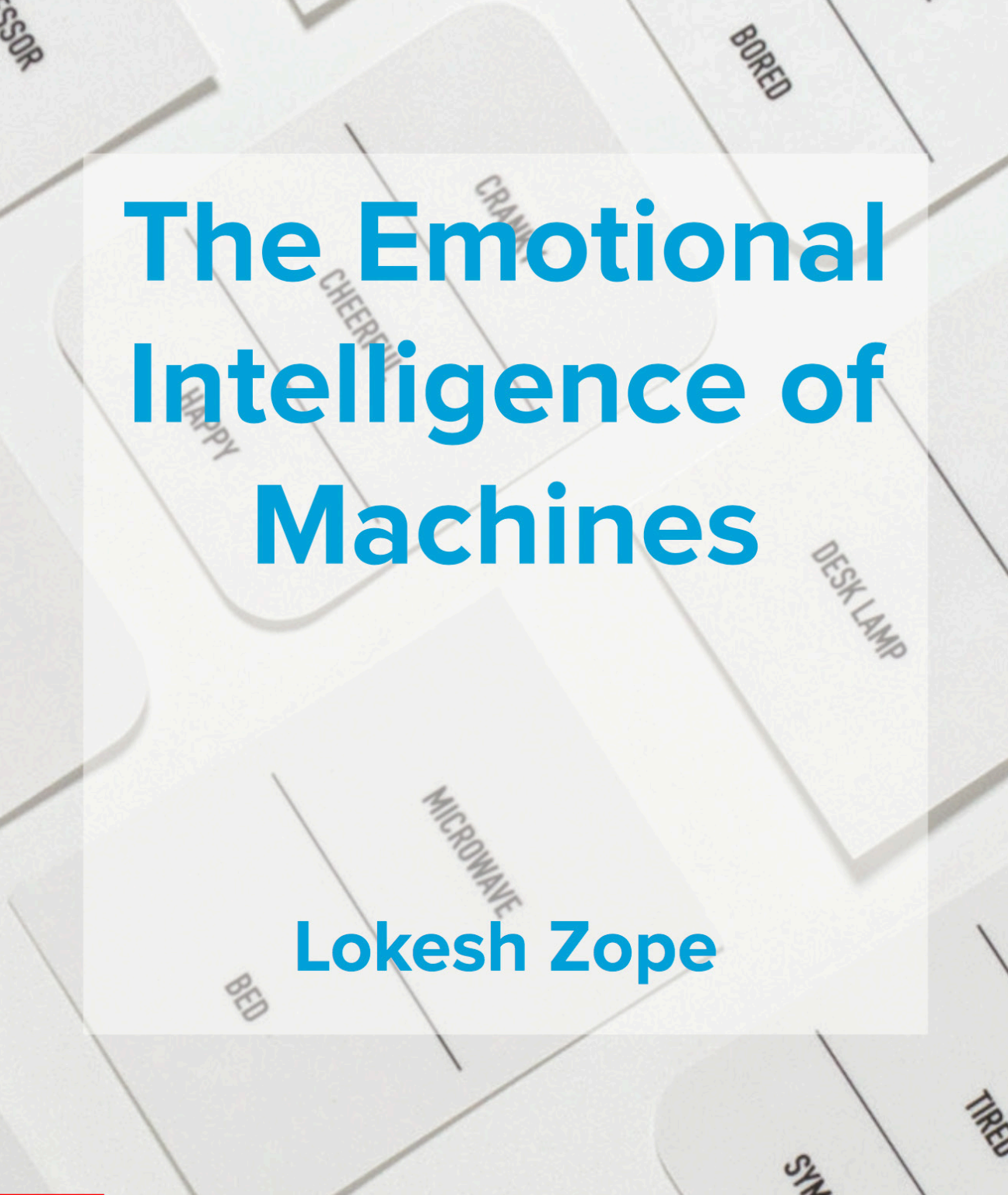

The Emotional Intelligence of Machines

Lokesh Zope

www.lokeshzope.com

The Emotional Intelligence of Machines

A thesis presented in partial fulfillment of the requirements for the degree Master of in the Department of the Rhode Island School of Design, Providence, Rhode Island.

By Lokesh Zope, 2017

Approved by Master's Examination Committee:

Professor Charles Cannon

Associate Professor, Industrial Design, Rhode Island School of Design / Full time Advisor

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Professor Joy Ko

Adjunct Professor, Architecture, Rhode Island School of Design / Part-time Advisor

---

Ryan Scott Bardsley

Senior Director R&D, Anesthesia at The Medicines Company / External Advisor

With Expert Guidance from: Dr. Peter Snyder

Sr. Vice President & Chief Research Officer, Lifespan Health System; Professor, Department of Neurology, Alpert Medical School of Brown University; Scholar in Residence, Rhode Island School of Design

To my parents

Abstract

Technologies today claim to be capable of detecting human emotion. When such technologies appear on our everyday objects, how will our interactions be like? Can these objects know when we are frustrated with them? Wouldn't that radically change the field of user experience design? However, would people be scared of such capability?

Born from this curiosity, this thesis project is a speculative and an experimental approach that explores the overlap of the fields of User Experience Design, Affective Technologies, and Artificial Intelligence. This exploration is aimed at investigating its need and illustrating a newly designed adaptive nature of domestic appliances.

