relationships with others. When I encountered a large body of research on how the perceived sense of loneliness, not actually physically being alone, has astounding health consequences, I decided to focus on loneliness in particular. This is timely, as feelings of social isolation are growing. This is the subject of Sherry Turkle's recent research, and I first discuss her work and how current technology is undermining human connection. With this knowledge that feelings of social isolation are on the rise at the same time as empathy is declining, I summarize recent discoveries about loneliness and its extensive repercussions.

To design technologies that enhance meaningful feelings of connection, I introduce Lakoff's theory of embodied mind, which explains how much of our thinking

occurs unconsciously and is influenced by the body. I give specific examples of research that demonstrate the inextricable link between physical sensations in the body and feelings of loneliness and connection. While I conclude that designing technologies that interface with both the conscious and unconscious mind is the most natural, effective, and efficient, I warn against the incredible threat this poses for people's autonomy.

I designed and built two devices: the Empathy Box, a tabletop appliance inspired by *Do Androids Dream of Electric Sheep?* by Philip K. Dick; and the Empathy Amulet, a wearable device that fosters an unconscious sense of our connection to strangers. Both devices use shared physical warmth as a way to cultivate empathy and a novel sense of connection with anonymous others. With the understanding that the aesthetic qualities of a technology greatly influence its effectiveness, I conclude that the perspective of an artist, which is focused on combining aesthetics and context to make meaning, has an important role in the development of new technologies that interface with the self or that mediate relationships between people. I end with directions for future work and consider how the study of loneliness, the Empathy Box, and the Empathy Amulet can inform the design of other new technologies that deal with subjective experiences in the service of improving mental and physical well-being.

ALONE TOGETHER

Despite the proliferation of modern technologies that promise to save us time and keep us connected with others, somehow we have ended up more distracted and isolated than ever. This incongruity is the subject of Sherry Turkle's most recent book, *Alone Together: Why We Expect More from Technology and Less from Each Other*. She writes, "As we instant message, e-mail, text, and Twitter, technology redraws the boundaries between intimacy and solitude. [...] In the half-light of virtual community, we may feel utterly alone," (2011, p. 12).

Recent research attests that we are less authentically connected with one another than in the past. In 1985, when researchers asked Americans how many confidants they have, the most common answer was three. In 2004, the most common answer was none. Since 1985, the number of people who say that they have nobody to talk to openly and intimately nearly tripled (McPhereson, Smith-Lovin, & Brashears, 2008). New working and living patterns promote isolation. People are now much more likely to go away to school and relocate for work, which takes them away from their families, friends, and neighbors. Suburban sprawl reduce the likelihood of natural social gatherings with neighbors (Cacioppo & Patrick, 2008, p. 248). People work longer hours and interact with fewer people outside of work. In general, developing long-term relationships is more difficult. In the suburbs, families increasingly tend to focus inward with parents lacking a broader range of social support. An astonishing number of people rely on their spouse as their sole source of companionship (Cacioppo & Patrick, 2008, p. 252). In 1990, one in five households with children was headed by a single parent. Now, this number has jumped to nearly one in three. In 2011, thirty-two million people in the United States lived entirely alone, 37.5% of which were older than sixty-five (United States Census Bureau, 2012).

Claude Fischer, a researcher of social networks, classifies someone who has only one person or nobody with whom to discuss personal matters as having "marginal or inadequate counseling support". This means that we have jumped from one quarter of the population being isolated from counseling support to one half of the population being isolated (McPhereson et. al, 2008).



Zittel, A. (2013). *To Live Alone or Together?* [Polyacrylic on marine grade plywood label with steel frame, 45 x 93 x 2 1/10 in.]. Retrieved from
http://www.domusweb.it/en/news/2013/06/3/andrea_zittel_howtolive.html

In *Alone Together*, Turkle examines how recent cultural and technological shifts are harming our ability to genuinely connect with one another. She highlights three areas: simulated affection through sociable robotics, the oversimplification of people and relationships within social media, and overwhelmingly distracting, connective technologies that make it difficult to be fully engaged when in person. In her research of

sociable robots, Turkle notices that people are increasingly willing to accept simulated relationships when real people are not available. Sociable robots mimic care and emotion though they really have none, and human beings must fully give themselves up to the simulation in order for them to be useful (2011, p. 124, p. 113). She warns, "We are tempted, summoned by robots and bots, objects that address as if they were people. And just as we imagine things as people, we invent ways of being with people that transform them into something close to things," (2011, p. 224). A disabled former colleague of Turkle's poignantly said, "Show me a person in my shoes who is looking for a robot, and I'll show you someone who is looking for a person and can't find one," (2011, p. 281).

Feelings of isolation are growing at the same time as empathy is declining. Researchers at the University of Michigan found that, since the year 2000, young people are dramatically less interested in other people. College students today are much less likely to say that it is valuable to try to imagine oneself in someone else's place or attempt to understand their feelings. (Turkle, 2011, p. 293; Konrath, O'Brien, & Hsing, 2011). These researchers attribute this trend to online games and social networking, which encourage superficial engagement with others. Turkle writes, "Online, we easily find 'company' but are exhausted by the pressures of performance. We enjoy continual connection but rarely have each other's full attention. We can have instant audiences but flatten out what we say to each other in a new reductive genres of abbreviation," (2011, p. 280). Based on her interviews of psychotherapists, Turkle believes that these trends are not only causing people to lose interest in others but to also feel detached from their own bodies (Turkle, 2011, p. 293).

Even with all our shiny technology, people are lonely. Research suggests that, rather than helping, technology is even exacerbating loneliness and undermining empathy. This loneliness is harmful to mental and physical well-being, but the solution is not to avoid technology. Turkle explains that every era develops a style of being with one another that is socially sanctioned because certain ways of relating come to feel natural (2011, p. 177). Our current technology is making it very easy for us to interact with each other in certain harmful ways. We are in danger of these unhealthy and shallow modes of interaction becoming the new norm, and we must design technology differently. In *Alone Together*, Turkle concludes, "I believe we will find new paths toward each other, but considering ourselves victims of a bad substance is a not good first step. The idea of addiction, with its one solution that we know we won't take, makes us feel hopeless. We have to find a way to live with seductive technology and make it work to our purposes. This is hard and will take work. Simple love of technology is not going to help. Nor is a Luddite impulse. [...] We don't need to reject or disparage technology. We need to put it in its place," (2011, p. 294).

LONELINESS

loneliness, n. (*The Oxford English Dictionary*)

1. Want of society or company; the condition of being alone or solitary; solitariness, loneliness.
2. Uninhabited or unfrequented condition or character (of a place); desolateness.
3. The feeling of being alone; the sense of solitude; dejection arising from want of companionship or society.

John Cacioppo, a psychologist and leader in the field of social neuroscience, spent much of his career researching loneliness and its significant side effects. Through his research, he realized that loneliness is incredibly destructive and uncovered many surprising misconceptions about why that is so. Cacioppo estimates that twenty percent of people (this amounts to sixty million people in the United States alone) feel sufficiently isolated for it to be a major source of unhappiness in their lives. Clearly, this adversely affects relationships, productivity, and other aspects of mental well-being, but loneliness also has dire physical consequences. Cacioppo concludes that social isolation negatively impacts physical health at levels comparable to high blood pressure, lack of exercise, smoking, obesity, and more. However, one of his most unexpected results is that being physically alone is not what is responsible for these negative consequences. The true culprit is the subjective experience known as loneliness, a perceived sense of social isolation (Cacioppo & Patrick, 2008, p. 5).

For a long time, people believed the reason that the socially isolated were drastically less healthy and died earlier was because they lacked a spouse or close

friends who would encourage them to eat well and exercise, take them to the doctor, or provide other positive influence and material help. However, psychologist Dan Russell found that this is not the case. Studying the health histories of over 3000 elderly people, he saw that those with high levels of loneliness were more likely to end up in a nursing home within a four year period. The amount of objective social support they had, like someone who would help out around the house, was not a significant predictor of the eventual need for increased care once loneliness was taken into account. What was significant was whether or not the people perceived their interactions with others to be meaningful (2008, p. 24). Cacioppo and his team built on this research by studying a group of both young people and adults. They found that the young and lonely did not exhibit unhealthier behavior than the non-lonely. For both the young and the old, the subjective sense of loneliness, not a lack of objective social support, uniquely predicted chronic health conditions, elevated blood pressure, and depressive symptoms (2008, p.99).

However, being alone is not necessarily bad. Solitude is important for mental health and productivity, and many would argue that it is a necessity for creativity. While solitude and loneliness both involve being alone, they are very different states of mind. Solitude is pleasurable, while loneliness is depressing and disruptive. Solitude feels safe, but loneliness involves feelings of insecurity and danger, similar to being physically threatened. Cacioppo believes that human beings evolved to feel not only good but secure when connected with others because, during more primitive times, human beings were more likely to survive when they worked together in groups. Cacioppo writes that loneliness is social pain, and he believes that it originally developed to protect individuals from the dangers of remaining isolated (2008, p. 15). Furthermore, fMRI studies show

that the emotional region of the brain that is activated when we experience rejection, the dorsal anterior cingulate, is the very same region that is activated when we experience physical pain (2008, p. 8). When these feelings of danger become chronic, they affect stress hormones, immune function, and cardiovascular function, which all accelerate the aging process (2008, p. 5).

Loneliness is not the same as depression nor simply an aspect of depression. Loneliness and depression are two distinct dimensions of human experience. Loneliness is an unpleasant feeling that reflects how you feel about relationships, but it motivates you to build new relationships and repair old ones. Depression involves feelings of apathy and holds you back from reaching out (2008, p. 83). However, loneliness and depression are related. In another study, Cacioppo and his team followed a group of middle-aged and older people for three years. Those who were lonely in the beginning of the study were more likely to become depressed by the end. Those who were depressed in the beginning of the study were more likely to withdraw and become lonely (2008, p. 90). Depression clearly also has many negative consequences on mental and physical well-being in addition to those already resulting from loneliness by itself.

Cacioppo found that the lonely spend no more time alone than those who feel more connected. They do not have deficient social skills and do not differ, on average, in terms of looks, height, weight, age, education, or intelligence (2008, p. 13). Cacioppo writes, "People who get stuck in loneliness have not done anything wrong. None of us is immune to feelings of isolation, any more than we are immune to feelings of hunger or physical pain," (2008, p. 31). A single destabilizing event can trigger even someone who has always had strong social ties into a state of loneliness.

The physiological consequences of loneliness are measurable. Cacioppo found increased levels of the stress hormone epinephrine and the steroid cortisol in lonely adults. Cacioppo's findings concerning cortisol are especially interesting. Our bodies produce cortisol in response to physical threats. It increases our alertness and allows us to do things like run fast and fight hard. Cortisol also increases our inflammatory and allergic responses in preparation for possible injury. In general, inflammation helps the body heal itself, but too much results in other health problems and, in particular, chronic inflammation causes cardiovascular disease. Cacioppo found that feeling lonely on a given day resulted in elevated cortisol levels the next morning. Even more fascinating, Cacioppo found that gene expression differed in lonely people and that this affected how cortisol is processed. Loneliness predicted changes in DNA transcription resulting in cells becoming less sensitive to cortisol and reducing the body's ability to shut off the inflammatory response. A different study found that lonely students were much more likely to get sick during stressful experiences like exam time. Cacioppo also studied the differences in sleep between the lonely and non-lonely. Though total sleep time did not differ between the two groups, lonely people took longer to fall asleep and reported greater fatigue the next day. Even when they slept for the same amount of time, their quality of sleep was greatly diminished (2008, p. 103-108). This is only a small sample of the numerous physical health problems caused by loneliness, and they clearly indicate that chronic feelings of loneliness should be taken very seriously.

Unsurprisingly, loneliness also has a negative impact on mental functioning and productivity. In a series of studies, Cacioppo showed that lonely people performed less well on tasks requiring focused attention. In one particularly unsettling study, Cacioppo and his team had students take a personality test and then gave them fake results. As a

control, some students were told that they were accident-prone (bad news, but not related to social rejection). Another group was told that, based on their scores, they would have fulfilling relationships in their future. The last group was sadly told that they were likely to end up alone. After being given their personality test results, the students took a portion of the GRE (Graduate Record Exam). The Future Alone group scored significantly worse than both the Future Belonging and Misfortune Control groups. The Future Alone students did fine on rote memorization but attempted to solve the fewest logical reasoning problems. On the few problems they did try, they made the most mistakes. Bad news itself was not enough to disrupt performance on the test, but social rejection was. In multiple studies, Cacioppo found that social rejection and loneliness drastically impaired higher-order processes requiring focused attention such as logical reasoning (2008, p. 41).

Part of what was affecting the performance of people in the Future Alone group was that they were more likely to give up. Cacioppo found that loneliness has a huge effect on people's perceptions of stress and their ability to cope with it. When asked how many sources of stress they had in their lives, lonely people reported more stressors than the non-lonely. Even when the stressors encountered were essentially the same, the lonely saw them as being more severe and experienced greater feelings of helplessness and threat (2008, p. 102). Also, the lonelier a person feels, the more likely he is to attribute a failure to something about himself and a success to something external about the situation. For the non-lonely, the reverse holds. As a result, lonely people may respond to stressful situations with passive coping (2008, p. 174).



Zittel, A. (1996). *A-Z Escape Vehicle: Customized by Andrea Zittel* [Exterior: steel, insulation, wood and glass. Interior: colored lights, water, fiberglass, wood, papier-mâché, pebbles and paint, 62" x 7' x 40"]. Retrieved from

http://www.moma.org/collection_images/resized/649/w500h420/CRI_226649.jpg

While lonely people turn out to be equal in their inherent social skills to the non-lonely, feelings of loneliness can make them less likely to employ the skills they have (2008, p. 14). Further confounding the lonely person's ability to help himself, lonely people seem to experience social interactions with others as less positive. For example, in an fMRI study, lonely people show a dampened response in the reward area of the brain when shown a picture of a happy human face. Because lonely people have a heightened sense of threat, they are highly attuned to other people, but this feeling of

threat interferes with their ability to be in the present moment and enjoy their interactions (2008, p. 163). Specifically, lonely people are much more likely to be attentive to and remember social cues like facial expressions and tone of voice. However, the higher their level of loneliness, the more likely they are to misinterpret those cues (2008, p.161). The sense of danger that lonely people feel causes them to apply defensive perceptions to situations that are neutral or benign, creating self-fulfilling prophecies (2008, p.17). As a result, lonely people are more likely to have negative perceptions of those around them and remember their interactions with people more negatively as time passes (2008, p. 180).



Calle, S. (2009). *Take Care of Yourself* [Calle asked 107 women professionals to analyze a breakup email she received from a boyfriend]. Retrieved from <http://www.emma.museum>

We all construct narratives about ourselves and how we fit into the world. Cacioppo writes, "Human beings are inherently meaning-making creatures, and the lonely are hardly unique in interpreting social cues through a highly subjective lens," (2008, p. 176). The lonely experience a particularly negative kind of biased meaning-making that likely results from the heightened sense of threat they feel. This affects how they perceive others and how they are themselves perceived, reinforcing their negative bias. This feedback loop makes it even more difficult for them to escape their loneliness (2008, p. 173).

Finally, the lonely exhibit a few other interesting traits that could potentially be useful. Socially rejected individuals are more likely to mimic those around them. For example, in the presence of someone who is nervously shaking his foot, the rejected individual is more likely to shake his own foot. Rejected individuals are also much more likely to conform to the opinions of others (2008, p. 119). Another interesting observation is that lonely people are much more likely to anthropomorphize. Anthropomorphism is the projection of specifically human attributes onto nonhuman entities, and "parasocial relationships" are the kinds of connections we make with pets, television characters, computers, machines, etc. as a substitute for human relationships. People coping with loneliness, divorce, widowhood, or even being single are much more likely to anthropomorphize and form these parasocial relationships. In particular, people tend to anthropomorphize pets and machines, but Cacioppo and his colleagues demonstrated

that the lonely are able to anthropomorphize even unlikely things. The researchers showed images taken by the Hubble telescope to both the lonely and non-lonely and asked them a series of questions about them, some of which were related to human characteristics. The lonely had a stronger tendency to anthropomorphize celestial objects, even acting on the basis of lessons learned from past experience (2008, p. 256).

The physical and social consequences of loneliness are severe, and multiple barriers exist making loneliness difficult to overcome. Cacioppo writes, "What makes loneliness especially insidious is that it contains this Catch-22: Real relief from loneliness requires the cooperation of at least one other person, and yet the more chronic our loneliness becomes, the less equipped we may be to entice such cooperation," (2008, p. 33). How can technology be used to heal loneliness rather than exacerbate this pervasive problem? Could we build a social prosthesis that helps a lonely person to overcome the threshold caused by the unfortunate side effects of isolation?

SOCIAL NETWORKS

In June 2014, Facebook had over 829 million daily active users and 1.32 billion monthly active users (Facebook Newsroom, n.d.). With such staggering usage statistics, sites like Facebook are rapidly transforming the way people interact with each other and view themselves. Interactions mediated through Facebook are increasingly supplanting face-to-face and other more direct types of communication. Though many people turn to social media sites like Facebook in their loneliness, these types of social networks may be doing more harm than good. Alarmingly, research shows that sites like Facebook are making people lonelier, less happy, and more envious of each other.

In a 2010 study, researchers found that people who predominantly spent their time on Facebook passively viewing friend's status updates and photos reported increased feelings of loneliness (Wilson, Gosling, & Graham, 2012). In 2013, Kross and Verduyn followed a group of Facebook users over an extended period to see how their feelings of well-being changed over time. The researchers observed the subjects' Facebook usage for two weeks and gave them questionnaires randomly five times a day. Kross and Verduyn found that the more a person used Facebook in the period between questionnaires, the less positively he felt when given the next questionnaire. The researchers did find that the lonelier a person felt, the more he used Facebook over time. However, they controlled for the loneliness and found Facebook usage predicts a decline in affective well-being whether people were lonely or not at the start of the study. These findings were true for both sexes, and the size of subject's social network also was not a factor. Kross and Verduyn concluded that Facebook usage does not enhance well-being but actually undermines it. They write that perceptions of social isolation, which seem to be increased by Facebook usage, are a more powerful determinant of well-being than

objective social isolation (Kross, Verduyn, Demiralp, Park, Lee, Lin, Shablack, Jonides, & Ybarra, 2013).

The cause of these negative consequences may largely be due to “image crafting” or the way people carefully construct an overly positive image of themselves on social media sites. People compare their own lives, which are made up of both good and bad experiences, with the idealized and crafted personas they encounter on social networks. Stanford researchers studied this phenomenon and found that when people underestimate the number of negative experiences or overestimate the number of positive experiences in other people’s lives, they are more susceptible to loneliness and rumination and experience lower life satisfaction (Jordan, Monin, Dweck, Lovett, John, & Gross, 2011).