*The purpose of this book is to showcase the range of collaborative explorations that led to the formulation the theory - "**Emotional Intelligence of Objects."***

“In the next 10 years, we will see the gradual transition from an Internet to a brain-net, in which thoughts, emotions, feelings, and memories might be transmitted instantly across the planet.

“Scientists can now hook the brain to a computer and begin to decode some of our memories and thoughts. This might eventually revolutionize communication and even entertainment. The movies of the future will be able to convey emotions and feelings, not just images on a silver screen. (Teenagers will go crazy on social media, sending memories and sensations from their senior prom, their first date, etc.). Historians and writers will be able to record events not just digitally, but emotionally as well.

“Perhaps even tensions between people will diminish, as people begin to feel and experience the pain of others.”

Michio Kaku
Huffington Post, 2015

Contents

Acknowledgments

This project was made possible with generous contributions from:

Charlie Cannon
Joy Ko
Ryan Bardsley
Peter Snyder
Tim Maly
Paolo Cardini
Claudia Rebola
Jessica Miller
Scott Geiger
Ayako Takase
Tanmay Dharmaraj
Brian Kane
David Kim
Khipra Nichols
Jeremy Bass
Chris Novello
Nathan Davis
Ingrid Fetell Lee
Bill Stewart
Tom Weis

Chapter Zero

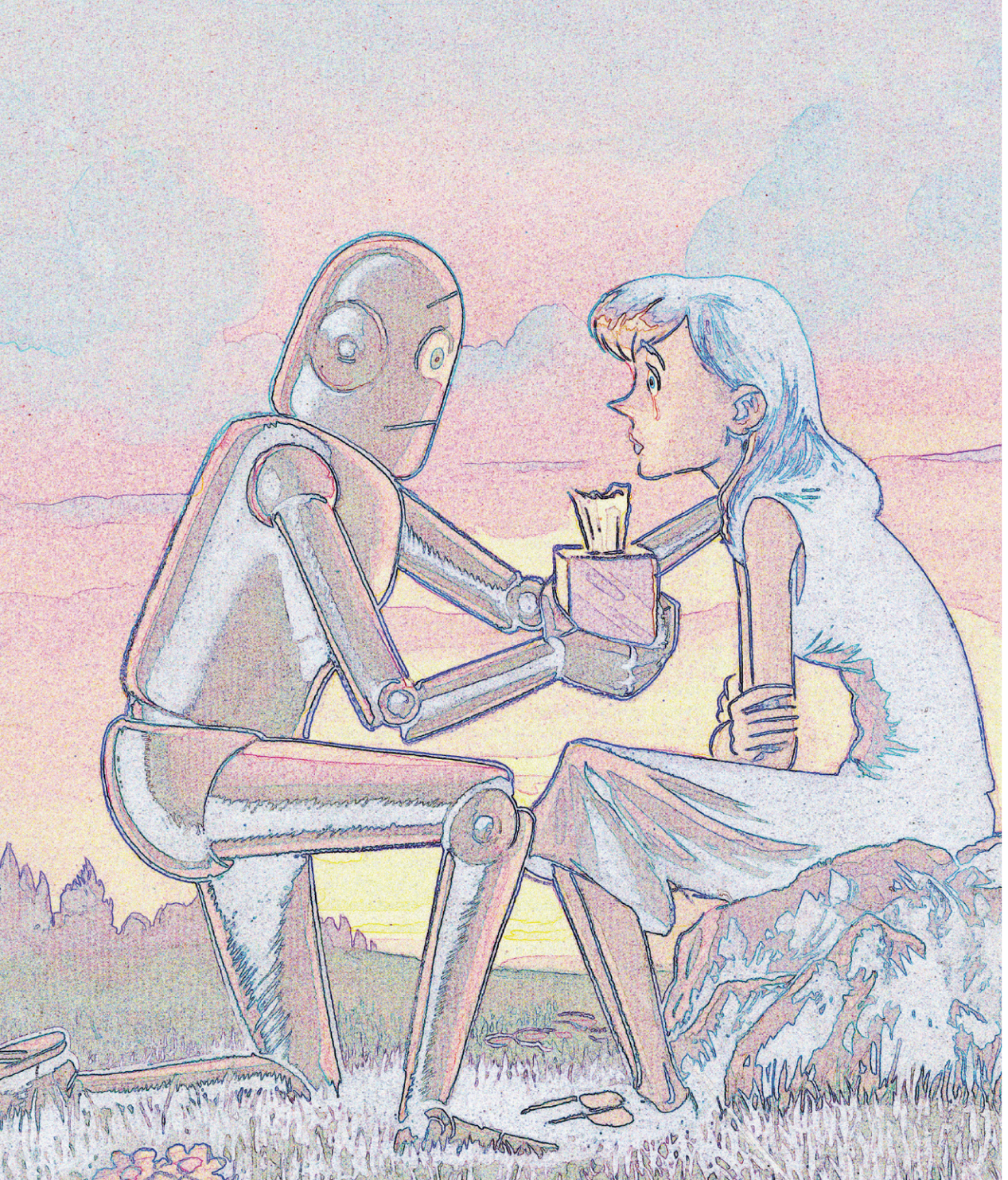
Why Should You Care?

Introduction

Everyday-objects are increasingly becoming digital and networked. Due to the incorporation of technology in them, their behavior is rapidly evolving and seemingly exhibiting personalities. Homes are becoming “smart”; cars, “driverless”; and receptionists, “virtual”. When people give objects the permission to provide them suggestions, they expect smart objects to be effective. However, for instance, when your GPS keeps repeating “Turn left...Turn left...Turn left!” and you cannot for some reason, what impact will those incessant notifications have on you? Will that make you irritated? Nervous? Your emotional response could very well impair your ability to make wise decisions or to make decisions at all. Perhaps, if your GPS understood the effect it was having on your mind and emotions, it could be more sensitive and gentle.

Our everyday decisions are mostly dependent on how we feel. Happiness makes us more open to things around us. Stress brings out our love for sweet sugary food. Anger kills our sensibility. Love takes us to unimaginable limits. Emotions matter. They help rationalize our decisions. The quality of a human being to be sensitive to other’s emotional state, be aware of their own, and act in an emotionally considerate manner is called emotional intelligence. This is an attribute that makes them efficient communicators, great companions, and effective at their tasks. I believe that the next revolution in smart objects should be an ability to be mindful of their effect on users and respond with consideration.

Would it be possible for machines to possess emotional intelligence? My work explores the meaning of emotional intelligence of objects through user research, testing, and prototyping. This exploration puts forth a theory that informs a new behavior for objects capable of producing more meaningful, respectful, and delightful interactions.



Chapter One

Emotional Intelligence Of Machines

A Brief Explanation

Intelligent objects are trained to make sense of the data available to them and respond to their users based on this programmed understanding. Artificial intelligence models that run the “brain” of such objects allow them to adapt to particular environments. The responsive behaviors of such machines lead human beings to think of them as autonomous creatures. However, if they lack emotional understanding, and their programmed responses become evident to their users, we realize that they are merely a machine and their responses become less significant to us. Especially, when we buy objects such as physical fitness trackers or meal monitoring apps to maintain healthier lifestyles, they are forgotten after about a week. We render them useless for their inability to understand what will motivate us and when a motivational response will make sense.

The understanding of human emotions should be programmed in machines’ intelligence models. This understanding includes the knowledge and ability to assess: when to intervene, when to keep quiet, how to intervene, and how to make sense of past user feedback to choose from the programmed responses.

A machine’s ability to acquire users’ affective information and to respond to it with a sensitivity to their state of mind is the programmed emotional responsiveness of machines. This trait can be perceived by human beings as their ‘emotional intelligence.’

I claim that the fibers of emotional intelligence should be weaved into the larger fabric of artificial intelligence in appropriate spaces of human-machine interaction.

Chapter Two

The Conversation Starters

Research Objects

The emotionally intelligent interactions must be carefully designed with thorough understanding of the technologies used and meticulous user research. However, this concept is new to current users, hence, research props were designed to aid the participant's imagination of future scenarios and gather their opinions about what they would prefer and what would be beneficial. Let's move on to the conversations with the potential users.

Oona

Pitch to the participants:

"Oona is an empathetic object that listens to what the user says to it and responds to the user in the language of a heartbeat. It listens through the microphone on it and decodes the content to identify the words and the tone of voice to ultimately recognize the underlying mood.

"Oona is new to the English language so it only understands a few contexts. Here are a few statements that would act as a guide.

"If you express something with fear or sadness the heart rate would slowly rise and if you said something happy or pleasant, the heartbeat would slow down."

The participants were with prompt cards with blanks for them to fill.

Research technique: Puppeteering/Wizard-of-Ozing is an experience that is choreographed for the participant to push them towards believing that a scenario exists, thereby priming them to answer research questions.

The heartbeat through a vibration motor was programmed as per the prompt card sequence to create the illusory experience of having an empathic conversation with an object. This helped in opening up deeper conversations about objects capable of being empathic and their views about affective technologies.

Prompt card questions:

My name is _____

I like to _____

I was really happy when _____

Once I was really scared when _____

I felt really proud when _____

When I first kissed my _____ I felt like _____

I don't want people to know that I _____

Some participants felt that Oona was ***like a small pet*** *because of its form and the heartbeat* ***motivated them to handle it carefully.***

Some expressed the ***need for a more precise language****. They required more quantifiable data and stated that they expect machines to be definitive.*

Some expressed a concern that if objects like these existed, ***people would lock themselves in their houses and only talk to these boxes****.*

One woman expressed that an object like this ***would help her to be more aware of how she felt*** *as sometimes she gets caught up in her own feelings and forgets to acknowledge them.*

Story Engines

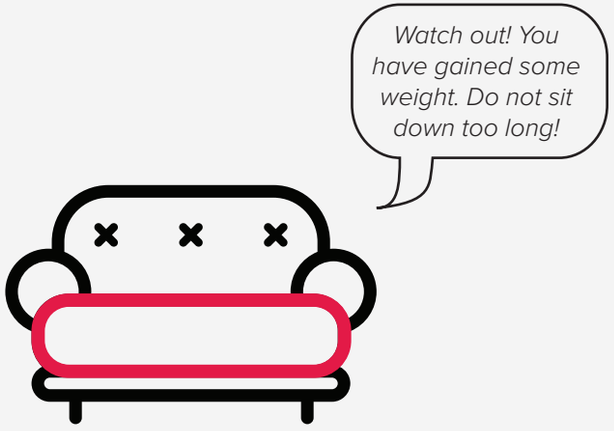
Two interactive setups to initiate conversations with participants and instigate them to share narratives from their experience about domestic objects and emotions associated to them.