Rather than promoting empathy and meaningful connection, social media sites like Facebook promote comparison and competition. As a result, instead of feeling closer to others, people feel lonelier and less happy with their lives. Social networks are clearly powerful and have the potential to do much good, but they need to be constructed in a completely different and much more sensitive, nuanced way. Within this thesis, I propose a new type of social network that encourages meaningful interactions between strangers and does not allow for comparison.

BEYOND BEING THERE

Many new technologies within industry and the field of human-computer interaction research are concerned with human connection and focus on improving real-time face-to-face communication. The goal is to make communication across distances as close to physical face-to-face communication as possible, to simulate the sense of being there physically. However, this type of communication is only one extreme of an entire spectrum of technologies dealing with human connection. On the other end of the spectrum, technologies can connect people using many other representations and abstractions that may or may not have any basis in the physical world.

In their influential paper “Beyond Being There”, Jim Hollan and Scott Stornetta conclude that actual face-to-face communication will always be better than a simulation of face-to-face communication no matter how realistic. We must, instead, develop technologies that go “beyond being there”. We must identify needs which are not ideally met in the medium of physical proximity and then leverage the strengths of the new medium to meet those needs (1992). Though this was written over two decades ago, unfortunately, not much has changed.

More realistic communication is not necessarily better, and simplified means of communications may actually be beneficial and preferred. Hollan and Stornetta use this apt metaphor to explain their position:

Perhaps a brief analogy could get us moving in the right direction. It is customary for a person with a broken leg to use crutches, but how odd it would be if they continued to use the crutches after their leg was restored to its natural

condition. In contrast, one wears shoes because they provide certain advantages over our natural barefoot condition. Special purpose shoes, such as running shoes, are designed to enhance our best performance. Now crutches and shoes are both tools of a sort, but there is a difference. The crutch is designed specifically to make the best of a bad situation—to let someone hobble around until they are back in shape. On the other hand, shoes are to correct some of the problems of our natural condition, and, in the case of athletic shoes, to enhance our performance.

In telecommunications research perhaps we have been building crutches rather than shoes. What we are getting at is this: telecommunications research seems to work under the implicit assumption that there is a natural and perfect state—being there—and that our state is in some sense broken when we are not physically proximate. The goal then is to attempt to restore us, as best as possible, to the state of being there. In our view there are a number of problems with this approach. Not only does it orient us towards the construction of crutch-like telecommunication tools but it also implicitly commits us to a general research direction of attempting to imitate one medium of communication with another.



Hamilton, A. (2013). *The Event of a Thread* [Swings connected with a system of pulleys to a large white curtain]. Retrieved from
<http://www.thisiscolossal.com/2013/01/the-event-of-a-thread>

Sherry Turkle also warns us of the dangers of simulation, "When online life becomes your game, there are new complications. If lonely, you can find continual connection. But this may leave you more isolated, without real people around you. So you may return to the Internet for another hit of what feels like connection. Again, the Shakespeare paraphrase comes to mind: we are 'consumed with that which we were nourished by,'" (2011, p. 227). Within this thesis, I argue that connective technologies that attempt to mimic face-to-face communication and simulate "being there" are not the ideal approach to heal loneliness. Rather than building devices with the purpose of

keeping in touch or improving remote collaboration, I propose to build technologies that connect people in a wholly different way, and, like the running shoe, assist with some of problems of our natural condition while creating a sense of connection with others beyond what is possible face-to-face.

THE EMBODIED MIND

The design of connective technologies needs to incorporate the new understanding of how the mind works. Cognitive science is a relatively new field (founded in the 1970s) focused on the study of conceptual systems. In a very short time, cognitive scientists have made astonishing discoveries about the way the human mind works. In *Philosophy in the Flesh*, George Lakoff and Mark Johnson consider how these recent discoveries challenge fundamental aspects of Western philosophy. In particular, cognitive science tells us:

1. The mind is inherently embodied.
2. Thought is mostly unconscious.
3. Abstract concepts are largely metaphorical. (1999, Chapter 1)

Reason is not disembodied, as the tradition has largely held, but arises from the nature of our brains, bodies, and bodily experience. This is not just the innocuous and obvious claim that we need a body to reason; rather, it is the striking claim that the very structure of reason itself comes from the details of our embodiment. The same neural and cognitive mechanisms that allow us to perceive and move around also create our conceptual systems and modes of reason. Thus, to understand reason we must understand the details of our visual system, our motor system, and the general mechanisms of neural binding. In summary, reason is not, in any way, a transcendent feature of the universe or of disembodied mind. Instead, it is shaped

crucially by the peculiarities of our human bodies, by the remarkable details of the neural structure of our brains, and by the specifics of our everyday functioning in the world.
(Lakoff & Johnson, 1999, Chapter 1)

Understanding that the mind is embodied requires our views of reason to change significantly. Our bodies are the result of evolution, and thus reason is evolutionary. This completely changes our relation to animals and our notion that human beings are uniquely rational. Furthermore, reason is not completely conscious but is, instead, mostly unconscious (Lakoff & Johnson, 1999, Chapter 1). Most of our thoughts operate beneath the level of cognitive awareness and are inaccessible to our conscious minds. These thoughts occur too quickly for us to even be able to focus on them (Lakoff & Johnson, 1999, Chapter 2). Lakoff and Johnson write, "Conscious thought is the tip of an enormous iceberg. It is the rule of thumb among cognitive scientists that unconscious thought is 95 percent of all thought—and that may be a serious underestimate. Moreover, the 95 percent below the surface of conscious awareness shapes and structures all conscious thought. If the cognitive unconscious were not there doing this shaping, there could be no conscious thought" (1999, Chapter 2).

Reason is not purely literal but is, instead, extremely metaphorical and imaginative. Many believe reason to be dispassionate, but embodiment means that reason is actually emotionally engaged (Lakoff & Johnson, 1999, Chapter 1). We use metaphors to understand abstract concepts, and our metaphors evolved from our sensorimotor systems. In the process of learning, young children conflate subjective (non-sensorimotor) experiences and judgements with sensorimotor experiences. For

example, infants correlate the subjective experience of affection with the sensory experience of being held and feeling warm. As a result of this sort of conflation, our brains build up associations between these two domains. Though children are later able to differentiate between subjective and sensory experiences, these cross-domain associations remain ingrained in our minds. These neural structures are the basis for the metaphors we rely on later in life to make sense of abstract concepts. Lakoff and Johnson write, "An embodied concept is a neural structure that is actually part of, or makes use of, the sensorimotor system of our brains. Much of conceptual inference is, therefore, sensorimotor inference. [...] The peculiar nature of our bodies shapes our very possibilities for conceptualization and categorization" (1999, Chapter 3).



Jensen, Ole. (2009). *Hot Water Bottle, 'fingers'* [A soft item for heating areas of your body. Natural rubber with a stopper in gold-plated brass, 12 x 12 x 27 cm]. Retrieved from <http://www.olejensendesign.com>

Lakoff and Johnson call the types of metaphors that emerge as a result of this conflation “primary metaphors”. We acquire them automatically and unconsciously through the normal process of neural learning, and we often are unaware that we even have them. Because so many embodied experiences are universal, such as feeling warm while being held as a baby, the corresponding primary metaphors are universally acquired. The authors have identified hundreds of primary metaphors that we rely on to understand and reason about abstract concepts. Subjective experience is enriched by the co-activation of corresponding sensorimotor networks, and words related to sensorimotor experience are used to name and describe many aspects of subjective experience (1999, Chapter 4).

Because of the strong neural ties between subjective and sensorimotor experiences, the reverse can also occur. Physical experiences can activate the neural networks for subjective experiences. This suggests that these primary metaphors may be leveraged in the design of therapeutic experiences and technologies, which is what I explore within my work. The primary metaphor most dominant in my recent projects is “Affection is Warmth” (1999, Chapter 4). Across cultures, people use warm/cold metaphors to communicate the concepts of social connection and affection. The English language contains numerous examples of this:

She is warm-hearted.

He gave me a warm handshake.

She gave me a warm hug.

What she said gave me the chills.

She's an old flame.

He gave me a warm reception.

She gave me a cool reception.

He gave a tepid speech.

I'm hot for her.

She gave me an icy stare.

He was frozen with fear.

A new romance kindled.

The party heated up.

She gave me a warm smile.

She greeted me coolly.

He greeted me coldly.

She greeted me warmly.

She gave me the cold shoulder.

She's a cold fish.

It was a warm welcome.

She held warm feelings towards him.

The relationship cooled off.

The relationship heated up.

It's a cold world out there.

Anger can also be associated with heat, such as when someone says, "Anger made my blood boil," or "He's got a hot temper." However, metaphors for anger are evocative of uncomfortable or unbearable levels of heat. Soothing, comforting heat is associated

with affection, empathy, generosity, and trust. Cold is associated with social rejection and loneliness. Many studies confirm the strong relationship between temperature and social connection, several of which are highlighted in next chapter.



Jensen, Ole. (2009). *Hot Water Bottle, 'double'* [A soft item for heating areas of your body. Natural rubber with a stopper in gold-plated brass, 12 x 12 x 27 cm]. Retrieved from <http://www.olejensendesign.com>

While warmth is particularly important to my work, other primary metaphors are also relevant to social connection and loneliness. "Intimacy is Closeness" is a central metaphor when dealing with human relationships. For example, you might hear people say "We've been close for years, but we are starting to drift apart." However, when designing technologies for people to be connected over long distances, especially with anonymous others, this metaphor is trickier to utilize. A possibility is to use wearable technologies or other devices that interface with the body. If a person cannot be

physically close, then a device can be put close to the body and incorporated with other primary metaphors like warmth. Additionally, the primary metaphors "Help is Support" and "Understanding is Grasping" suggest that technologies that are supportive, grounded, and deliberate to use have the potential to be more effective (1999, Chapter 4).



Jensen, Ole. (2007). *Reminiscor* [An item of furniture for intensive storage and retrieval of memories. Tailored and upholstered wool cover over a wooden frame and foam, 140 x 90 x 80 cm]. Retrieved from <http://www.olejensendesign.com>

Most technologies are currently designed under the assumption of disembodied reason and traditional Western philosophical ideas of the self. Recent discoveries in cognitive science upset this way of thinking. Understanding embodied reason and the embodied mind means we must design technology in fundamentally different ways. Primary metaphors can be used to engage with subconscious thought and can reinforce or undermine our subjective experiences.

THERAPEUTIC TECHNOLOGIES

Cognitive Behavioral Therapy

Cognitive Behavioral Therapy (CBT) is a method of redirecting emotions by modifying everyday thoughts and behaviors. It begins with examining current thought patterns that may be unrealistic or harmful. It then encourages people to try out new ways of behaving, gradually doing things they might normally otherwise avoid. CBT often also incorporates relaxation strategies. CBT involves recognizing irrational beliefs, which for the lonely might be that they will always be alone and are under threat. These beliefs color the lonely person's perceptions and behavior causing self-fulfilling properties. Overall, CBT is concerned with recognizing the narratives people tell themselves and slowly transforming them into healthier ones (Cacioppo & Patrick, 2008, p. 235). When designing technologies that deal with both mental and physical well-being, this therapeutic practice is valuable to keep in mind.

Light Box Therapy

Seasonal affective disorder (SAD) is a type of depression that typically occurs during fall and winter when days are short. Disruptions to circadian rhythm and changes in serotonin and melatonin levels are possible causes of this disorder. Light box therapy is one of the main treatments recommended for people with SAD. During fall and winter, patients sit with light boxes, which mimic natural light, for a portion of the day. While light boxes are not replacements for natural light and being outdoors, they are a simple technology that can be helpful during the times when these people are struggling the most (Mayo Clinic, n.d.).

Mirror Box Therapy

Mirror box therapy is another interesting example of a therapeutic process that relies on a technology. Many people who lose a limb experience phantom limb pain. Though the person no longer has the limb, the person still vividly feels that it is there and experiences persistent pain, sometimes severe. Knowing that the brain is plastic, neuroscientist Vilayanur Ramachandran developed the mirror box as a way to treat patients with phantom limb pain. Before amputation, phantom limb patients often are in extreme pain and discomfort, and Ramachandran believes the patients' brains become fixed in this state when the amputation occurs. In mirror box therapy, Ramachandran uses a system of mirrors to trick the patient's brain into believing that the mirror image of his healthy limb is actually his phantom one. By convincing the brain that the arm is fine, Ramachandran believes that the phantom pain can be "unlearned". In a series of studies, Ramachandran and other researchers found they were able to use the mirror box and a series of visualization exercises to eliminate phantom limb pain in many of the subjects and diminish it in others. The therapy was most effective with patients who had been living with the phantom limb pain for less time, which makes sense because their neural pathways are less established. (Doidge, 2007). However, the idea of being able to non-invasively treat such a health condition with a technology that simply engages the imagination is truly remarkable.

THE QUANTIFIED SELF

In recent years, sensors have become smaller and cheaper making wearable technology viable and giving rise to the Quantified Self movement. Proponents of the Quantified Self use technology, most often wearable devices and phone applications, for self-tracking. The Fitbit and Jawbone UP are two of the most well-known examples of a class of devices that exist to track all aspects of life including fitness, diet, mood, relationships, and more. The goal of the movement is self-knowledge and self-improvement through data collection and analysis. This approach is misguided for many reasons. First of all, most of the devices and apps treat the user like a computer and are designed without any consideration of the embodied mind. Rather, these technologies track naive metrics and then present the user with data and graphs. Lakoff writes:

There is no such thing as a computational person, whose mind is like computer software, able to work on any suitable computer or neural hardware-whose mind somehow derives meaning from taking meaningless symbols as input, manipulating them by rule, and giving meaningless symbols as output. Real people have embodied minds whose conceptual systems arise from, are shaped by, and are given meaning through living human bodies. The neural structures of our brains produce conceptual systems and linguistic structures that cannot be adequately accounted for by formal systems that only manipulate symbols. (Lakoff & Johnson, 1999, Chapter 1)

Furthermore, these technologies are what Hollan and Stornetta would call crutches. Rather than augmenting what we can do, they do for us what we should be doing ourselves. The devices use sensors such that they are aware for you, so that you don't have to be self-aware. The devices notify you of what you should or shouldn't be doing, so you don't have to think. Rather than enhancing self-awareness, these devices encourage complacency. Rather than being devices to think *with*, they are devices that think for you. A high level of intrinsic motivation requires both a feeling of competence as well as a sense of autonomy (Ryan & Deci, 2000). These devices rely on interactions that undermine the user's sense of autonomy, which, in turn, undermines intrinsic motivation. This encourages dependency on the technology, and people are likely to discontinue their healthy behaviors once they stop using the device.

Many of these devices compare your performance with people on a social network or use systems of rewards and/or punishments (for example, the threat of failure in the eyes of others). This competitive approach is supposed to motivate you to do better. While this may work in the short term, it undermines intrinsic motivation and long-term success. In fact, research confirms that virtually every type of expected tangible reward or threat (this includes deadlines and the pressure of competition) made contingent on performance undermines intrinsic motivation because people experience them as controllers of their behavior (Ryan & Deci, 2000). Because these technologies are very new and proper clinical studies take time, there is a lack of rigorous statistics about user retention. However, less formal sources report these devices and apps have tremendous drop-off rates.

Quantified Self technologies also present the user with aggregate data about their performance over time in the form of charts and statistics. In addition to the chosen metrics being overly simplistic, this encourages the user to be fixated on their overall performance rather than concentrating on what they are doing in the moment, which, I believe prevents optimal performance. It also is at complete odds with mindfulness, a simple concept that has been demonstrated to be very beneficial for mental and physical well-being (Greeson, 2009). John Kabat-Zinn, creator of Mindfulness-Based Stress Reduction, writes, "Mindfulness means paying attention in a particular way; On purpose, in the present moment, and non-judgmentally," (Kabat-Zinn, 1994). Quantified Self is a distracting mindset, and users are constantly pushed to make judgements about their performance. Moreover, this way of thinking assumes endless growth, and human beings are just not capable of always improving. With any sort of setback, like an injury, this mentality quickly becomes demoralizing.

Technologies, especially those dealing with the self, must be designed for the embodied mind, and not treat us as if we are computers with simple inputs and easy-to-measure metrics. Moreover, rather than turning us into lab rats reacting to treats and electric shocks, we must build technologies that encourage people to be self-aware, not to be aware *for* them. For reasons of both ethics and effectiveness, these technologies must preserve the user's autonomy.

AFFECTION IS WARMTH

Intuitively, the idea that warmth could comfort the lonely makes perfect sense.

Human beings radiate body heat, and closeness involves feeling someone else's warmth through the skin. Warmth is associated with care, intimacy, pleasure, and security.

Various studies confirm the relationship between temperature and loneliness.

Psychologist and researcher, Thalma Lobel collected many of these studies in her recent book, *Sensation: The New Science of Physical Intelligence*. In her book, Lobel situates the studies within embodied cognition theory, which states that the human mind cannot work separately from the physical world. The senses act as a bridge between unconscious and conscious thought processes (Lobel, 2014, p. 11). This supports what traditional artists and designers have always known: aesthetics strongly affect thoughts, emotions, and, as a result, behavior. Accordingly, to create a technology that influences how people perceive themselves and others, every detail of its aesthetic design is significant and will determine its effectiveness.

In 2008, Laurence Williams and John Bargh published an article in *Science* entitled "Experiencing Physical Warmth Promotes Interpersonal Warmth" presenting the results of two experiments tying together psychological warmth and physical warmth.

Psychological warmth or "interpersonal warmth" refers to how favorably we perceive someone's intentions towards us. This assessment seems to be made unconsciously and includes traits such as friendliness, helpfulness, and trustworthiness. Williams and Bargh based their experiments on research that shows physical and psychological warmth are processed in the same region of the brain, the insular cortex, which is the same region associated with empathy, social inclusion and rejection, and other social emotions. In the first experiment, Williams and Bargh primed subjects by giving them either a cup of hot

or iced coffee to briefly hold. The subjects were then given a packet containing a person's description and asked to rate this person on ten personality traits. Half of these traits were semantically related to the warm-cold dimension, such as "good-natured" or "generous", and half were unrelated. As Williams and Bargh suspected, the subjects who held the hot coffee perceived the target person as being significantly warmer than those who held the iced coffee. The subjects of the study showed no awareness of the impact of the physical experience on their judgements.