1 The first engine was a card game. Participants were presented with two decks of cards; one with a choice of moods such as happy, sad, depressed, angry, etc. and the other with a choice of domestic objects such as vacuum cleaner, microwave, coffee maker, etc. They were asked to make Mood-Object pairs for instance, a Depressed-Vacuum Cleaner.

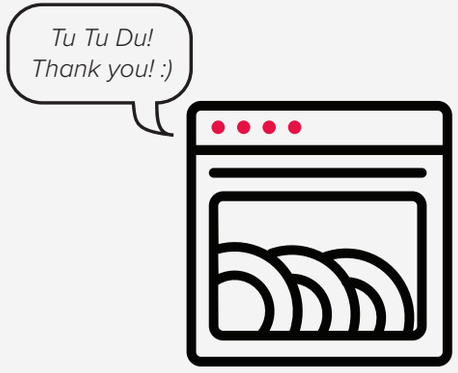
Takeaways: **The expression of an object was a reaction to the participant's interactions with them and were connected with the inherent affordances of the objects. This experiment allowed random associations that invited possible interpretations by participants. This experiment exposed subjectivities about potential emotional interactions.**

A few of the

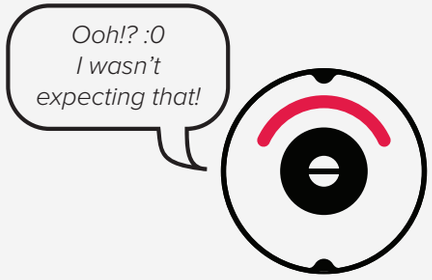
Participants' Stories



A cynical sofa
cautions you if you have gained weight.

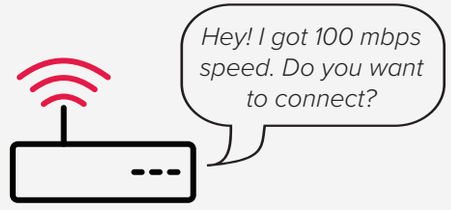


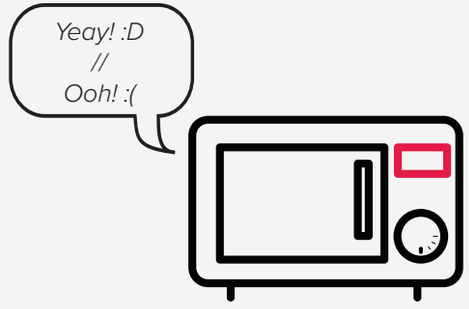
A cheerful dishwasher
hums tunes while washing dishes and thanks you for giving it your dishes!



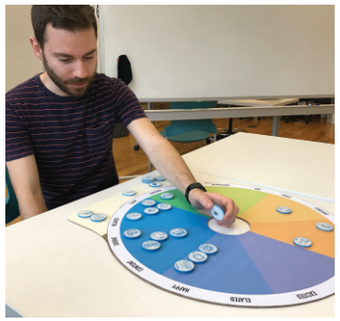
A confused vacuum cleaner *(Rhoomba) sucks up something that it shouldn't such as a pen-cap or a screw. It would show its distaste.*

A flirty wifi-router *sees other devices coming into its range and tries to lure them in. The devices would get distracted by a superior wifi connections around.*





A stressed microwave
changes its mood based on the healthiness of your food choice and makes a happy or a sad sound accordingly.



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The second engine is a board game consisting a wheel of moods segmented into four categorical sections: high energy-positive, high energy-negative, low energy-positive, and low energy-negative. Participants were presented with plastic chips having icons of domestic objects. They were asked to place the objects near the corresponding mood relevant to their experience with the object.

Takeaways: Participants were discovering their emotional relationships with their everyday-objects while interacting with the board. This allowed me to get their pain-points, in other words, build new problem statements. After being prompted to think about their emotions towards objects, participants were discovering new relationships and were able to describe how they would imagine its new design. In the beginning, none of the participants could accurately describe their relationship with their work computer/laptop and at the end, everyone described it as a stressful relationship.

This exercise provided new narratives which were used to build quick diegetic prototypes discussed in the next chapter.

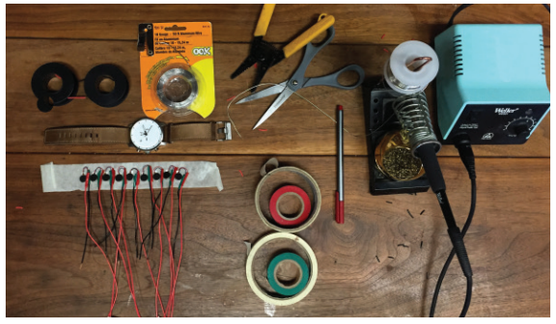
Chapter Three

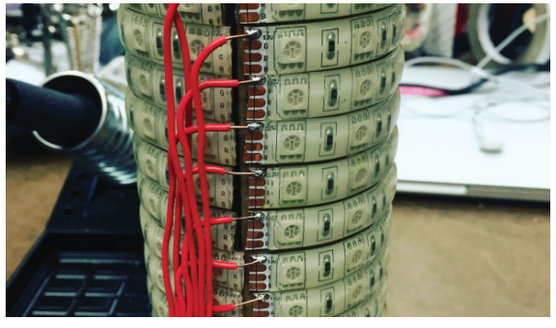
Catalog of earlier exploration

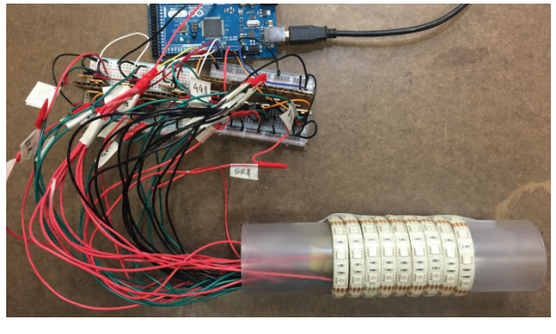
Diegetic Prototypes

A collection of prototypes to generate deeper insights about people's preferences and expectations that feeds into the theory of emotional intelligence of machines.

Some prototypes were developed with self-generated curiosity and some are a response to the narratives generated by the participants from the Story Engines.





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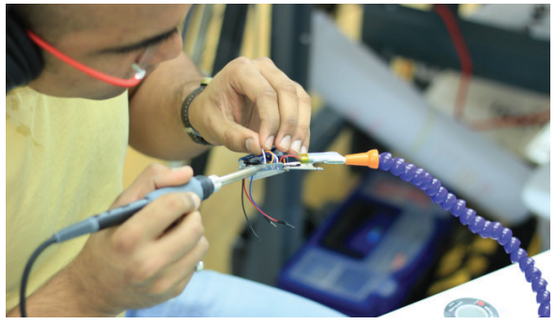
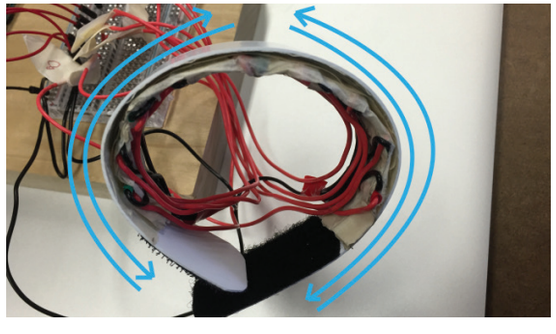
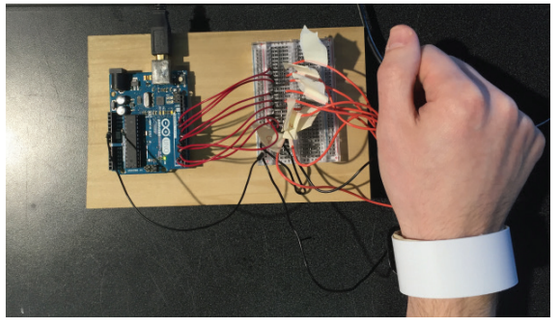






Prototype 1.

Comfort Huggable

Empathy objects

Takeaway: Objects responding to emotions can potentially be a source of comfort to those who find trouble in reaching out to others for emotional help.

Description: A child has just walked out of an embarrassing conversation with a friend. She feels insecure and shy. She does not have the courage to speak with anyone from her family. She resorts to the comfort-cushion and hugs it tightly. The cushion recognizes the force that the child puts on it and the sensors on the cushion touching her palm detect a severe change in emotions. The cushion warms up gently and provides thermal comfort.

Prototype 2.

Emotion Feedback Bracelet

Commercial perspective

Takeaway: Anonymous emotional data collection can inform the curators which museum exhibits are receiving more response. This might help in curation of the exhibits. However, to be able to share such private information would require a certain level of acceptance from people. This information should be collected only with participant's consent.

Description: A visitor at the museum wears the bracelet and walks around viewing the art exhibits. He stops at a painting and looks at it for a while. He is overwhelmed by the artist's expression, the emotional change is recorded, and the proximity sensors index the painting.

The museum curator has a map of emotions corresponding to every exhibit and they learn about which objects create genuine interest in the visitors from the map. This honest feedback might help the curators to choose pieces for the future exhibitions.

Prototype 3.