Wexler, A. (1990). *Coffee Seeks Its Own Level* [Four cups connected with tubes such that everyone must coordinate their drinking or the coffee overflows]. Retrieved from <http://www.allanwexlerstudio.com/projects/coffee-seeks-its-own-level>

Not only does physical warmth cause people to perceive others as more psychologically warm, it also seems to cause people to be more psychologically warm themselves. In their second study, Williams and Bargh asked subjects to briefly hold either a hot or cold therapeutic pad under the guise of a product evaluation. Afterwards, the participants were given a choice of a reward for participating in the study. Half the participants were given the choice of a Snapple for themselves or a \$1 gift certificate at an ice cream shop for a friend. The other half of the participants were given the choice of the \$1 ice cream shop gift certificate for themselves or a Snapple for a friend. Regardless of the type of gift, participants primed with physical warmth were more likely to choose the gift for a friend (54% of participants) as opposed to those primed with cold (46%).

Building on the work of Williams and Bargh, other researchers have expanded on how physical temperature grounds abstract ideas of affection. In one study, researchers primed subjects with hot or cold beverages. The subjects were then asked to think of a real person they knew and rate how close they were to that person (social proximity). Participants holding the warm beverage rated that person as closer to them emotionally than those who were holding the cold beverages (Ijzerman & Semin, 2009). In another similar study, researchers asked participants to remember a time when they felt socially excluded or lonely or a time when they were socially included. Later, they told the participants that the maintenance staff wanted to know how hot or cold the room was. Students who remembered lonely experiences judged the room as colder (70.5 degrees) than those who had recalled being socially included (75.2 degrees) though all had sat in exactly the same room. Going further, these same researchers designed a computer game that caused the player to feel either included or excluded. After the participants played the game, they were offered a choice of food: hot coffee, hot soup, an apple,

crackers, or an icy Coke. Excluded participants were much more likely to choose something hot than those who were not excluded (Leonardelli & Zhong, 2008). Lobel (2014) writes, "Emotional memories can influence your physical experience in the present. There is a powerful connection—even across time—between coldness and loneliness" (p. 13).

It turns out that the lonely and excluded actually become physically colder. Researchers again asked subjects to play the inclusion/exclusion computer game and measured the skin temperatures of the participants' fingers. The skin temperature of the excluded participants actually decreased! In a second experiment, the same researchers wanted to see if warmth could improve the feelings of the excluded. Participants first played the inclusion/exclusion computer game. After a few minutes, the game had a fake error and a researcher brought the user a warm or cold beverage to hold while he pretended to fix the computer. Afterwards, the participants were asked to rate their feelings. Only those who were excluded and held the cold drink had more negative feelings. Those who were excluded and warmed their hands with the warm drink felt better (Ijzerman, Gallucci, Pouw, Wei β gerber, Doesum, & Williams, 2012).



Celmins, V. (1964). *Heater* [Oil on canvas, 47 7/16 x 48 in.]. Whitney Museum of American Art, New York. Retrieved from <http://whitney.org/Collection/VijaCelmins/9519/>

These results clearly show that physical feelings of temperature and psychological feelings of social connection are inextricably linked. Lobel (2014) concludes, "Feeling cold or warm is determined not only by the temperature of the room but also by your mental

state. If you feel lonely, whether you are actually excluded from an activity or you are in the same room with individuals who do not share your opinions, choices, and views, both your physical experience and your psychological experience actually change. Even if you just stand or sit far from someone or from a group, you feel isolated. The room becomes cold for you. In contrast, if you feel socially accepted, if you are in a room with people who share your opinions and preferences and views, or if you just sit close to someone, you feel that the room is warmer" (p. 16). Furthermore, this research demonstrates that warmth can be a remedy for loneliness and may even encourage greater empathy and generosity towards others.

ARTISTS AS ENGINEERS

Lobel writes "Temperature, texture, weight, sound, taste, smell, and color, among a symphony of other physical sensations affect us every day. We are moved without knowing we are being moved. We feel ownership of and responsibility for our decisions and actions, yet they are greatly influenced and sometimes created by the sensory world around us," (2014, p. 6). For artists and designers, this is familiar territory. Artists and designers are experts at putting together texture, color, sound, and other aesthetic properties in evocative ways. Through intense observation, they learn how people respond to these qualities and spend their lives mastering how to use them to effectively make meaning. By themselves, these types of studies are inadequate for determining how to incorporate aesthetic properties into a technology. These studies involve testing a single property in isolation, usually in a very unnatural situation. As soon as these properties are combined or placed in different contexts, artists and designers know that people's reactions can completely change.

To design technologies that deal with emotions and relationships, an artistic perspective is as necessary as technical skills. These sorts of technologies cannot be approached like a traditional engineering problem. Especially with our new knowledge of cognitive science, the rigid separation between artist, designer, and engineer is a serious barrier to making real progress. Technologists must learn to think more like artists in their design process, and artists should stretch themselves to make functional work that is incorporated into the lives of real people rather than just existing in a traditional gallery setting.

MECHANISMS OF POWER

Interfaces structure our thoughts and behavior. This power can be harnessed to influence perceived social isolation in both positive and negative ways. Sherry Turkle wrote, “[According to Winston Churchill], we shape our buildings, [and] then they shape us. The same is true of our digital technologies. Technology has become the architect of our intimacies,” (2011). Neuroplasticity is the idea that the brain can change its own structure and function through thought and activity. This recent discovery is exciting because it provides hope that people can recover from brain injuries and suggests that people can, in fact, change. However, it also means that we are more vulnerable to outside influences. Any repeated thought, action, or experience reinforces pathways in our brains shaping our thoughts and behavior (Doidge, 2007).

Moreover, Lakoff and Johnson conclude that, with our new understanding of the embodiment mind, we actually don't have complete free will. Because so much of our thinking is done unconsciously (around 95%) and conscious thought is built on unconscious thought, we are not the rational beings we thought we were:

Since reason is shaped by the body, it is not radically free, because the possible human conceptual systems and the possible forms of reason are limited. In addition, once we have learned a conceptual system, it is neurally instantiated in our brains and we are not free to think just anything. Hence, we have no absolute freedom in Kant's sense, no full autonomy. There is no a priori, purely philosophical basis for a universal concept of morality and no transcendent, universal pure reason that could

give rise to universal moral laws. The utilitarian person, for whom rationality is economic rationality—the maximization of utility—does not exist. Real human beings are not, for the most part, in conscious control of—or even consciously aware of—their reasoning. Most of their reason, besides, is based on various kinds of prototypes, framings, and metaphors. People seldom engage in a form of economic reason that could maximize utility. (Lakoff & Johnson, Chapter 1)



Abramović, M. (1980). *Rest Energy*. Retrieved from <http://pomeranz-collection.com>

User experience design places an emphasis on the design of behavior. Good user experience design is described as empowering the user to effortlessly accomplish some goal without drawing any attention to itself. It guides, even controls, the user's behavior.

As Wendy Chun discusses in *Programmed Visions*, this description is uncannily similar to Michel Foucault's concept of governmentality, which describes the techniques used by governments to produce the citizens best suited to fulfill those government's policies (2011, p. 6-8). Designing technologies that work with both our conscious and unconscious minds is a way to interface with our complete selves. It is more natural as well as more efficient. However, allowing ourselves to be manipulated through our unconscious mind is extremely dangerous, and we must be very cautious to whom or what we give that sort of power. For example, Facebook recently ran a large-scale experiment on half a million of its users that involved changing the number of positive and negative posts they saw in order to study how emotions spread on social media (Goel, 2014). It turns out that moods on Facebook are, indeed, contagious. Normally, people would give explicit consent to participate in such a study, but, in this case, users unknowingly submitted to being experimented on when they checked the box agreeing to Facebook's terms of service. All interfaces are mechanisms of power. When interfaces influence the unconscious mind, we may discover too late (or possibly even never) that we are being controlled, abused, or changing in ways we don't like.



Abramović, M. (1977). *Breathing In / Breathing Out* [Abramović and Ulay shared breath without external access to oxygen until they collapsed]. Retrieved from <http://pomeranz-collection.com>

SCIENCE FICTION

Before coming to the MIT Media Lab, I was a software engineer in Silicon Valley, where I designed and built technologies that were used by tens of millions of people. I was struck by Silicon Valley's frenzied culture of building and launching projects as quickly as possible without considering their social impact in the long term. Unfortunately, the makers of technology are generally not encouraged to be introspective or reflect too deeply on what they are making, and this really worries me. Once any sort of technology has users, it becomes extremely difficult to change it—even if you know it should or must be changed. Usually the only thing you can do is tack on more features, but it can be impossible to change the core structure. And once something has thousands, millions of users, the impact of every design decision is huge. Millions of people will be engaging in the same interactions possibly even hundreds of times a day, and this is reinforcing very particular pathways in the brain. How is that affecting our social structure and values? How is that changing the way we view ourselves and even the way we understand our own mental functioning?

After years working in the software industry, I went to the Rhode Island School of Design for my MFA, and, as an artist, I began to think about technology much more critically. Within my artwork, I investigated how constantly interacting with computer interfaces and code since a young age has affected my thought processes and perceptions. For example, I got my first computer, a Commodore 64, when I was two years old, and I was struck by how my experience of virtual space in the early days of computers shaped my experience of real, physical space for the rest of my life. My memories of my physical environments seem more like a graph of nodes completely devoid of scale, very much like representations of space in early computer games.



Brueckner, S. (2011). *Commodore 64* [I painted my computers from memory. Gouache on paper, 30 x 22 in.]



Brueckner, S. (2011). *Dell Dimension XPS D266 Pentium II 266 MHz* [I painted my computers from memory. Gouache on paper, 30 x 22 in.]



Representations of space from the 1990 DOS computer game *Maniac Mansion*. Retrieved from <http://magisterrex.files.wordpress.com/2010/07/maniacmansionnesmap.png>

Much of my artwork involves computer programming, where I explore the tension between the ecstatic feeling of a programmer “being in the zone” with the control that technology’s interfaces exert over us. The seductive feelings of power and pleasure that come from programming only occur when we become completely fluent in code and no longer have to even think consciously about how to translate our intentions to machine instructions. Our awareness of the interface disappears as the computer becomes an extension of ourselves. However, to achieve this state, we give up some of our human nature as we allow ourselves to be shaped by the machine.

I have been an avid reader of science fiction all my life. Both at RISD and at the MIT Media Lab, I was surprised to discover that many people designing new technology as well as artists whose work is concerned with technology had little or no exposure to science fiction. No matter what the subject of these people's work, science fiction authors have explored related topics for decades, and being familiar with their writing is invaluable. These authors do more than merely prophesy modern technologies—they also consider the consequences of their fictional inventions in great detail. Ursula K. Le Guin wrote, "Science fiction is not prescriptive; it is descriptive." Science fiction looks at current technological and social trends and extrapolates them into the near or far future. It speculates on the consequences of these trends, both good and bad, if they continue unchecked. In some ways, these works are concerned with today's reality far more than the future. For example, science fiction written during the Cold War often dealt with communism and themes of apocalypse, and recent science fiction commonly explores contemporary issues like genetic engineering, the hazards of being overly virtual, etc.

At RISD, I designed and taught a course to familiarize students with important works of science fiction, especially those related to their own research, and then asked them create projects in response to the reading. Depending on their background, students used the science fiction as a jumping off point to build functional prototypes, speculative objects, or traditional works of art. I have since re-taught this course at the MIT Media Lab, RISD, and Brown University. For many of my students, their class projects became an important part of their main thread of research.

Science fiction is also an important part of my own work. The topic of this thesis was inspired by one of my favorite technologies within all of science fiction, the empathy box from *Do Androids Dream of Electric Sheep?* by Philip K. Dick. Published in 1968, Dick's

novel predicted several modern technologies and their repercussions. For example, Dick wrote about people taking care of robotic animals, and now people in nursing homes have PARO, the robotic harp seal that Sherry Turkle heavily criticizes in *Alone Together*. With the empathy box, Dick envisioned the potential for technology to not only connect people across long distances but to do so with emotional depth. I could easily fill hundreds of pages with fascinating examples of technologies from science fiction related to mental processes, therapy, spirituality, and social connection¹. In this thesis, I focus only on the empathy box, which I will discuss in much greater detail in later sections.

Reading science fiction is like an ethics class for inventors, and engineers and designers should be trying to think like science fiction authors when they approach their own work. Numerous science fiction stories warn against technologies that involve mind control and surveillance, which is of particular importance to my work. Wearable sensors and interfaces that communicate with the unconscious mind are particularly dangerous, and the preservation of user autonomy is vitally important. In general, the projects we build here at the Media Lab often become widely adopted or serve as examples that influence countless other projects, and I feel with great urgency that we need to very thoughtfully consider what we build as well as encourage that same thoughtfulness out in the world.

¹ Kurt Vonnegut's science fiction novel, *Slapstick* or *Lonesome No More!*, is a particularly compelling example. In this novel, the main character wins the presidency by running on a platform with the slogan "Lonesome no More!". His idea was to assign all people a special middle name giving them an artificial extended family of thousands of people as a support system.

RELATED WORK

Overview

My research merges psychology, cognitive science, engineering, art, and design, and I am influenced by work within all these fields. I will first discuss some related projects that connect people haptically, connect people anonymously, or make use of embodied interfaces but that fall short of a holistic solution. I will then discuss projects from artists, engineers, and designers who successfully combine engineering and interface design with the nuanced approach of an artist to build technology in the spirit of what I myself hope to accomplish with my own work.

inTouch



Brave, S, Dahley, A, and Ishii, H. (1998). *inTouch*. Retrieved from
<http://tangible.media.mit.edu/project/intouch/>

Created at the MIT Media Lab, *inTouch* uses force-feedback technology to create the illusion that people, separated by distance, are interacting with a shared physical object. The aim of the project is to enrich current real-time communication by opening a channel for expression through touch (Brave & Dahley, 1997). This demo is a compelling experience by itself, but, like many similar projects, it is intended to supplement traditional teleconferencing technology for remote communication and collaboration.

This project is about simulating “being there”.

LightMate



Lanzavecchia, F. (2006-2010). *LightMate*. Retrieved from
<http://lanzavecchia-wai.com/projects/lightmate>

LightMate is a project by Francesca Lanzavecchia that asks the question, "Can electric energy fill the void of human absence?" Lanzavecchia designed anthropomorphic pillows in many shapes that produce warmth and light (Lanzavecchia, n.d.). While beautiful and comforting, the pillows are not responsive nor tied to other people and are functionally quite similar to simple heating pads.

Prayer Companion



Interaction Research Studio, Goldsmiths University of London, UK. (2010). *The Prayer Companion* [Photopolymer resin, dot-matrix display, and printed circuit board, 13 3/4 x 8 3/4 x 5 1/2 in.]. Retrieved from <https://www.moma.org/interactives/exhibitions/2011/talktome/objects/145526/>



Interaction Research Studio, Goldsmiths University of London, UK. (2010). *The Prayer Companion* [Photopolymer resin, dot-matrix display, and printed circuit board, 13 3/4 x 8 3/4 x 5 1/2 in.]. Retrieved from
<https://www.moma.org/interactives/exhibitions/2011/talktome/objects/145526/>

The Prayer Companion was one of two devices designed for elderly people by a group of designers at Goldsmiths, University of London. Over the course of two years, the designers conducted many interviews with a group of cloistered nuns to understand the role of prayer in their lives. Though these nuns have little contact with the outside world, many people ask them to pray on their behalf, and the nuns wish for their prayers to be pertinent. The designers worked closely with the nuns to build a functional device that alerts them of issues that need prayer. *The Prayer Companion* is an unobtrusive,

tabletop device with a small screen on the top that displays scrolling news headlines and sentences about people's feelings taken from blogs. The nuns incorporated this device into their lives for a period of ten months and reported that it played a prominent role in their prayer life (Gaver, Blythe, Boucher, Jarvis, Bowers, & Wright, 2010).

In their corresponding CHI paper, the designers conclude that materiality and aesthetics were critical in the nuns' acceptance and interpretation of the device and go so far as to say, "We separate the functionality and materiality of our prototypes at our peril." They also stress the importance of openness and the danger of over-specifying the interactions with such devices. They write, "Overly defined systems may be unable to encompass the many nuanced ways people organize and give meaning to their activities, and may commodify personal experience, encouraging people to consume activities and meanings defined by others and alienating them from their own meaning-making," (Gaver et al., 2010). For devices dealing with spiritual and mental well-being, people must be able to formulate their own narratives and make their own meaning, and, thus, aesthetics and openness are vital to the devices' effectiveness.

Wendy Jacob

Wendy Jacob is an artist whose work bridges architecture, sculpture, and interaction design. Of particular relevance to this thesis, she explores how architecture influences our perceptual experiences, and she often uses warmth. In one series of work, Jacobs incorporated warmth with decorative rosettes, a type of traditional architectural ornament. The rosettes were heated electrically and unexpectedly warm to the touch. Placed near eye level and painted a smooth white, the rosettes looked touchable. As

visitors repeatedly touched the rosette, the finish darkened leaving a poetic record of all those who interacted with it.



Jacobs, W. (1993). *Wall Rosettes* [zinc rosette, heating elements, latex paint, plaster, 5" diameter]. Retrieved from <http://www.wendyjacob.net>



Jacobs, W. (1994). *Column Rosettes* [zinc rosette, heating elements, latex paint, plaster, 5" diameter]. Retrieved from <http://www.wendyjacob.net>

In another piece, *Doorknob*, Jacobs created rubber-coated doorknobs that were heated electrically and warm to the touch. Knowing that physical warmth significantly

affects psychological warmth, could such a simple intervention improve our interactions with all those behind the door?



Jacobs, W. (1992). *Doorknob* [rubber, wood, latex, blowers and timing mechanism, 90 x 24 x 3 in.]. Retrieved from <http://www.wendyjacob.net>

In addition to her work with architecture, Jacobs uses her background as an artist to design therapeutic technologies such as *Squeeze Chair*, a collaboration with engineer and animal scientist Temple Grandin. The chair was inspired by Grandin's "squeeze

machine", which Grandin built to apply even pressure to her body as a way to calm her anxiety and autism (Jacobs, n.d.). Grandin's research shows that deep pressure (unlike light pressure, which tends to excite) can be very calming to people to people with autism, hyperactivity, and other forms of anxiety. She also found that many normal adults as well as animals are relaxed by deep pressure. For Grandin, being touched was once a source of extreme anxiety and panic attacks. The machine helped her overcome this and, as a result, improved her relationships with others. She writes:

Using the machine enabled me to learn to tolerate being touched by another person. By age 25, I was able to relax in the machine without pulling away from it. It also made me feel less aggressive and less tense. Soon I noted a change in our cat's reaction to me. The cat, who used to run away from me now would stay with me, because I had learned to caress him with a gentler touch. I had to be comforted myself before I could give comfort to the cat. (Grandin, 1992)



Jacobs, W. *Squeeze Chair*. Retrieved from <http://www.wendyjacob.net>

Jacobs' version, *Squeeze Chair*, has gone through many iterations and is an upholstered chair whose arms inflate to give the user a firm hug. The project was part of her work with *Autism Studio* at the Massachusetts Institute of Technology, whose mission was to use artistic strategies to design spaces and tools for autistic individuals.