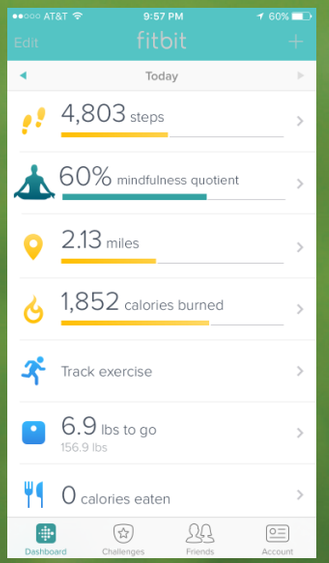
FitBitMind

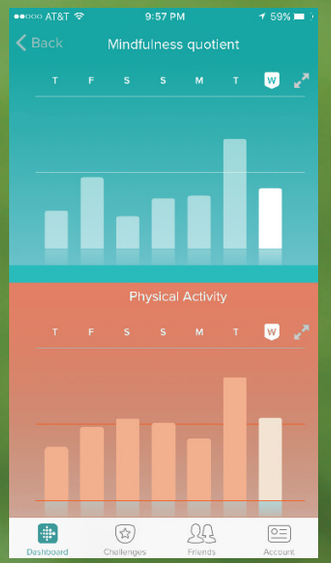
Shade of information

Description: FitBitMind is a holistic health tracker. Along with tracking physical activities, its sensors detect physiological signs that point towards the emotional status of the user and recognize if they feel stressed. However, instead of conveying that the user is highly stressed, the band conveys that they are less mindful, thereby indicating to them that they should work towards being more mindful. This measure of stress is communicated through a new term: Mindfulness Quotient.

Sam checks his FitBitMind app and finds that his Mindfulness Quotient is lower than that from the last week. He realizes that lately he hasn't been feeling particularly productive. He uses FitBitMind's recommended guided meditation with built-in vibration motors on the band. He starts to feel better and notices that he has been more physically active as well. He also learns that being mindful helps him to remain physically active.

Takeaway: A machine's read on emotions are numbers. One of the major responsibilities of an emotionally responsive object would be to provide useful information in a manner that motivates users to make good use of it. Translating the right data into a right form for communication can prove to be very beneficial. The effectiveness of this translated form can be identified with appropriate user research.





Prototype 4.

Winki

Companionship through objects

Description: Ryan and Alison are in a long-distance relationship. They both have Winki near their beds. Their sleep trackers and lamps are connected over the Internet. Today Alison is home all day. It is evening and Ryan walks into his house. The device at Ryan's house detects his presence and lights up Alison's lamp. She notices that and learns that he is home now. The lamp at Ryan's is already lit up as she is at home all day.

Now it is sleeping time. Alison is about to sleep. Lamp at Ryan's starts to get sleepy. Lamp at Alison's is all lit up as Ryan is still working. He notices that she is sleepy and doesn't want to keep her up. So he turns off his laptop and goes to bed.

Takeaway: Abstract human-like characteristics integrated into objects can communicate deeper meaning. Material and phenomenal qualities of an object's design can afford a powerful medium for representing the presence and activity of other loved people.

Prototype 5.

Qualitative Watch

Resolution of data

Description: He used to constantly look at his digital watch because of his anxiety. Whenever he looked at the precise time he used to realize how fewer and fewer hours were left in the day to achieve his goals and that used to cause stress.

He now uses a watch that is designed to be mindful of its effect on him. As he lifts his wrist to look at his watch, it shows him the time of the day in the form of a color. The color rather than representing a precise time, gives him a rough idea of the time in the day. He always has the option to tap on the watch to know the precise time if needed. The colors respond to the ones seen in the sky at respective times so that he would intuitively be able to associate them to the time of the day.

Takeaway: User testing of this watch revealed that the interactions with digital objects should be designed so that the display of data does not induce stress or demand excessive cognitive attention. All digital objects provides information at a certain resolution. This resolution should be set to be considerate of its effect on the user.

Prototype 6.

Dexcom Ring

UI mindful of social etiquettes

Description: His six-year old daughter has type-1 diabetes. He deeply cares for her. He bought a Dexcom blood glucose monitoring system. A sensor sits on her abdomen and constantly reads her blood glucose (BG) levels. The device has a smartphone application that receives her BG levels every 5 minutes in the day which is 288 times in 24 hours.

He would receive a notification if it requires his attention. However, he is always anxious to know if the BG levels are under control. When he was in meetings he would pull out his phone and check the levels. He could not help but keep checking the levels, although checking phone in middle of a conversation could be perceived as socially disrespectful.

The ring offers him a new interface. It has a scroll wheel on it and if it is moved a quarter turn it snaps into a position and communicates with the phone to know if everything's under control or if immediate attention is needed. It notifies him of either one of the message using distinct haptic patterns.

He now scrolls the wheel whenever he feels anxious to know her condition. Nobody notices that he is checking it, thereby eliminating the element of social disrespect.

Takeaway: Follow-up with a user of Dexcom product helped me to affirm that most design solutions requiring digital platforms resort to visual interfaces. Major reasons being that it facilitates ease of execution and a broader range of functionality. However, screen interfaces can be perceived with a social stigma in certain situations. Digital applications that require such high number of interactions should be designed to preempt compulsive human behavior in response to limitless data inputs. They should be designed so they are respectful of others around the user.

Prototype 7.

Dishwasher + Sleep

Intuitive and meaningful notifications

Description: She used the f.lux app on her laptop to remind her to go to bed. Starting from 10 PM every hour a notification popped out *“8 hours to wake up”, “7 hours to wake up”,* and so on. She had turned off the color change long ago and felt that the notifications nagged her.

Scenario 1: She installs an emotionally intelligent home system. She asks to it *“Can you remind me to sleep on time?”.* It replies, *“Sure! Would you like me to do anything specific at the time of reminder?”* She says with a lack of thought, *“I don’t know. Figure something out.” “Got it”*, the system acknowledges.

The system is programmed to recognize patterns and derive relationships between user’s activities. It starts to learn what makes her feel sleepy from her sleep tracker. It recognizes that every time dishwasher switches on, she feels a little drowsy. The system asks, *“I may be wrong but it seems like the running dishwasher makes you feel sleepy. Can I switch it on as a bedtime reminder?”* She realizes that the sound of water in it makes her feel calm and she approves the request. Now around 10 PM when the dishwasher goes on. It reminds her to go to bed and she likes the way the system notifies her of that.

Scenario 2: It is 10 PM. She is ready to go out for a party. But now the dishwasher switches on. She does not like that and says to the system with slight annoyance in the tone, *“Hey don’t switch it on now, I am going for a party!”*. The system responds, *“Got it. Do you want me to remember that every time you have an appointment?”* She affirms that and now the system adapts to the new requirement.

Takeaway: Emotionally intelligent machines could be programmed to identify unique relationships that users have with objects through pattern recognition. AI models have classifiers (mathematical equations that classify the sample data set) that can recognize new patterns. Detailed user research could help identify the requirement of such classifiers that could help designers to build intuitive and meaningful interfaces. Intelligence models allow machines to be programmed constantly and this could make machines more adaptive and customizable for specific requirements of every user.

Chapter Five

The Theory

Building Emotional Intelligence Into Machines: A Detailed Account

Intelligence in human beings is defined as the capacity to generate adaptive behavior resulting from within-lifetime experiences leading to changes in the brain states. This adaptive behavior enables human beings to acquire information from sources around them and apply it to achieve a desired result. The acquisition entails being able to seek and choose appropriate sources and read relevant information from them. The past experiences create knowledge that can be employed in future experiences, real and potential.

Recently, we have been designing and programming machines to appear intelligent. These machines are equipped to acquire information from the surroundings with the use of electronic sensors and external sources such as the Internet. This information then goes through human defined classifiers (mathematical equations that help segregating data sets) which look for predefined patterns from the streams of data acquired. Machines are programmed to act in desired ways based on its analysis.

This artificial intelligence is now built into the objects that we use on a daily basis. Internet-based search engines predict what we would like to look up before typing the entire keyphrase. Music services such as Spotify and Pandora suggest the music that we might like. Google Home can work with appliance switches, etcetera. These objects/services make suggestions and sometimes decisions based on user's past choices and inputs.

Slowly more devices in our home will become artificially intelligent. From my research, I have gathered that people have unique relationships with the objects that they interact with on daily basis. As these objects become more responsive, humans begin to perceive personalities and their performance affects the user's emotional state. Hence, there would be a requirement for these machines to seek information related to the emotional states of the user as well. So that they could be programed to be mindful of their effect on its users.

Designing machines with programmed understanding of user's feelings into its intelligence architecture is the beginning of emotional intelligence in machines. Emotion should be the extra layer of information and reasoning added to the existing architecture in order to bring machines' 'understanding' closer to that of human beings.

Human cognition interprets and understands the world around us, while emotions allow us to make quick decisions about it.[1] If objects would be able to accommodate the user's feelings while making suggestions, they would seem more meaningful. These objects should not make decisions for us but only make suggestions that help us in the process by showing us a broader context.

> **We have a tendency to give human attributes to objects that appear to be autonomous and we form relationships with them. Hence, intentionally anthropomorphizing objects with helpful behaviors could lead to better and healthier interactions. And if objects are programmed to respond to users' affect, the responsiveness will be perceived as their emotional intelligence.**

This programmed emotional responsiveness, in other words, the perceived emotional intelligence involves a two-stage capacity.

1 ACQUISITION: its ability to acquire information about the emotions with the use of electronic sensors, learning users behavior patterns from the interaction with the machine, and external sources of information such as the Internet.

2 APPLICATION: its ability to act (through appropriate programming) considering the user's affect based on the acquired knowledge.

1. Norman, Donald. Emotional Design: Why We Love (or Hate) Everyday Things. New York: Basic Books, 2005.

The Acquisition

Based on expert interviews and research papers

Designers might pursue emotionally intelligent objects programmed to be sensitive to the information pertaining to the user's emotion involved during their interaction with objects. **Designers would need to learn to find markers within the interaction with the object that correspond to such information and choose appropriate sensors for the object.** The information might be gathered in ways that minimize the efforts required from the user and result into elegant user interaction.

Human emotional states reflect significantly through physiological changes. **These changes can be tracked through the use of electronic sensors that detect characteristics such as galvanic skin response, skin temperature, heart beat, facial changes, brain activity, etcetera.** Based on statistical analysis of the physiological information gathered, the emotional states could be segregated for each user. Machines should be programmed to find patterns in this information which can be used as one of the factors while making suggestions.