Mobile Feelings



Mobile Feelings II
© 2001-04 Christa Sommerer & Laurent Mignonneau
developed at IAMAS Institute of Advanced Media Arts and Sciences, Gifu, Japan
sponsored by France Telecom Studio Creatif

Sommerer, C. and Mignonneau, L. (2004). *Mobile Feelings II*. Retrieved from
<http://www.interface.ufg.ac.at/christa-laurent>

In 2004, artists Christa Sommerer and Laurent Mignonneau created *Mobile Feelings* as a way to explore society's increasing ambivalence towards sharing personal information with an anonymous audience. The project involved building custom mobile phones that allow users to communicate through touch. The phones capture the users' heartbeat, blood volume pressure and pulse, skin conductivity, sweat and smell. This data is sent to the other phones and felt by anonymous users through the use of actuators, vibrators, ventilators, micro- electromechanical and micro-bio-electrochemical systems embedded in each device. The artists note that the sense of touch remains one

of our most private sensations and is something we often avoid to share with strangers (Sommerer & Mignonneau, 2003).

Sommerer and Mignonneau also stress the need for artists to build functional works that live outside the gallery. In a section called “Mobile Art for Daily Life”, they write, *“Mobile Feelings* works anywhere and anytime, and the physical location of people becomes completely irrelevant. *Mobile Feelings* proposes an art form [that is not location-based] or context-based but instead becomes integrated into people’s daily lives. [...] In our aim to get media art off the walls and out into people’s lives, *Mobile Feelings* presents another step towards the merging of art, life and society,” (Sommerer & Mignonneau, 2003).

Omo



Dobson, K. *Omo*. From “Machine Therapy,” by K. Dobson, 2008



Dobson, K. *Omo*. From "Machine Therapy," by K. Dobson, 2008

Kelly Dobson's research focuses on the development of therapeutic machines, and, in her study of what she calls the Parapraxis of Machines, she investigates how people relate to machines beyond their intended purpose. On the relationship between machines and people, Dobson writes:

The making of machines affords dramatic new perspectives on how we constantly make ourselves and our worlds. We build ourselves alongside, and relative to, the invention of machines. The cross contingencies are literal, physical, psychological, social, and political. From the machines of modern industry that

distilled and extended what an arm could be and what to work could mean, to companion robots that call us to ponder what caring may become, we map what we are, and how we are to behave towards others, via our conceptual and material machine designs and interactions. Our machines have vital and critical roles in our becoming human. (2008)

In particular, Dobson's *Omo* is a perfect example of a technology that interfaces with the embodied mind. *Omo* is a breathing companion machine that senses and syncs to the breath pattern of the person holding it. *Omo* can be focused on consciously or used unconsciously. Once *Omo* has synchronized with a person, it starts to alter its breathing, which, in turn, affects the person's breathing. Breathing is not just a window into a person's inner state. Consciously or unconsciously modifying breathing patterns can affect a person's emotional state (2008).

Krzysztof Wodiczko

Krzysztof Wodiczko has been working within the intersection of art and interaction design for decades. Rather than building props for galleries and museums, he builds devices meant for public performance that mediate interactions between people. His series of "social prostheses" are particularly relevant.

One of these prostheses is the *Alien Staff*, a storytelling device designed to be used by immigrants. The staff contains a small screen and a speaker. The monitor is purposefully small and near the operator's face. The staff plays a video recording, not too loudly, of the operator telling the story of his immigrant experience. To see and hear the

video, observers must get close to the operator. The immigrant, normally ignored, becomes real and his story is heard. The staff invites crossing the boundary between stranger and non-stranger (Interrogative Design Group, n.d.).



Wodiczko, K. (1992). *Alien Staff*. Retrieved from
<http://www.galerielelong.com/artist/krzysztof-wodiczko>



Wodiczko, K. (1999-2000). *Dis-armor*. Retrieved from
<http://www.galerielelong.com/artist/krzysztof-wodiczko>

Dis-armor is another one of Wodiczko's social prostheses. It is an instrument designed for Japanese "school refusers", high school students who live in silence and lack facial expression. *Dis-armor* allows for indirect, mediated communication by allowing its users to speak through their backs. The screens on the back of the armor display live video of the wearer's eyes. Beneath the screens is a speaker that amplifies the wearer's voice. The back of the armor also contains a microphone and rearview mirror/camera, so

the wearer can see the face and hear the words of the person behind. The armor is designed to help youths who have survived traumatic events wishing to overcome their shame and break their silence (Interrogative Design Group, n.d.).

Wodiczko writes, "Between the speechless pain of the [...] stranger and the sequestered fear of one's own strangeness lies the real frontier to be challenged. Can art operate as a revelatory, expressive, and interrogative passage through such a frontier? [Equipment facilitating such an intervention] would be the result of 'interrogative design', a critical articulation of what is most questionable and unacceptable in the present," (1999, p. 9). Wodiczko writes that we must design devices for communication and mediation that are like the bandage, both treating the wound and calling attention to the wound. The bandage signifies the presence of pain as well as hope for recovery. The device that is like a bandage treats the individual who is suffering as well as the external society that produced the wound, (1999, p. 10).

feelSpace belt



feelSpace belt. Retrieved from <http://www.creativeapplications.net/environment/feelspace>

Interested in creating new sensory modalities through the use of technology, a team of cognitive scientists from the University of Osnabrück developed the feelSpace belt. The belt is designed to give its wearer an unconscious sense of direction. The belt projects the direction north onto the waist of the wearer through thirty vibrating actuators. The device itself is simple, but it has profound implications on our understanding of perception.

Researchers have experimented with sensory substitution for decades. For example, Paul Bach-y-Rita pioneered the transformation of visual stimuli to haptic information with the goal of assisting the blind. One of his early devices mapped input from a camera to vibrotactile information transmitted to the skin allowing the blind to

get a sense of their surroundings. This type of work continues to be meaningful as researchers attempt to understand the brain's functioning as well as look for ways to help people with disabilities. However, the feelSpace belt goes beyond sensory substitution. Human beings do not inherently have a strong ability to sense magnetic fields, like many animals do, and are not able to feel the direction north. The belt provides the wearer with this feeling. Because the brain is plastic, the feelSpace researchers believe that exposing the brain to a novel set of sensorimotor contingencies, not normally supplied by any other sensory organs, will engender a new perceptual experience and thus result in a new modality. The researchers conducted many experiments with the feelSpace belt (too many to enumerate within this thesis) that demonstrate that human beings are able to learn new sensorimotor contingencies, and they conclude that these new sensorimotor contingencies can have profound effects on performance and perceptual experience (Nagel, Carl, Kringe, Märtin, & König, 2005).

Some animals, like dolphins and whales, are able to perceive the other animals in the area near them through echolocation. What if we were to create a new sensorimotor contingency that gives human beings the ability to sense their connection with many others? Could this new perceptual experience be used to heal the lonely and depressed? How would the creation of such a new modality change human consciousness? Would this result in human beings having greater empathy for one another?

EMPATHY BOX

BACKGROUND

Philip K. Dick's classic science fiction novel *Do Androids Dream of Electric Sheep?* was the basis for the famous movie *Bladerunner*, but, while the movie was very inspiring, many of the most compelling technologies from the book did not make into the screenplay. One of these was the empathy box, a device associated with a theology called Mercerism, that connected many people anonymously. On a ruined Earth, this device emerged during a time of extreme isolation and where the development of highly intelligent androids challenged the entire concept of empathy.

Interestingly, the word "empathy" can be used to describe both our ability to identify with either an object or another person's feelings and experiences.

empathy, n. (*The Oxford English Dictionary*)

1. The quality or power of projecting one's personality into or mentally identifying oneself with an object of contemplation, and so fully understanding or appreciating it.
2. The ability to understand and appreciate another person's feelings, experience, etc.

Keeping these definitions in mind while reading the passages concerning the empathy box is thought-provoking. For brevity, I only include the most relevant excerpts here, but the full passages can be found in the appendix.

Time to grasp the handles, he said to himself, and crossed the living room to the black empathy box. When he turned it on, the usual faint smell of negative ions surged from the power supply; he breathed in eagerly, already buoyed up. Then the cathode-ray tube glowed like an imitation, feeble TV image; a collage formed, made of apparently random colors, trails, and configurations which, until the handles were grasped, amounted to nothing. So taking a deep breath to steady himself, he grasped the twin handles.

[...] He had crossed over in the usual perplexing fashion; physical merging—accompanied by mental and spiritual identification—with Wilber Mercer had reoccurred. As it did for everyone who at this moment clutched the handles, either here on Earth or on one of the colony planets. He experienced them, the others, incorporated the babble of their thoughts, heard in his own brain the noise of their many individual existences. They—and he—cared about one thing; this fusion of their mentalities oriented their attention on the hill, the climb, the need to ascend.

[...] A rock, hurled at him, struck his arm. He felt the pain. [...] God, he thought in weariness. In what way is this fair? Why am I up here alone like this, being tormented by something I can't even see? And then, within him, the mutual

babble of everyone else in fusion broke the illusion of aloneness.

You felt it, too, he thought. Yes, the voices answered. We got hit, on the left arm; it hurts like hell. Okay, he said. We better get started moving again. He resumed walking, and all of them accompanied him immediately.

[...] Anyhow he was no longer sinking; he had begun to ascend, along with the others. Long ago he had lost sight of them. He found himself evidently climbing alone. But they were there. They still accompanied him; he felt them, strangely, inside him.

Isidore stood holding the two handles, experiencing himself as encompassing every other living thing, and then, reluctantly, he let go. It had to end, as always, and anyhow his arm ached, and bled where the rock had struck it. (Dick, 1968, p. 21)

"It would be immoral not to fuse with Mercer in gratitude," Iran said. "I had hold of the handles of the box today and it overcame my depression a little—just a little, not like this. But anyhow I got hit by a rock, here." She held up her wrist; on it he made out a small dark bruise. "And I remember thinking

how much better we are, how much better off, when we're with Mercer. Despite the pain. Physical pain but spiritually together; I felt everyone else, all over the world, all who had fused at the same time." She held the elevator door from sliding shut. "Get in, Rick. This'll just be for a moment. You hardly ever undergo fusion; I want you to transmit the mood you're in now to everyone else; you owe it to them. It would be immoral to keep it for ourselves."

She was, of course, right. So he entered the elevator and once again descended.

In their living room, at the empathy box, Iran swiftly snapped the switch, her face animated with growing gladness; it lit her up like a rising new crescent of moon. "I want everyone to know," she told him. "Once that happened to me; I fused and picked up someone who had just acquired an animal. And then one day—Her features momentarily darkened; the pleasure fled. "One day I found myself receiving from someone whose animal had died. But others of us shared our different joys with them—I didn't have any, as you might know—and that cheered the person up. We might even reach a potential suicide; what we have, what we're feeling, might—"

"They'll have our joy," Rick said, "but we'll lose. We'll exchange what we feel for what they feel. Our joy will be lost."

The screen of the empathy box now showed rushing streams of bright formless color; taking a breath, his wife hung on tightly to the two handles. "We won't really lose what we feel, not if we keep it clearly in mind. You never really have gotten the hang of fusion, have you, Rick?" (Dick, 1968, p. 173)²

Joan saw a metal box with two handles, attached by a lead of twin-cable wire to the TV set. Ray seized the two handles, and at once a grimace of pain shot across his face. "What is it?" she asked, in anxiety.

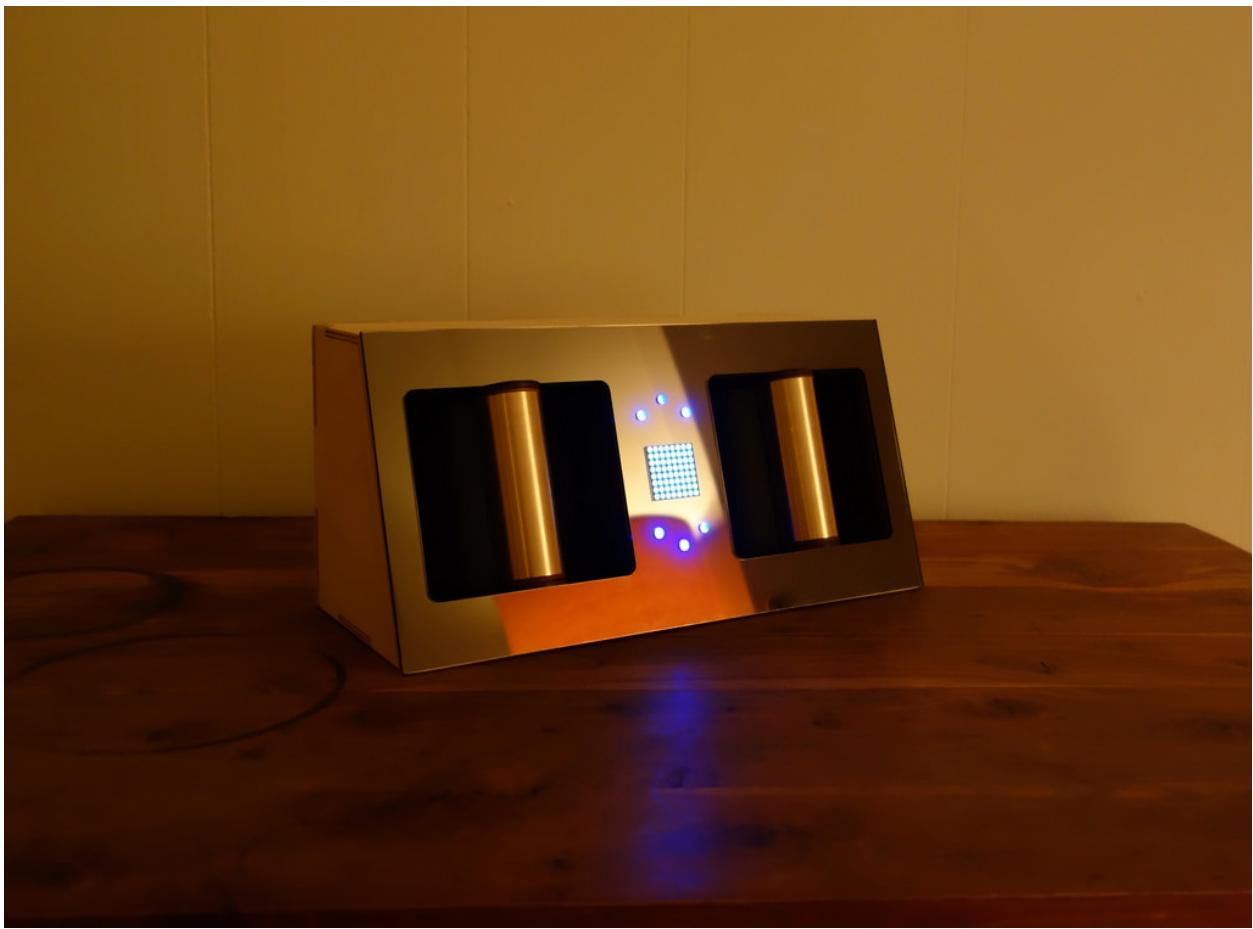
"N-nothing." Ray continued to grip the handles. On the screen, Wilbur Mercer walked slowly over the barren, jagged surface of a desolate hillside, his face lifted, an expression of serenity—or vacuity—on his thin, middle-aged features... To Joan, he explained, "This is the empathy box, my dear...when you take hold of these handles you're no longer watching Wilbur Mercer. You're actually participating in his apotheosis. Why, you're feeling what he feels."

² The Buddha taught, "Thousands of candles can be lit from a single candle, and the life of the candle will not be shortened. Happiness never decreases by being shared," and Nichiren, Japanese Buddhist monk, said, "If you light a lamp for another, your own way will be lit."

"An empathy box," he said, stammering in his excitement,
"is the most personal possession you have. It's an extension of
your body; it's the way you touch other humans, it's the way
you stop being alone. (Dick, 1968, p. 66)

DESIGN

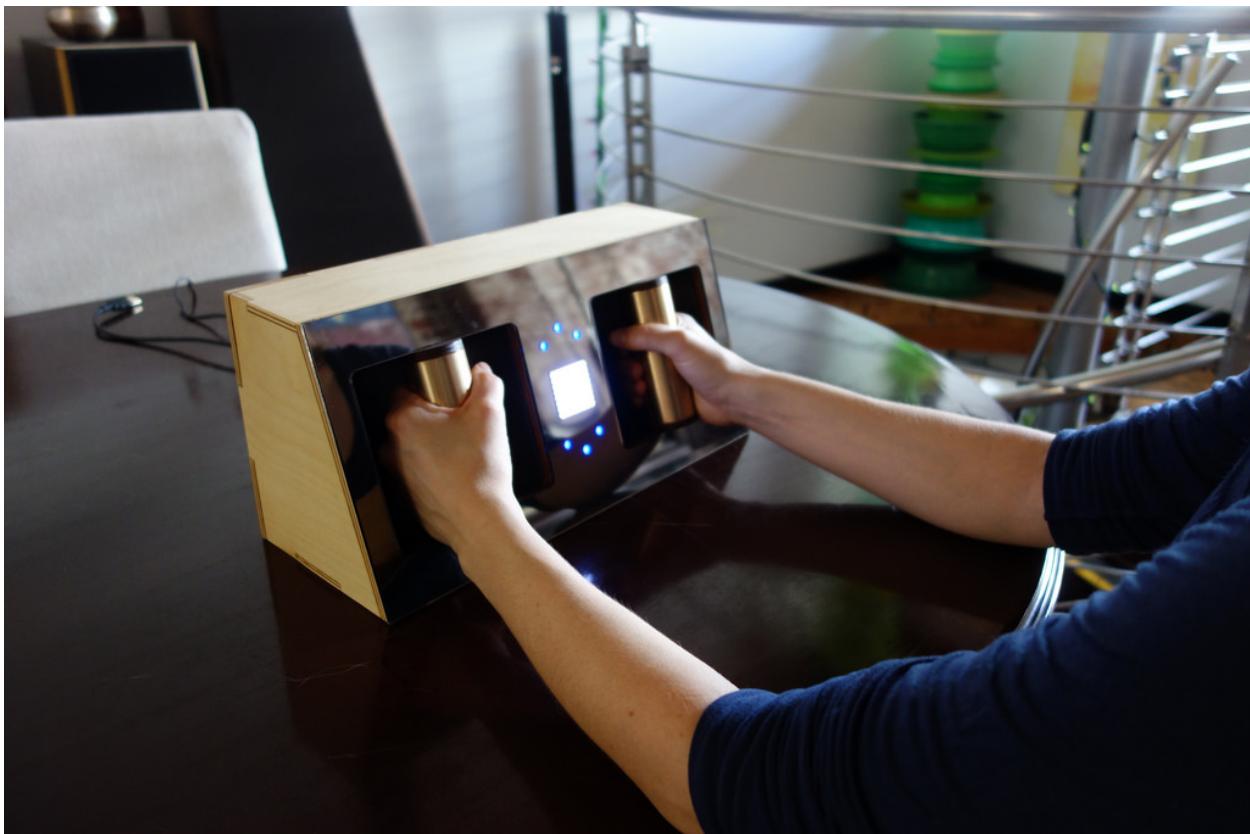
To build a heightened sense of connection to anonymous others, I designed and built two devices: a tabletop appliance and a wearable. The first device, the tabletop appliance, is based on Philip K. Dick's empathy box. Dick did more than just describe a technology for keeping people in touch, like I so commonly see being developed today. In his novel, many anonymous people, maybe thousands or more, are connected through their empathy boxes at the same time. In today's world, people are much less likely to feel empathy towards those not in their immediate network of family and friends, and I designed my version of the empathy box to also cultivate a sense of connection between strangers.



Brueckner, S. (2014). *Empathy Box* [wood, bronze, heaters, electronics].

My interpretation, which I also call the Empathy Box, is an appliance that connects many anonymous people through shared warmth. First, I will describe the user experience and then follow with my thinking behind the design. I built five prototypes that are networked together, but I ideally would have hundreds or more. I imagine these appliances being kept in homes as well placed in public spaces (like in a counseling center, for example). By default, the devices are turned off and unlit. When one person grasps the handles of his device, the small blue lights turn on for feedback. Both handles must be grasped to interact with the device. Simultaneously, all of the other empathy

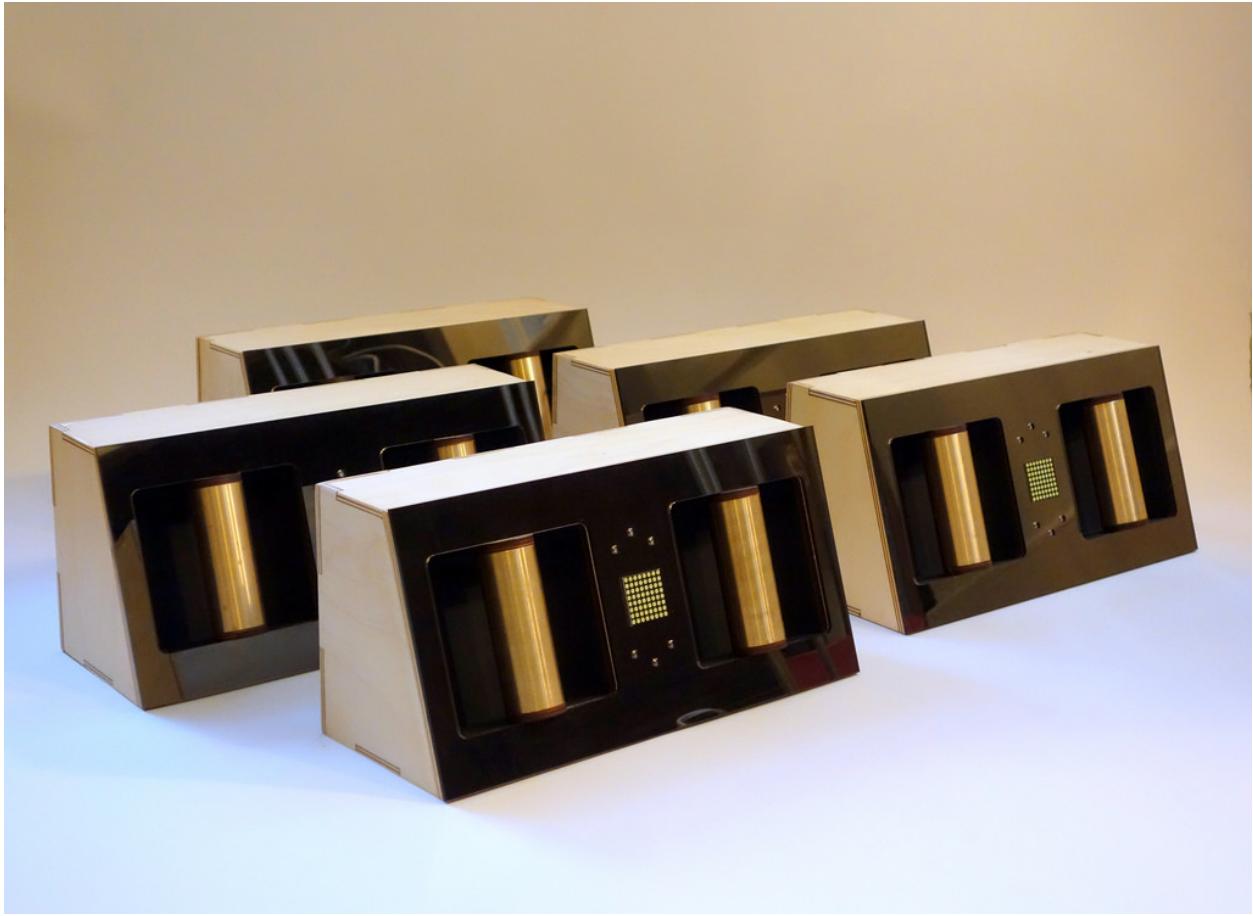
boxes turn on, and the white squares in the middle of all the boxes pulse slowly. If one or more people grasp the handles of their devices in response to this signal, everyone will feel pulsing warmth in their hands through the handles. This interaction has no time limit.



Brueckner, S. (2014). *Empathy Box* [wood, bronze, heaters, electronics].

To summarize, the devices have three states:

- **Zero people using the Empathy Boxes:** The devices are all turned off and unlit.
- **One person using an Empathy Box:** All the boxes pulse white light.
- **Two or more people using the Empathy Boxes:** The handles of all the boxes pulse warmth.



Brueckner, S. (2014). *Empathy Boxes* [wood, bronze, heaters, electronics].

Like Dick's version, I also require the user to grasp two handles to activate the device. This interaction appeals to me for many reasons. It is deliberate and requires the user to invest time and mental energy in the experience. Because both handles must be held at the same time, multitasking is difficult. The user is encouraged to be present and focused much like what is taught by mindfulness. The two metal handles remind me of an exercise machine, again a very deliberate and active experience, but I am asking the user to be physically still and instead mentally active. This interaction also incorporates another one of Lakoff's primary metaphors, "Understanding is Grasping" as I ask the user

to project understanding and empathy towards anonymous others while they grasp the handles of the device. The fact that the interaction requires both hands is more intimate; it's less of a handshake and closer to holding someone. Though I could exaggerate this even more in the next version, I require the user to be comfortably seated, and the bronze handles are weighty and substantial. The user feels stable and grounded, relating to another primary metaphor, "Help is Support". Lastly, I like that the posture assumed by the user is mirrored by all the other users. This reminds me of the study Cacioppo discussed on how lonely people are much more likely to mimic the posture of others around them, suggesting that the shared posture could foster a sense of connection.

Shared physical experience is an important aspect of Dick's empathy box. I chose not to implement the shared pain and instead chose to use simple warmth. "Affection is Warmth" is a compelling primary metaphor, and numerous studies show the relationship between warmth and connection. Research shows that warmth by itself soothes lonely people, and, in addition, the warmth of the Empathy Box is actually mapped to a real connection with other people. To experience the warmth, at least one other actual person must choose to give you their time. For all users both lonely and non-lonely, the feeling of warmth cultivates affection and generosity towards strangers. Furthermore, the pulsing warmth is calming and grounds the experience, much like how breath is used as a focus in meditation. I purposefully chose the rate that the light and warmth pulse to be similar to heartbeat as a way to evoke a sense of aliveness. If it were easier to get a good measurement of heart rate through the palms, I would set this to be the average heart rate of all the people with which you are connected.

Though I cannot actually implement shared emotions exactly in the way Dick described, I believe I have achieved something in the same spirit with the Empathy Box.

First of all, people come to the device with similar intentions. They wish to connect. Sherry Turkle writes, "Sharing a feeling is a deliberate act, a movement toward intimacy," (2011, p. 175). By choosing to use the device, the person is sharing their desire for connection with the other anonymous Empathy Box users. Additionally, the shared warmth encourages a shared emotional experience. Primary metaphors, like "Affection is Warmth" are universally acquired as the result of the conflation of sensorimotor and subjective experiences during our neurological development. The neural networks for the two types of experiences are inextricably linked. Thus, shared physical experience utilizing primary metaphors encourages a shared emotional experience in the users. By making use of primary metaphors like "Affection is Warmth", "Intimacy is Closeness", "Understanding is Grasping", and "Help is Support", the users of Empathy Box are more likely to share feelings of empathy, generosity, affection, and connection.

Cacioppo writes that one of the best ways to heal loneliness is simply helping someone else (2008, p. 233). Reciprocity is built into the design of *Empathy Box*. First of all, the warmth fosters altruistic behavior. Secondly, in a similar way to how warmth and affection are conflated in the human mind, I purposefully conflate helping others with helping oneself. In order to be comforted by the *Empathy Box*, you must, at the same time, comfort someone else. Like Wodiczko's idea of a device being like a bandage, the Empathy Box treats the individual who is suffering as well as the society that produced that suffering. Interestingly, every single user of the Empathy Box assumes both the role of the individual sufferer at the same time as being a part of the external society that caused the pain. Lastly, the pulsing white light calling the user to help reminds them that they are needed, which is known to be helpful to both the lonely and the depressed.

Many of the connective technologies being built now, both software and hardware, connect people very superficially. By making it so easy to connect, connection has become drastically stripped of meaning. Practically no time or mental investment is needed to send a signal (a click, tap, or swipe is often all that is required), and this changes what the gesture means. Furthermore, because it is so easy to send these signals, we get too many and they become noise. In *Alone Together*, Turkle writes, "Anxiety is part of the new connectivity," (2011, p. 242). A typical example of this is the act of remembering someone's birthday. In the rush to build technology that makes everything easy and efficient, we now have many tools that make it trivial to know someone's birthday and be notified of it at the right moment. As a result, remembering a birthday, which used to be representative of someone caring for you and a strong relationship, now means nothing. Turkle also writes, "When we lose the 'burden' of care, we begin to give up on our compact that human beings will care for other human beings," (2011, p. 292). I paid particular attention to avoid this with my devices. My focus is not on easy, efficient connections with others; it is to build meaningful connections with others. To use the Empathy Box, a person commits significant time and engaged imaginative attention. This does not have to be explained to the user, because focus and reflection are built into the interaction itself. Designing for efficiency is not the right way to address the problems of social isolation and declining empathy. Our culture's fixation on ease and efficiency is what is causing it. Instead, we need to design technologies that foster authentic, meaningful connections, and here I see the role for artistic thinking, primarily concerned with making meaning, in the development of technology.

The Empathy Box is not a substitute for having real relationships. It does not attempt to simulate a normal face-to-face relationship as way to keep in touch or as a

remedy for loneliness. It is designed to work more like a light box, which helps during the darkest times in winter, but does not replace being outside. Similarly, the Empathy Box can help when people feel hemmed in by feelings of danger that make reaching out to others more difficult. Cacioppo writes, "When any of us feels connected, the absence of social pain and the sense of threat allows us to be truly *there*: in sync with others. The lack of negative arousal leaves us free to be more genuinely available for and engaged by whatever real connection might develop," (2008, p. 18). By reframing our cognitive perceptions, we can begin to transform ourselves and our relationships with each other. Sherry Turkle says, "Loneliness is failed solitude," (2011, p. 288). Could the Empathy Box, with its anonymous intimacy, shift people's mental narratives to transform loneliness into mindful solitude? Finally, the Empathy Box does more than just help the lonely. It builds a new awareness of our connection to others beyond what we could experience without the technology. This last aspect is what I explore more fully with my wearable device, the Empathy Amulet.

IMPLEMENTATION

The electronics for the Empathy Box are fairly simple. The current prototypes use the Arduino Uno and WiFi, though I designed them in such a way that swapping in another microcontroller or wireless module is easy. My first version of the devices used GSM modules for wireless communication over the cellular phone network. The devices communicated by sending each other simple SMS messages. While GSM was ideal because it works anywhere with good cell phone reception, each device needed its own SIM card and cell phone plan, which was expensive. To save on cost, the current version uses WiFi to communicate through Xively, an Internet of Things platform. This is somewhat inconvenient because any passwords required by private WiFi networks must be stored by the boxes.



Brueckner, S. (2014). [Handles for Empathy Boxes].



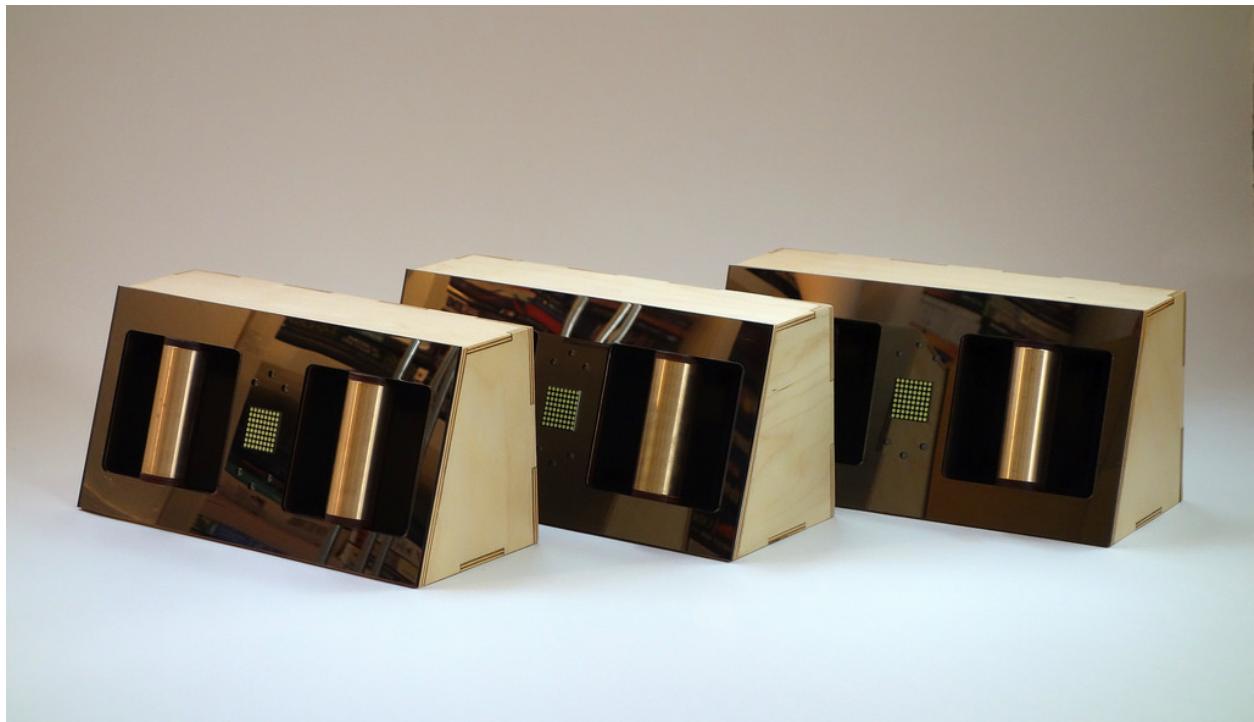
Brueckner, S. (2014). [Handles for Empathy Boxes].

The handles are made of bronze and warmed by flexible Kapton heating panels. The Empathy Boxes use high resistance switching to sense when the handles are held. The user closes the switch by grasping the handles. An added bonus of this implementation is that two users can activate an Empathy Box by holding hands with each other and then each grasping one handle.

For visual feedback, the Empathy Boxes each contain six RGB LEDs toned down with light diffusing film. Each Empathy Box also has a white 8x8 LED matrix that can be used as a low resolution display. Though I do not currently use the matrix as a display, I may experiment with it in the future. For example, I might want to see if displaying the number of people to whom you are connected changes the experience.

I wanted the Empathy Box to be reminiscent of science fiction, in particular of J. G. Ballard's Vermilion Sands short-story collection. The futuristic Vermilion Sands resort is

suggestive of Palm Springs, decadent, and full of fascinating and whimsical technology. While I wanted it to feel vaguely futuristic, I also wanted to keep it timeless so it can fit into many environments. To accomplish this, I alluded to simplicity of a Dieter Rams design (Dezeen, n.d.). This fusion of styles is represented by my choices of materials: bronze, which evokes the luxurious Vermilion Sands, and birch plywood, which evokes mid-century design. I also looked at many pictures of vintage radios, mockups for videophones, and other kitchen appliances when deciding other aesthetic details such as scale and the placement of lights.



Brueckner, S. (2014). *Empathy Boxes* [wood, bronze, heaters, electronics].

I contrasted warm, rich materials like bronze and darkly stained wood with cool white and blue light. Though contrasting, both evoke a sense of calm. All the surfaces are

smooth, polished, and refined. Because of the heavy bronze handles, the devices feel substantial and give an impression of strength. These material choices make the experience of using the Empathy Box feel more significant. The handles are placed such that the user's hands are half outside and half inside in the box, analogous to the idea of being half here and half there. The front face of the Empathy Box is laser cut from bronze-colored mirror acrylic, allowing glimpses of the user's reflection on the surface. The LED matrix, which pulses with white light when others are connected, is placed in the center of the user's reflection. This visual mixing of the self with others echoes the underlying concept of the device, which is to feel a sense of connection with anonymous others as well as to know that to help another is helping oneself.

EVALUATION

For this thesis, I collected qualitative feedback by interviewing people while they used the Empathy Box. However, in the near future, I would like to do some more formal, but short-term, studies of the Empathy Box's effects. Due to time constraints, I cannot include these studies in my thesis, but I will summarize my plans here.

To confirm that the combination of warmth with connection to real people is the most powerful, I would create four versions of the experience:

1. Test the Empathy Box where the warmth is actually mapped to real people.
2. Test the Empathy Box with warmth, but only tell the user they are connected to other people.
3. Test the Empathy Box using warmth only (this is similar to the hot/cold drink studies).
4. Test the Empathy Box with no warmth, but connect the user to other people using the lights alone.

The full experience of the Empathy Box (the first scenario) should outperform the controls. I believe that the second scenario would also work short-term because the placebo effect is real and would also influence people's mental narratives. Testing the placebo effect, however, isn't particularly interesting. Additionally, a placebo probably would not be as effective long-term because people would eventually figure out that they were misled and feel betrayed.

I've considered a few potential metrics of the Empathy Box's short-term effectiveness. For the user studies, I would invite people to come in for an hour and use the Empathy Box in one of the four configurations listed above. One question is if the

Empathy Box results in the user becoming more social. To test this, I could bring in a confederate after the subject uses the Empathy Box and then tell the subject that it was the person on the other end. Would the subject feel more connected to the confederate than a stranger? Another possibility is that I could have somebody call the subject later in the day and ask for help with a survey without telling him that it is related to my study. The survey could ask how the subject spent their day. Were they more social? The survey could also ask them to rate on a scale of 1-10 how kind they feel other people are.

To determine if using the Empathy Box increases empathy and altruism, I could have the subject meet a confederate in the hallway who needs help. Would the subject stop to help? How long does he stay to help? If the confederate asks the subject to get a coffee, does he go?

Lastly, it would also be informative to have people experience the full Empathy Box and then afterwards tell them it was a placebo. Does telling them it wasn't real take away any positive effects?



Abramović, M. (2010). *The Artist Is Present* [Abramović sat in the museum every day for two and a half months. Visitors were encouraged to sit across from her for a duration of their choosing.]. Retrieved from

http://www.moma.org/explore/inside_out/2010/06/03/marina-abramovic-the-artist-speaks

A long-term ethnographic study examining how people incorporate the Empathy Box into their actual living spaces and normal routines would be by far the most useful. I am most eager to find out how my devices could transform people's mental narratives long-term, and I would like to do interviews with people about how they experience the device over time. Like Dunne and Raby in *The Secret Life of Electronic Objects*, I am extremely curious about where people would keep the devices, how they would be used,

and what stories people would tell themselves about them. Would people put the Empathy Box in a more public area like their living room or office? Or would they put it in a private area of their house like the bedroom? Would they move it from room to room so it's near them all day or schedule certain times to be with it? Would they use it every day or just when they really needed it? I left the timing of the interaction unbounded because I am curious to see how people use it. How long will people sit with the Empathy Box? Will it converge on a certain amount of time or vary widely? Sitting across from Abramović during *The Artist Is Present*, people often lost track of time as they sat looking across at each other. Will people get lost in the experience of the Empathy Box too?

EMPATHY AMULET

DESIGN

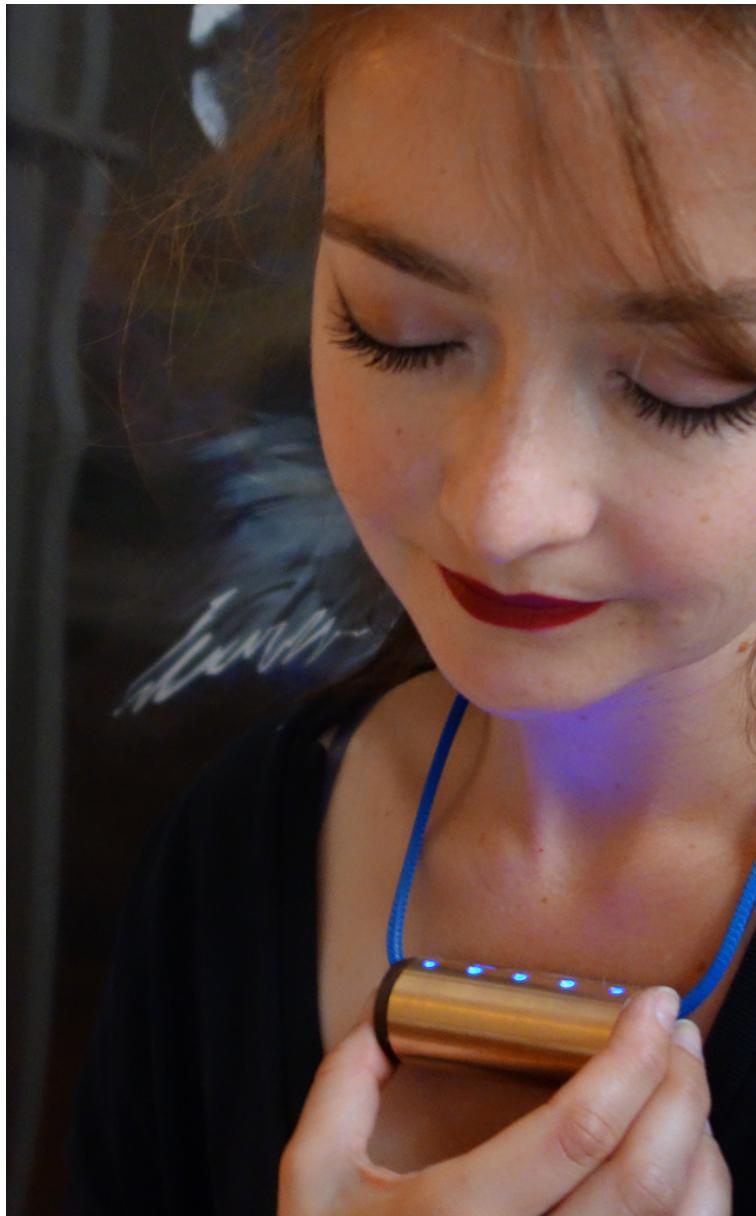
interconnect, v. (*The Oxford English Dictionary*)

To connect each with the other; to connect by reciprocal links



Orta, L. (2001). *Nexus Architecture X 50 Intervention Köln* [More than 100 people joined together by special overalls]. Retrieved from <http://www.studio-orta.com/en/artwork/103/Nexus-Architecture-x-50-Intervention-Koeln>

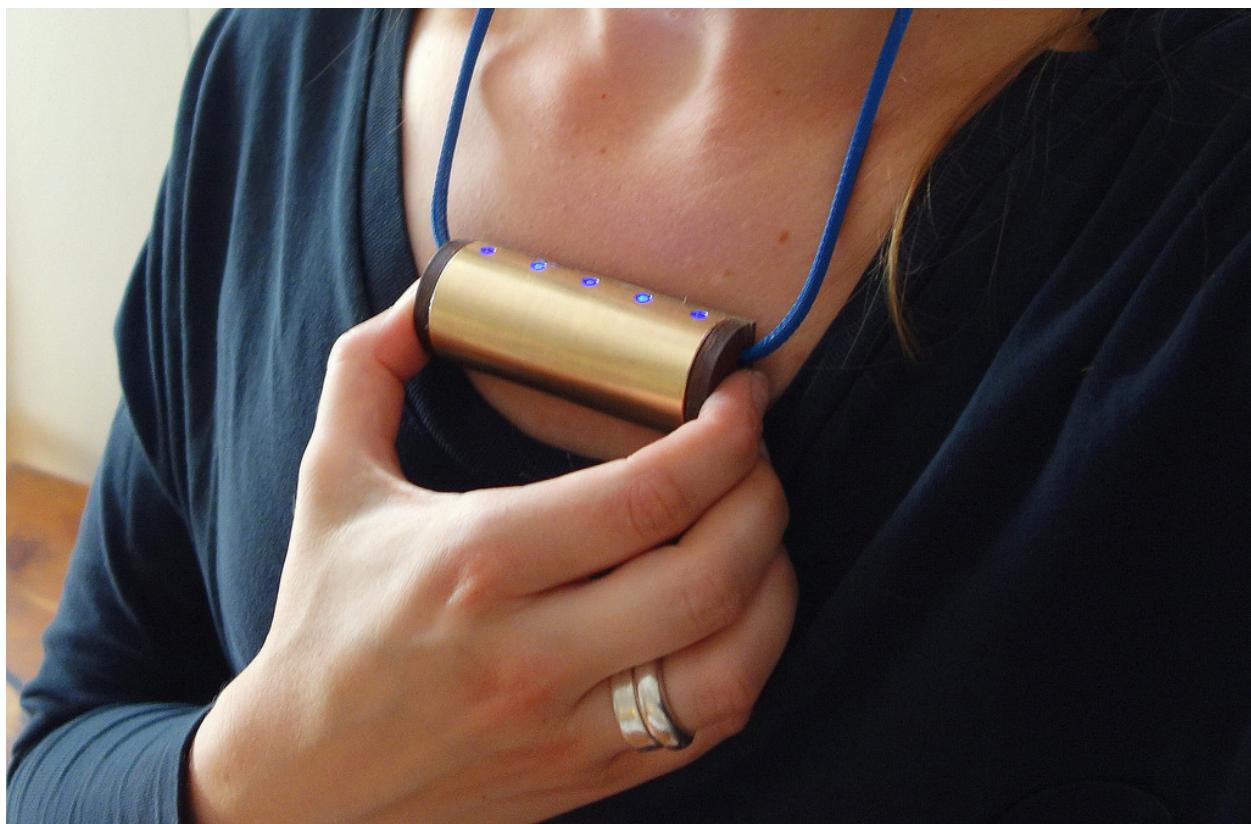
The Empathy Amulet is a wearable device in the spirit of the Empathy Box that also allows strangers to share warmth. It is a fusion of Philip K. Dick's empathy box with the feelSpace belt (Nagel, Carl, Kringe, Märtin, & König, 2005). With this wearable device, I get closer to the sense of interconnectedness being felt unconsciously through the body. With the Empathy Box, people experienced the warmth at the same time. With the amulet, the sharing of warmth is done asynchronously.



Brueckner, S. (2014). *Empathy Amulet* [bronze, wood, heater, electronics].

At first, I had planned to make the wearable in the form of a bracelet, but I decided against that for a few reasons. Wrist bands are becoming very popular within the Quantified Self movement, and I purposefully wanted to distance myself from that trend. With my early prototypes, I experimented with putting the heat on different parts of the

body. The warmth feels drastically different depending on where it is placed. The amount of thermoreceptors varies greatly in different parts of the body, so this makes sense. Furthermore, our brains have also built up different associations depending on where the warmth is felt. For example, putting the heater on the back of the neck is extremely intense, even unsettling. This may be because that feeling reminds us of someone sneaking up behind us and feeling warm breath on the back of our neck. Warmth on the wrist is soothing but impersonal, more like a warm handshake than a hug. Warmth on the core of the body feels intimate, calming, and powerful. I decided to make the amulet a heavy bronze and wood necklace that rests on the wearer's sternum. The weight and material quality evoke the power of armor or a shield. The location near to the heart evokes the intimacy of jewelry, which is often a gift from a loved one.



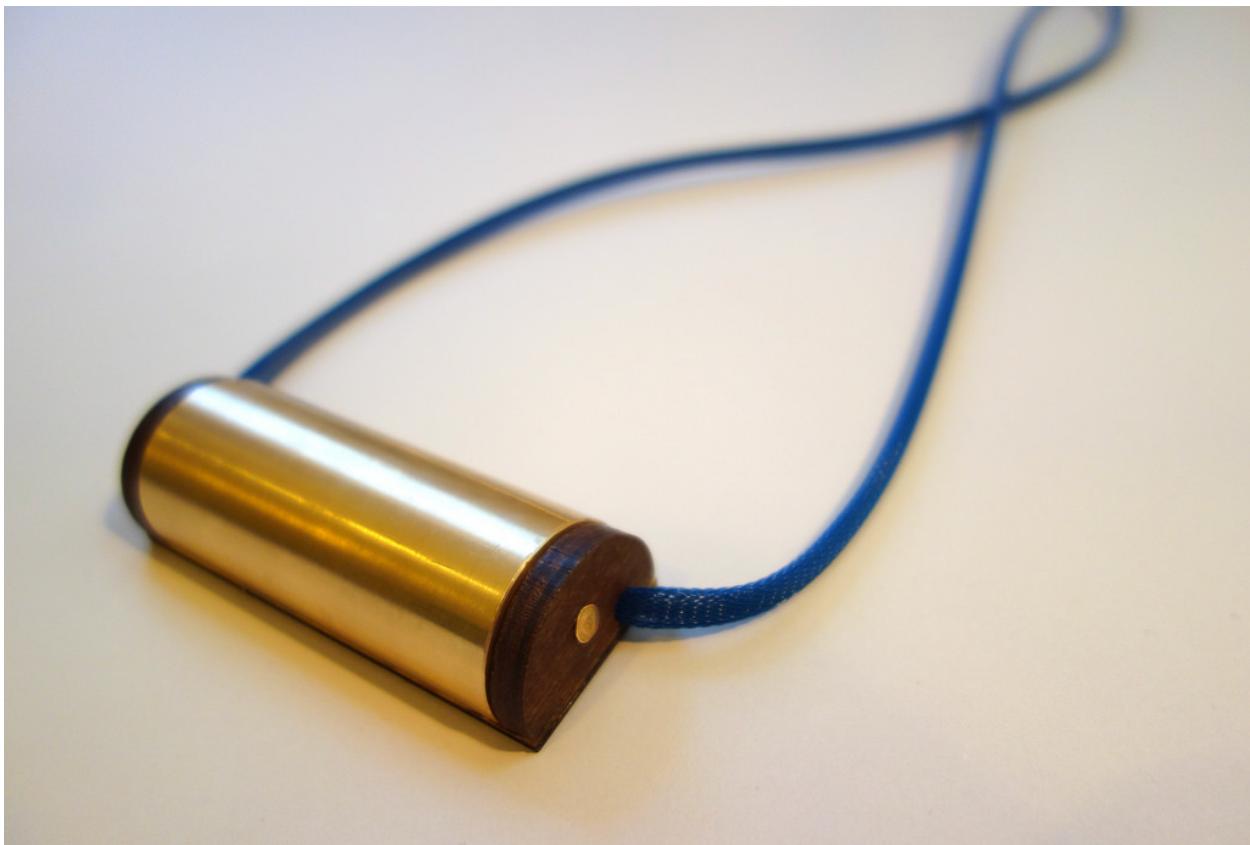
Brueckner, S. (2014). *Empathy Amulet* [bronze, wood, heater, electronics].

Again, I ideally would have hundreds of these devices networked together. To activate the necklace, the wearer holds the ends of the bronze tube. Subtle blue lights mark the passage of time, but they are not a necessary feature of the interaction. After three minutes, the necklace becomes warm on the wearer's chest for a short pulse, about a minute. Again, I incorporate reciprocity into the design. Simultaneously, the warmth is shared with one other random person within the network. This random person feels the warmth on his chest, and they may be conscious of it or not. Warmth works well as a cue because it is not socially and environmentally disruptive like vibration or sound. Even felt unconsciously, I believe it will affect how the user feels and thinks. In response to the warmth, the receiver can choose to also take some time to send the signal back out to someone else or may be more likely to do so later. If the receiver can't stop what they are doing, the warmth can also be a conscious or subconscious reminder to be focused and aware of our connection to other people in the world. I believe this asynchronous interaction will operate much like skipping stones on a lake as one person's decision to be still and think of others may inspire another person to do so and so on.

On the one hand, I am requiring the user to deliberately make the choice to take time to be still and reflect on his connection with others. On the other, the received warmth can be experienced consciously or unconsciously. With this embodied interaction, I hope to create a sensorimotor contingency that gives people a new sense of their connection to anonymous others. Though I am encouraging the device to influence the unconscious, user autonomy must be preserved no matter what. Additionally, I feel strongly that the signals must be sent deliberately because I want them to be associated

with conscious generosity. Again, I hope to conflate helping oneself with helping another as a way to encourage feelings of empathy.

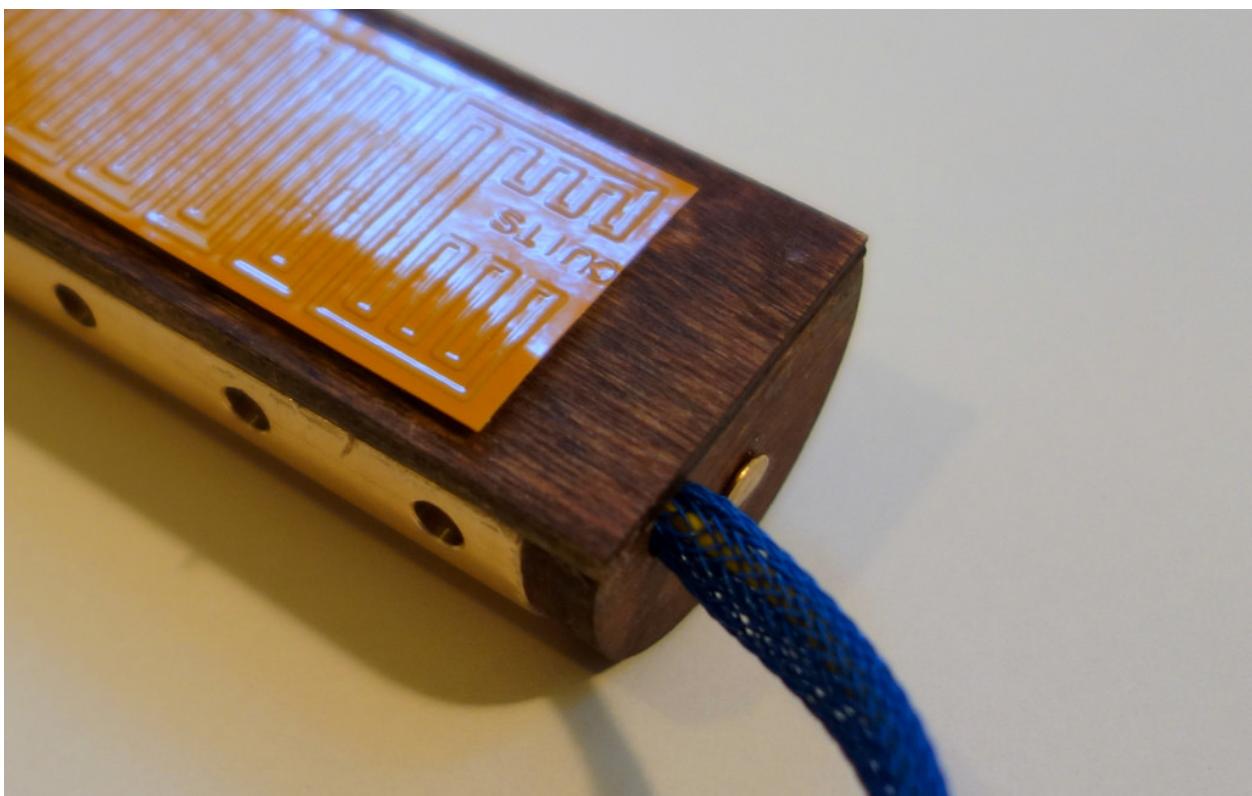
IMPLEMENTATION



Brueckner, S. (2014). *Empathy Amulet* [bronze, wood, heater, electronics].

The amulet is implemented very similarly to the Empathy Box. I use the same materials so that the two devices feel cohesive. The amulet is made from bronze with holes for five blue LEDs across the top. The LEDs are again made subtle by using multiple layers of light diffusing film (I also am excited to experiment with mother of pearl inlay to diffuse light in later versions). The back and ends of the amulet are made

from darkly stained wood. The cord is made of nylon mesh sleeving that hides the wires connecting the electronics in the amulet to the microcontroller (currently an Arduino Mini) and rechargeable battery, which unfortunately is a bit too large to build into the pendant itself but can be hidden in a pocket. The amulet uses Bluetooth (Bluefruit EZ-Link) to talk to an Android smartphone (relying on a smartphone is not ideal but is the most cost effective), which in turn connects to Xively, the same Internet of Things web service I use with the Empathy Box.



Brueckner, S. (2014). *Empathy Amulet* [bronze, wood, heater, electronics].

Like the Empathy Box, the Empathy Amulet also uses high resistance switching to detect touch. Instead of grasping the handles, the user holds the bronze tacks on either

end of the pendant with his thumb and forefinger to close the switch. A smaller flexible heater with an adhesive backing is placed on the back of the amulet against the wearer's skin.

EVALUATION

All of the interactions between the amulets will go through a central server, so that I can seek out and visualize these ripple effects. I also will be able to experiment with the system. For example, should the warmth be sent randomly to one person or two or more? Tuning the dynamics of the network will be very important. The frequency of the cues is very important to get right. If there are too few cues, the device won't be compelling. If there are too many, people may get desensitized. All social networks require this sort of calibration as they grow, and this system would be no different.

USER REACTIONS

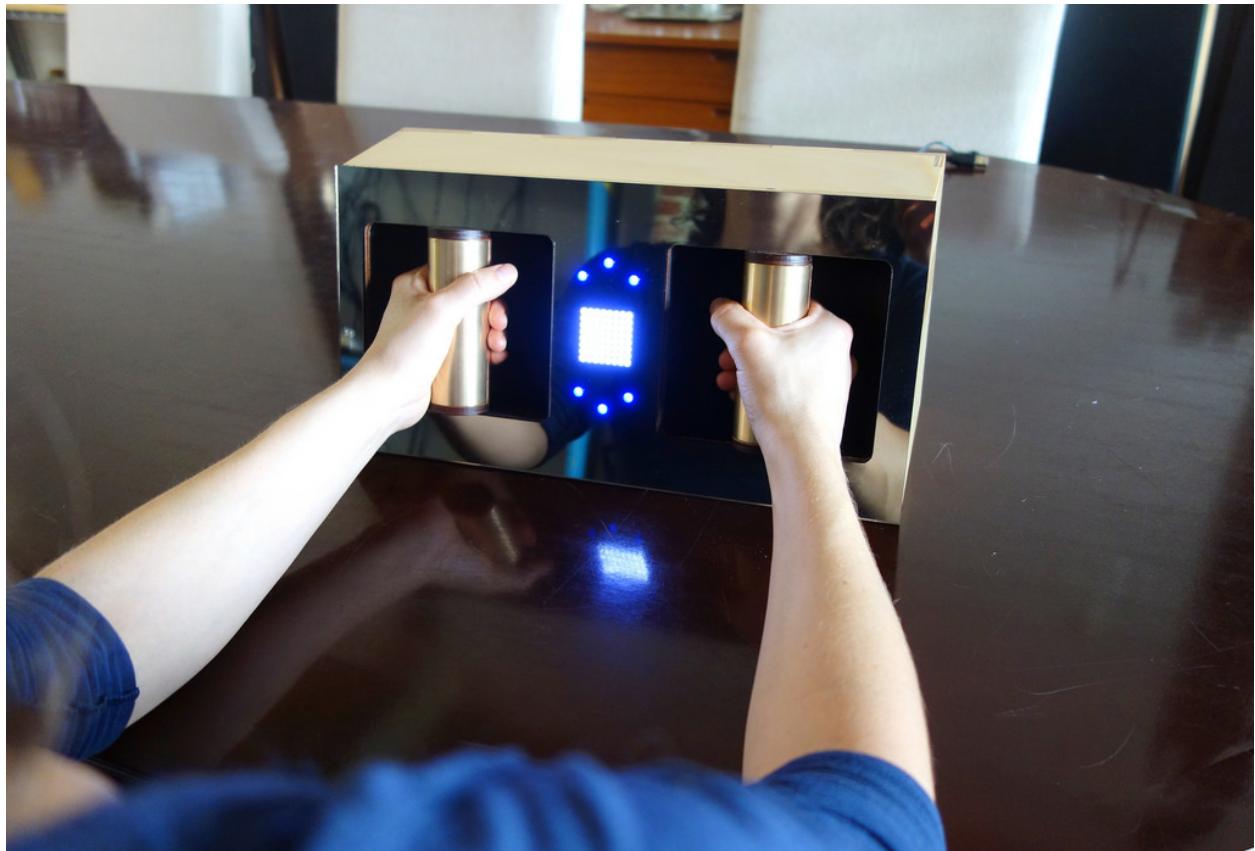
To obtain some early feedback on how users perceive the devices, I interviewed Kim, a dancer in her early 30s, and Caroline, a composer in her late 20s. I brought the devices to their homes, went through the possible scenarios, and transcribed our recorded conversations. I focused primarily on the Empathy Box, but, afterwards, I introduced them to the wearable as well.

KIM

[I set up the Empathy Box to be initially turned off, and let Kim grab the handles. After a few moments, the white light and warmth started to pulse as if other people decided to connect through their devices. I explained briefly that the device connects you to anonymous people.]



Brueckner, S. (2014). *Kim uses the Empathy Box.*



Brueckner, S. (2014). *Kim uses the Empathy Box.*

Kim: I like that when you sit to face it, at a normal table-top height, that you see your heart latitude reflected.

It's getting warm in a way that...it's like pulsing warmth in time with the light. It almost feels like there is hot water running through it. It's a little unnerving to hold it because I wonder how hot it will get. It makes me wonder how [the other people's] warmth and white light are pulsing.

I almost want to close my eyes, so I don't see the light anymore.

Because I'm holding the cylinders, it's not like I'm touching their hands, but rather...I imagine their device is pulsing at the same rate. It's almost like we are having a shared experience where our bodies or senses are overlaid on one another. So, it's not like I'm touching them, but it's that we are sharing the experience of what we are touching. It's like we are going on the same ride.

What is the white light responding to?

Sophia: What do you think it is responding to?

Kim: It seems like a breath pulse almost, but I could imagine that it's related to the heart rate...that it is sensing my pulse through my fingertips.

In a way, it's such an abstract experience...there's these cylinders getting warm, there's light pulsing...the experience lives as much in my imagination as it does in the touch. It just brought up all these imaginative questions...what is the other person experiencing? Are they experiencing it in the same way? What are they thinking about as they're holding the cylinders? Are they thinking about what I'm experiencing? Are they trying to send something through holding the handles? Or are they in a state of listening?

Sophia: What do you think about how it's very abstract and isn't exactly simulating a human being?

Kim: (Surprised) It kind of draws me in...because there is so much room to...imagine. I feel like I have a lot of latitude as the user to imagine what the other person is experiencing, imagining what they think the connection might be about, either practically or perceptually.

Sophia: Does it matter if it is a one-to-one mapping...that you are only connected to one person? What if you were connected to a hundred people?

Kim: I think smaller groups feel more potent to me. Like a hundred people...well, it would just be a very different experience. Because if it's one person, you are just imagining what this one other person is experiencing, which is kind of an intimate imaginative question. But if you are holding on to these cylinders and imagining there is a hundred other people, I might experience the heat differently...it might feel hotter...because there is a hundred people sending signal through the system. It would almost be like tapping into some larger energy source as opposed to trying to connect with one other person's perceptual experience...sensory experience.

Sophia: If you imagine this being incorporated into your life in some way, in what situations could you see yourself using it?

Kim: Like 2:00 a.m. when I can't sleep, and I can't think or do anything productive either. It would almost be a little grounding thing just to know somebody else is on the other end of the line...so you can have a very personal experience without having to use language, without having to talk to anyone or read anything or be on camera. It's like the

sensory version of sending someone a smiley face text...it's outside of language, but you get this little hit of dopamine...there's somebody else there, okay.

Sophia: How do you feel about the use of warmth as opposed to some other quality like vibration or squeezing? Or just light?

Kim: I like warmth because it's gentle. It's not didactic. It's ambient in a certain way whereas if there was something moving across my skin or putting pressure on me...that would be perceptually localized in a very different way...whereas the warmth can penetrate my hand and move up my arm. And, actually, because there's so many nerves in your hands, it makes the rest of my body feel a lot warmer even though the heat is just in my hands. I can feel it changing my circulation.

[I changed the device to be in the state where other people are connected through their devices. In this state, only the white light pulses until the handles are grabbed. Once the connection is established, all users experience pulsing warmth. Kim grabbed the handles to answer the call.]

Sophia: What would go through your head if you encountered the device and it was flashing like this?

Kim: So, I walk into my apartment and this is on...

I think the first question I would have is if it's one person on the line or is it a hundred or is it five. I would feel very differently about...Do I want to connect with it? Do I feel obligated to connect with it? Am I making someone wait?...if I knew it was one person or if it was a hundred.

Sophia: If it was one person, would you feel stressed out by it?

Kim: I would definitely feel compelled to connect...because having this one white pulsing light there by itself in the room knowing there is one other person on the end of the line, just sitting there waiting for someone else to connect in...I think if I were in a really busy state I'd be like...somebody else will pick up. And then I would keep checking back to make sure...Did someone else pick up? Did someone else pick up? Did someone else pick up?... But if it was a hundred people, or somewhere in between, on the other end, it would just be this comforting presence. At any time, I could go and connect. Like with one person, you are sending as much as you are receiving...with a hundred people you are more receiving than sending. If there are a hundred people on the other end, I guess I wouldn't feel compelled out of obligation to connect, but it would be nice to connect...to connect with this large group, it is kind of exciting.

Sophia: What would your reaction be if the warmth stops? If the person on the other end decides to stop?

Kim: That's interesting because, I suppose...then you would become the one person on the network waiting for a response if the warmth were to go away. It would be a little

jarring like...wait, where did everybody go? But because it's such an abstract interface in some ways...especially with the possibility of a hundred people...like when the white light is on, I just imagine it would be on indefinitely...depending on how many devices there are in the world and its use patterns. I think I'd feel a little sad... But, oh wait! I just connected and someone left...but why? Then I'd feel compelled to stay on until someone else came on.

Sophia: If you had this in your house, where would it live? A private space? Your living room? Would you move it from room to room?

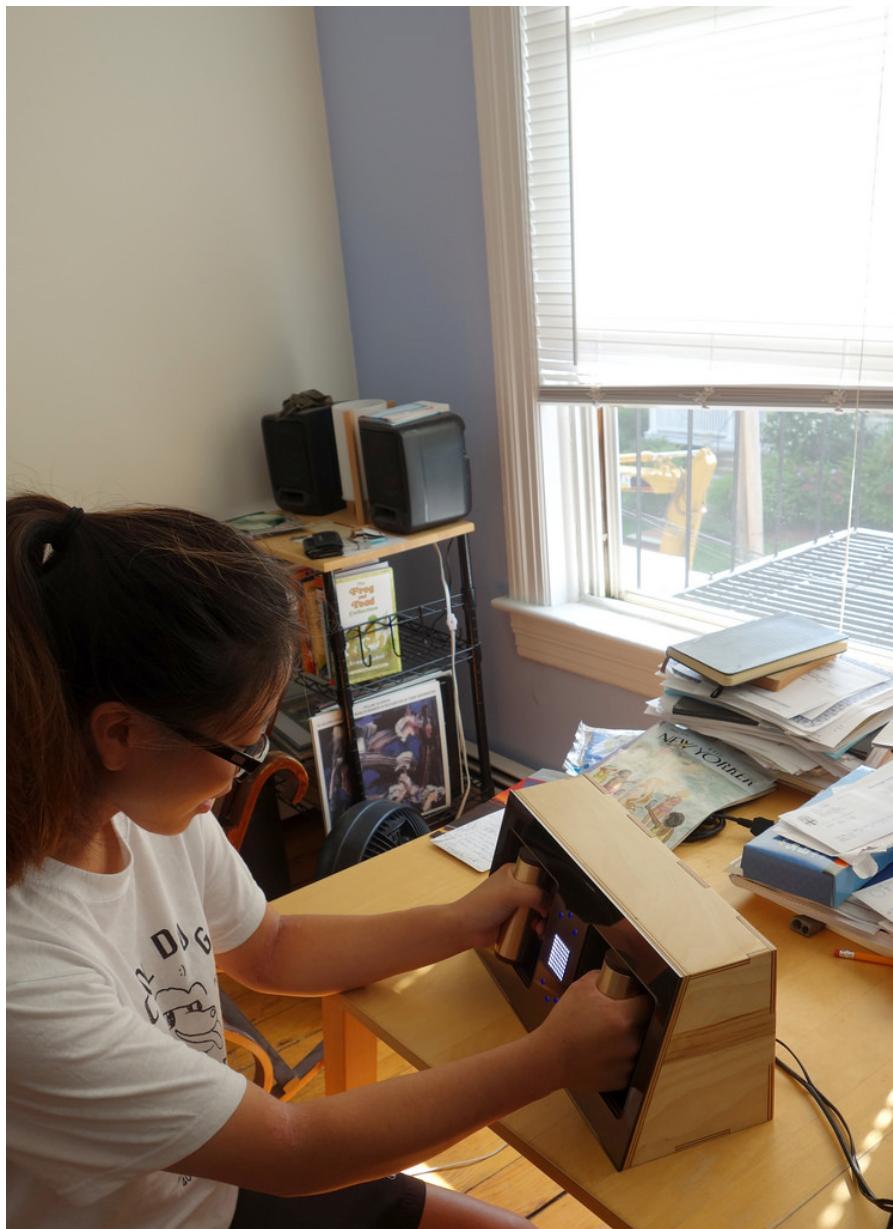
Kim: I think I would leave it in whichever room out where I could see it...because it would become this ambient character presence. I would always want to know is someone on, is someone not on. I might have it in my living room. I might have it in a little side place in the kitchen, almost where you place the family telephone. I would want it to be in a comfortable place, so you could really sit and experience it.

[I showed the Empathy Amulet to Kim and explained how it works.]

Kim: It's almost like a call to rest...or a call to sense. Just as you were talking about it, I was imagining myself in Soho walking between things...I've been spending a lot of time in New York this month...and that kind of out-of-body, busy experience in frenetic urban places...how long would it take me to tune into a warmth starting from the device on my chest. What would it make me do? Would it make me pull over and breathe differently? Would it call attention to breath because it's over the lungs?

CAROLINE

[I set up the Empathy Box to be turned off until Caroline grabbed the handles. After a few moments of holding, the white light and warmth started to pulse as if other people decided to connect through their devices. I explained briefly that the device connects you to anonymous people.]



Brueckner, S. (2014). *Caroline uses the Empathy Box.*

Sophia: What do you think you are supposed to do with it?

Caroline: I think I'm supposed to hold the handlebars. (Holds handles) Oh! It's getting warm! It's hot.

Sophia: Is it too hot?

Caroline: It's toasty. It feels like if it's a degree hotter I might burn myself, but I also might have really sensitive hands. I feel like I'm about to let go.

Sophia: Is it pulsing?

Caroline: It's pulsing, yeah. I feel like something is happening.

Sophia: What's going through your head knowing that you are connected to someone else through this interface?

Caroline: So, this is someone?

Sophia: Yes, there's someone else, one or more people holding the handles of their devices.

Caroline: Right now!? Right now!? It's really weird...it's like entering into a very physical and yet nonphysical anonymous chat room...where the constraint is very constrained, but there's this connection. There's this analog...I also haven't spoken to anyone all day, maybe that's better.

Sophia: How would it make you feel knowing that one person is on the other end vs. a hundred?

Caroline: A hundred seems like a lot of people. But then if they're en masse maybe it is like...how would I feel?...I guess I would feel generally positive for humanity, which is something I don't feel very often. If it were one person, I feel like it's really intimate. I don't know who this person is, and there's no way to judge anything. There's just simply the heat and the pulsing.

Sophia: What is your reaction to being intimately connected with a stranger?

Caroline: In this way, it feels trusting because this is the extent to which the connection exists, and there is no more beyond this nor there is less than this. It feels less lonely.

Sophia: How long do you think an interaction like this should be?

Caroline: Medium long, I guess. It feels like you have to sort of stay. It can't be a detect sort of thing and just be done. And, also, those questions you asked...does your perception change if it's a hundred people vs. one person? The idea of being connected to in this way to a stranger...it takes time to think through those things. I would say at least...it was a little hot for me...I would say 5-7 minutes at the very least. If it was slightly cooler, I would stay longer.

Sophia: In what situations could you imagine yourself wanting to use this device?

Caroline: Of the top of my head, days when I have not spoken to anyone all day, and I've just been in my house. Or I've only gone out to order a bagel or something...you know the feeling though, right? It's just like, oh God, I haven't talked to anyone all day, which is actually today. It's perfect! What was the original question again?

Sophia: In what situations could you imagine yourself using this?

Caroline: It's kind of a nice meditation routine. I could see this to be something [...] I would do...I would start my day with seven minutes. Or a portion of the midafternoon or early evening. I think there is an appropriate time slot for an individual. My time slot maybe would be morning, though I'm not a morning person necessarily.

When else? It's kind of a strange virtual but physical way of taking a break from ten hours of computer. It's very different...the connectivity...[than] me just sitting online on GChat. [...] Maybe I've just spent too much of today on social media, which is not one of my favorite things to do. But [this could be] something to take a break away from it. Maybe the seed concept is similar [to social media], but it's better. [...] There's something similar but also very different. Like if I were to say...am I going to go on Facebook or GChat or do this?...I feel like I might do this instead. I don't know...they're different!

[...] Or I might use this when I haven't hugged or been hugged in a while.

[I stopped and restarted the recording for a moment here.]

Caroline: There's something about attending to it, but it's not demanding. It's inviting. It's also wonderfully not part of this reality...or maybe it is...or maybe I don't know what reality is.

If everyone is doing what I consider to be stupid and necessary but evil things like marketing and social media pushing and connecting... That's all in the computer realm, the virtual realm, via things like 140 characters. That's like a line that is emphasized within a group of people...capitalism, I guess. This is different. This is a different thread. The intent is unclear in that it is not for money. No one is pushing any ads on me, which is nice. I can stay however long I want to. There is no required response. It's simply holding the handlebars. It's just kind of offering a space for contemplation, which is both feeding into the self but also feeding into what other connections are out there with people who are assumedly also holding the handlebars. It's not tied to grand advertising and money-making.

Interestingly, the front surface is a reflective surface. I wonder if it were different, would I be reacting differently? The lights make me really excited.

Sophia: What does the reflection make you feel?

Caroline: Because my head is above it, I'm not really looking at my face. It's just like my torso. There is a sense of like a self, definitely. It feels less anonymous in a way because I see that part of my reflection is there.

[I changed the device to be in the state where other people are connected through their devices. In this state, only the white light pulses until the handles are grabbed. Once the connection is established, all users experience pulsing warmth. Caroline grabbed the handles to answer the call.]

Caroline: So, I come in and it's pulsing. Someone's on the other end. It's like a notification.

Sophia: It could be one or many people. Would that make a difference?

Caroline: That's interesting. I feel a slight obligation.

Sophia: Is the sense of obligation different if it were one or many people?

Caroline: If it were one, I would have a greater sense of obligation for that person. It's sort of sad. It makes me think about random chatrooms and how everyone leaves. It's kind of sad...the chatroom kind of kills itself until random chat comes again. If it were one person, I would probably think it would be nice to have five minutes...it would be one's duty as a human to connect the chain. It doesn't feel as dramatic as someone throwing out a rope for safety, but it reminds me of that a little bit of it. It's like someone is lost at sea.

[The pulsing light and warmth turned off.]

Sophia: So, the pulsing just stopped because now nobody is connected. How do you react to that?

Caroline: Now, I'm just here! The person goes away, and there's no more pulsing. I kind of felt, "Oh!" It's not too dissimilar from being on a really busy subway, and you catch eyes with someone. It's not flirting necessarily but you catch a look, and then you look down. Not as a means of checking anyone out or a strange sexual encounter...this felt very asexual, which I like. Then, I can break with my analogy of the random chatroom because random chatrooms are always about internet hooking-up.

Sophia: So, you think this is more like catching a stranger's eye for a moment?

Caroline: Yeah! Or like a child's eye on the train. They give you that sort of stare like "Who are you?" and you are like, "I'm just someone." And they are about to play with their doll or their mom's bracelet. There's this very human connectivity and then this disengagement, which seems very necessary. If this were going on and on and on, I would be like...okay, well, I have to start cooking dinner. I have to start doing things and go back to life. If someone were hanging on forever, then it would take me out of my life and routine instead of just becoming part of my routine. It would overwhelm my routine. It feels natural...people and things come and go, and a sense of space is always nice. If someone were there for four hours...I'd be like, maybe, this person is a little clingy. Clingy I can't do, but I could do my seven or five minutes or whatever it is. Then, I'd go back to doing the things I normally do...then the next day...it's like a daily routine.

Sophia: If you had a device like this, where might you keep it?

Caroline: Someplace with sun. Someplace with daylight, I think.

Sophia: Do you think it belongs somewhere like an office or living room or bedroom?

Caroline: It could definitely be in an office. I keep picturing it outside, but it would have to be me-in-my-cave-next-to-the-sea sort of outside not like Six Flags Magic Mountain.

Sophia: Could you see it in a public space?

Caroline: Yeah, a public space that is not horrendously trafficked.

Sophia: Do you think each person needs her own or could it be shared?

Caroline: I think it could be shared by people. I lean more towards it being a communal resource. It doesn't feel like it ought to be like a coveted Apple computer or something where I must have my own, or an iPhone or device like that. Of course, I would enjoy having my own because it's a beautiful object. I think it would complement everyone's home quite nicely. It's not obtrusive. It kind of fits in everywhere. It could be a private item. I would enjoy having a personal...well, I guess I'm totally on the fence on that. I could see it being a shared thing, it being in a public space...I could also see it others having a personal one in their offices or their meditative spaces or something.

Sophia: I think that's all the questions I had. Did you have any other thoughts?

Caroline: It's a portal! (Investigates the dark area behind the handles.)

Sophia: I purposefully made that a very flat black and curved, so you can't see the corners.

Caroline: You can't! It's like a Mary Poppins bag. [...] It's like a portal.

This feels like a commitment that you make. There's this time to think about the pulsing and the heat. It feels like a good relativity check for one's own body too. Sometimes, I can't tell when my body is generally cold or generally hot or when it's deprived of something or if it's satisfied...I can't tell sometimes. I think this offers as a side thing a way of coming into one's self by accessing the portal.

[...] It's like a real piece of science fiction, and in this world of science fiction, I trust humans.

SUMMARY

Overall, Kim and Caroline experienced the devices in the way I hoped with a few surprises. I did not expect that the user might see the heat of the handles as limitless, especially if more people connect. Also, because people experience temperature very differently, I am not very surprised that Caroline found the heaters to be uncomfortably hot while others found them to be pleasant. A possible solution to both of these concerns is to add a dial that allows the user to choose a comfortable temperature.

Both Kim and Caroline noticed how the reflective surface of the Empathy Box encouraged associations between themselves and the people they were connected to through the device. In response to the simple and abstract interface, both constructed empathetic narratives in their minds about what the other people might be thinking and feeling. Both seemed to experience greater feelings of trust and generosity towards people in general. Both remarked on how the devices discouraged multitasking and created a space for contemplation and meditation.

Tuning the system to encourage feelings of generosity over feelings of obligation will be important. Both Kim and Caroline remarked that they felt obligated to respond to the Empathy Box if they imagined one person waiting alone. Making it more clear that many people are connected may alleviate this pressure.

Finally, I was particularly pleased that both Kim and Caroline felt the devices would help them feel a greater awareness of their own bodies in addition to the main goal of cultivating a meaningful and positive awareness of being connected with many others.

CONCLUSION

Popular connective technologies are designed to be efficient, not to be meaningful. By fixating on making connecting with others as easy as possible, as social networking applications do now, connection is cheapened. In addition, when connecting requires so little effort, we are overwhelmed with such a quantity of signals that they turn into noise. Paradoxically, though these technologies promised to save us time and keep us close to others, the very same technologies are increasing feelings of loneliness and making us more distracted than ever. Furthermore, the repercussions of loneliness on both mental and physical well-being are significant and should be taken seriously. Research shows that it is the subjective experience known as loneliness, not actually being physically alone, that is responsible for these negative consequences.

Recent discoveries in the field of cognitive science force us reconsider many of our most fundamental beliefs about the self. Because the majority of our thought processes are unconscious and experienced through the body, the most natural and efficient way to design technologies that interface with the self is to design for what Lakoff calls the embodied mind. Lakoff explains that human beings rely on primary metaphors to understand abstract concepts. These primary metaphors are the result of the conflation of sensorimotor and subjective experiences during early childhood causing the corresponding neural networks to become linked. Thus, primary metaphors can be used to both reinforce or undermine our subjective experiences. This suggests that designing for the embodied mind and leveraging primary metaphors such as "Affection is Warmth" have the potential to enhance our sense of connection with others and may be particularly be therapeutic for the lonely. With this understanding that the aesthetic qualities of a technology greatly influence its effectiveness, the perspective of an artist,

which involves expertly combining aesthetics and context to evoke meaning, is invaluable in the innovation of new technologies that interface with the self or that mediate relationships between people.

However, because these types of interactions are so powerful, designing technologies that influence the unconscious mind is a serious threat to people's autonomy. Thinking about the ethical implications of a technology from the start is more important than ever. In addition, the technology's long-term effectiveness is determined by the user's level of intrinsic motivation, which is completely dependent upon the user's sense of agency.

Inspired by science fiction, I designed and built two devices, the Empathy Box and the Empathy Amulet, that augment our sense of connection with anonymous others beyond what is possible without the use of technology. Both devices allow many anonymous people to share warmth as a means to augment our sense of connection as well as increase feelings of empathy towards strangers. Both devices encourage their users to make a deliberate and generous choice to invest their time and energy in connection with a stranger. They incorporate reciprocity into their design, such that helping oneself means helping someone else. The Empathy Box explores synchronous connection, while the Empathy Amulet uses asynchronous connection allowing the user experience the shared warmth either consciously or unconsciously. The amulet furthers my long-term goal of designing technologies that gives us a new sense of awareness, perhaps even a new modality, of our connection with others. In the future, I intend to develop and study these two devices further as well as design new technologies that deal with other mental conditions such as post-traumatic stress disorder, anxiety, depression, and more. I see the two devices as part of a new, larger interdisciplinary field of research

that incorporates interaction design, cognitive science, psychology, neuroscience, engineering, and art to build technologies that aid mental and physical well-being.

Finally, while writing this thesis, I found myself adopting the binary view of loneliness that many researchers seem to have assumed. I caught myself talking about the lonely and the non-lonely as if there are only two options, one good and one bad. Certainly, the health consequences caused by an overabundance of stress chemicals and maladaptive behaviors are serious problems, but perhaps our understanding of loneliness should not be so simplistic. Maybe loneliness should be viewed as a spectrum, and feelings of loneliness might actually be positive and beneficial. Feelings of loneliness indicate a sensitivity to seeing the potential for human connection. For example, many people experience that it can feel lonelier to live in a city full of people than to be out in the wilderness alone. These feelings of loneliness arise from being able to see the potential for connection that is not yet realized.

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APPENDIX

Full Passages from *Do Androids Dream of Electric Sheep?*

Time to grasp the handles, he said to himself, and crossed the living room to the black empathy box. When he turned it on, the usual faint smell of negative ions surged from the power supply; he breathed in eagerly, already buoyed up. Then the cathode-ray tube glowed like an imitation, feeble TV image; a collage formed, made of apparently random colors, trails, and configurations which, until the handles were grasped, amounted to nothing. So taking a deep breath to steady himself, he grasped the twin handles.

The visual image congealed; he saw at once a famous landscape, the old, brown, barren ascent, with tufts of dried-out bonelike weeds poking slantedly into a dim and sunless sky. One single figure, more or less human in form, toiled its way up the hillside: an elderly man wearing a dull, featureless robe, covering as meager as if it had been snatched from the hostile emptiness of the sky. The man, Wilbur Mercer, plodded ahead, and, as he clutched the handles, John Isidore gradually experienced a waning of the living room in which he stood; the dilapidated furniture and walls ebbed out and he ceased to experience them at all. He found himself, instead, as always before entering into the landscape of drab hill, drab sky. And at the same time he no longer witnessed the climb of the elderly man. His own feet now scraped, sought purchase among the familiar loose stones; he felt the same painful, irregular roughness beneath his feet and once again smelled the acrid haze of the sky—not Earth's sky but that of some place alien, distant, and yet, by means of the empathy box, instantly available.

He had crossed over in the usual perplexing fashion; physical merging—accompanied by mental and spiritual identification—with Wilber Mercer had reoccured. As it did for everyone who at this moment clutched the handles, either here on Earth or on one of the colony planets. He experienced them,

the others, incorporated the babble of their thoughts, heard in his own brain the noise of their many individual existences. They—and he—cared about one thing; this fusion of their mentalities oriented their attention on the hill, the climb, the need to ascend. Step by step it evolved, so slowly as to be nearly imperceptible. But it was there. Higher, he thought as stones rattled downward under his feet. Today we are higher than yesterday, and tomorrow—he, the compound figure of Wilbur Mercer, glanced up to view the ascent ahead. Impossible to make out the end. Too far. But it would come.

A rock, hurled at him, struck his arm. He felt the pain. He half turned and another rock sailed past him, missing him; it collided with the earth and the sound startled him. Who? he wondered, peering to see his tormentor. The old antagonists, manifesting themselves at the periphery of this vision; it, or they, had followed him all the way up the hill and they would remain until at the top—

He remembered the top, the sudden leveling of the hill, then the climb ceased and the other part of it began. How many times had he done this? The several times blurred; future and past blurred; what he had already experienced and what he would eventually experience blended so that nothing remained but the moment, the standing still and resting during which he rubbed the cut on his arm which the stone had left. God, he thought in

weariness. In what way is this fair? Why am I up here alone like this, being tormented by something I can't even see? And then, within him, the mutual babble of everyone else in fusion broke the illusion of aloneness.

You felt it, too, he thought. Yes, the voices answered. We got hit, on the left arm; it hurts like hell. Okay, he said. We better get started moving again. He resumed walking, and all of them accompanied him immediately.

Once, he remembered, it had been different. Back before the curse had come, an earlier, happier part of life. They, his foster parents Frank and Cora Mercer, had found him floating on an inflated rubber air-rescue raft, off the coast of New England...or had it been Mexico, near the port of Tampico? He did not now remember the circumstances. Childhood had been nice; he had loved all life, especially the animals, had in fact been able for a time to bring dead animals back as they had been. He lived with rabbits and bugs, wherever it was, either on Earth or a colony world; now he had forgotten that, too. But he recalled the killers, because they had arrested him as a freak, more special than any of the other specials. And due to that, everything had changed.

Local law prohibited the time-reversal faculty by which the dead returned to life; they had spelled it out to him during his sixteenth year. He continued for another year to do

it secretly, in the still remaining woods, but an old woman whom he had never seen or heard of had told. Without his parents' consent they—the killers—had bombarded the unique nodule which had formed in his brain, had attacked it with radioactive cobalt, and this had plunged him into a different world, one whose existence he had never suspected. It had been a pit of corpses and dead bones and he had struggled for years to get up from it. The donkey and especially the toad, the creatures most important to him, had vanished, had become extinct; only rotting fragments, an eyeless head here, part of a hand there, remained. At last a bird which had come there to die told him where he was. He had sunk down into the tomb world. He could not get out until the bones strewn around him grew back into living creatures; he had become joined to the metabolism of other lives, and until they rose he could not rise either.

How long that part of the cycle had lasted he did not now know; nothing had happened, generally, so it had been measureless. But at last the bones had regained flesh; the empty eyepits had filled up and the new eyes had seen, while meantime the restored beaks and mouths had cackled, barked, and caterwauled. Possibly he had done it; perhaps the extrasensory node of his brain had finally grown back. Or maybe he hadn't accomplished it; very likely it could have been a natural

process. Anyhow he was no longer sinking; he had begun to ascend, along with the others. Long ago he had lost sight of them. He found himself evidently climbing alone. But they were there. They still accompanied him; he felt them, strangely, inside him.

Isidore stood holding the two handles, experiencing himself as encompassing every other living thing, and then, reluctantly, he let go. It had to end, as always, and anyhow his arm ached, and bled where the rock had struck it.

Releasing the handles, he examined his arm, then made his way unsteadily to the bathroom of his apartment to wash the cut off. This was not the first wound he had received while in fusion with Mercer, and it probably would not be the last. People, especially elderly ones, had died, particularly later on at the top of the hill when the torment began in earnest. I wonder if I can go through that part again, he said to himself as he swabbed the injury. Chance of cardiac arrest; be better, he reflected, if I lived in town where those buildings have a doctor standing by with those electro-spark machines. Here, alone in this place it's too risky.

But he knew he'd take the risk. He always had before. As did most people, even oldsters who were physically fragile.
(Dick, 1968, p. 21)

[...] The Voigt-Kampff Empathy Test, had emerged as criteria by which to judge. An android, no matter how gifted as to pure intellectual capacity, could make no sense out of the fusion which took place routinely among the followers of Mercerism—an experience which he, and virtually everyone else, including subnormal chickenheads, managed with no difficulty.

He had wondered, as had most people at one time or another, precisely why an android bounced helplessly about when confronted by an empathy-measuring test. Empathy, evidently, existed only within the human community, whereas intelligence to some degree could be found throughout every phylum and order including the arachnida. For one thing, the empathic faculty probably required an unimpaired group instinct; a solitary organism, such as a spider, would have no use for it; in fact it would tend to abort a spider's ability to survive. It would make him conscious of the desire to live on the part of his prey. Hence all predators, even highly developed mammals such as cats, would starve.

Empathy, he once had decided, must be limited to herbivores or anyhow omnivores who could depart from a meat diet. Because, ultimately, the empathic gift blurred the

boundaries between hunter and victim, between the successful and the defeated. As in the fusion with Mercer, everyone ascended together or, when the cycle had come to an end, fell together into the trough of the tomb world. Oddly, it resembled a sort of biological insurance, but double-edged. As long as some creature experienced joy, then the condition for all other creatures included a fragment of joy. However, if any living being suffered, then for all the rest the shadow could not be entirely cast off. A herd animal such as a man would acquire a higher survival factor through this; an owl or a cobra would be destroyed.

Evidently the humanoid robot constituted a solitary predator. (Dick, 1968, p. 30)

"It would be immoral not to fuse with Mercer in gratitude," Iran said. "I had hold of the handles of the box today and it overcame my depression a little—just a little, not like this. But anyhow I got hit by a rock, here." She held up her wrist; on it he made out a small dark bruise. "And I remember thinking how much better we are, how much better off, when we're with Mercer. Despite the pain. Physical pain but spiritually together; I felt everyone else, all over the world, all who had

fused at the same time." She held the elevator door from sliding shut. "Get in, Rick. This'll just be for a moment. You hardly ever undergo fusion; I want you to transmit the mood you're in now to everyone else; you owe it to them. It would be immoral to keep it for ourselves."

She was, of course, right. So he entered the elevator and once again descended.

In their living room, at the empathy box, Iran swiftly snapped the switch, her face animated with growing gladness; it lit her up like a rising new crescent of moon. "I want everyone to know," she told him. "Once that happened to me; I fused and picked up someone who had just acquired an animal. And then one day—"Her features momentarily darkened; the pleasure fled. "One day I found myself receiving from someone whose animal had died. But others of us shared our different joys with them—I didn't have any, as you might know—and that cheered the person up. We might even reach a potential suicide; what we have, what we're feeling, might—"

"They'll have our joy," Rick said, "but we'll lose. We'll exchange what we feel for what they feel. Our joy will be lost."

The screen of the empathy box now showed rushing streams of bright formless color; taking a breath, his wife hung on tightly to the two handles. "We won't really lose what we feel,

not if we keep it clearly in mind. You never really have gotten the hang of fusion, have you, Rick?" (Dick, 1968, p. 173)

Ray's voice was heavy with irony... "No one watches Mercer; that's the whole point." Tossing his cigarette into the fireplace, he strode to the TV set; there, before it, Joan saw a metal box with two handles, attached by a lead of twin-cable wire to the TV set. Ray seized the two handles, and at once a grimace of pain shot across his face. "What is it?" she asked, in anxiety.

"N-nothing." Ray continued to grip the handles. On the screen, Wilbur Mercer walked slowly over the barren, jagged surface of a desolate hillside, his face lifted, an expression of serenity—or vacuity—on his thin, middle-aged features... To Joan, he explained, "This is the empathy box, my dear...when you take hold of these handles you're no longer watching Wilbur Mercer. You're actually participating in his apotheosis. Why, you're feeling what he feels."

"An empathy box," he said, stammering in his excitement, "is the most personal possession you have. It's an extension of your body; it's the way you touch other humans, it's the way you stop being alone. (Dick, 1968, p. 66)