The Application

Based on the insights from catalog of diegetic prototypes and user interviews

Application Model

The responses of the 'emotionally intelligent objects' should be characterized by the following elements as per relevance:

Abstract human-like behavioral characteristics:

The response could be characterized by the good qualities portrayed by a human like forgiveness, kindness, politeness, apologetic, etcetera.

Right shade of information:

If the information is presented in the right form it could help the user make decisions and act on it if required.

Physical affordances mindful of social etiquettes:

As the digital platforms now travel with us in our pockets and wrists, they would need to be designed to be respectful of the user's social surroundings.

Minimal cognitive load:

The information presented to the users through digital platforms in ways that preserve their mental energy and protects against compulsive behavior.

Occasional delightful surprises: (if relevant)

Devices could occasionally exhibit positive behaviors capable of delightfully surprising the user.

Poetic/emotional significance: (if applicable)

If the response has a reflection of the past pleasant experiences, the responses become more personal and has the capacity to hold poetic or emotional significance.

Future Design Challenges

Emotions are sometimes extremely private, and a mere thought of machines capable of sensing and knowing their emotional state distresses people today. It is necessary for the designer to handle this subject with utmost sensitivity and beware that the knowledge of emotions to machines should not be disruptive. Here are some of the major challenges of the emergence of such technology that would need to be addressed.

Fear of surveillance:

Artificial Intelligence requires information gathering from disparate sources. With the current revelations of how government is learning about people from the cameras and microphones on our devices, users can be extremely reluctant to adopt these objects.

Standardized understanding of emotions through the lens of machine intelligence:

Emotions are a very complex area for a machine to be absolutely certain on its assessment. The emergence of this field might lead to people trusting machines to help them understand their or others emotions rather than attempting to do so themselves.

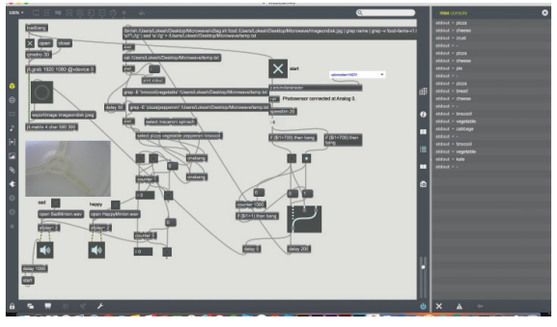
Technological dependencies:

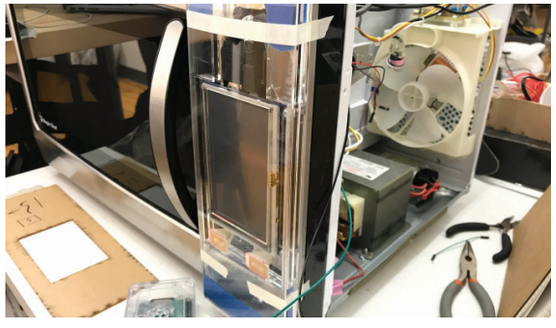
Humans have been known to grow dependent on the tools that they use. We outsource much of our thinking to machines. As a result, we are losing some of our cognitive abilities to the newly required ones. Dependence on technologies augmenting our emotional understanding could alter our emotional abilities which would be hard to anticipate.

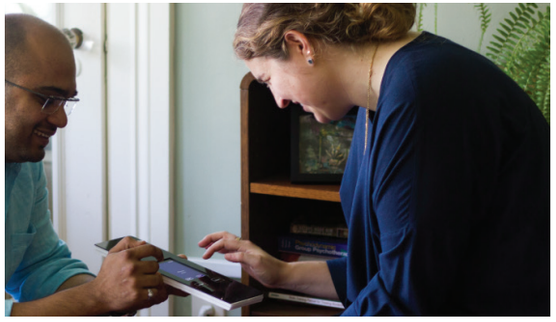
Personalities in subservient roles:

As a result of anthropomorphizing more objects gain personalities. For economic reasons, technological companies have been using feminine personalities. This practice perpetuates the stereotype of women in subservient roles.

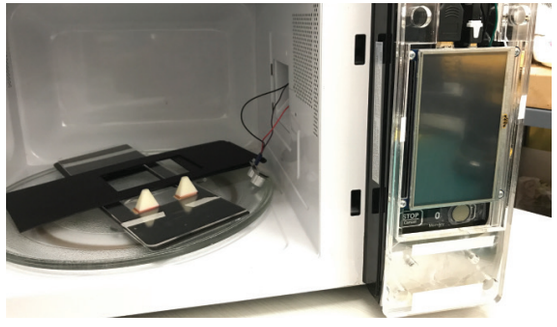

SHARP Carousel

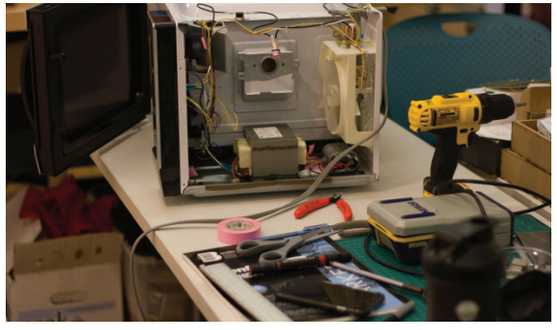


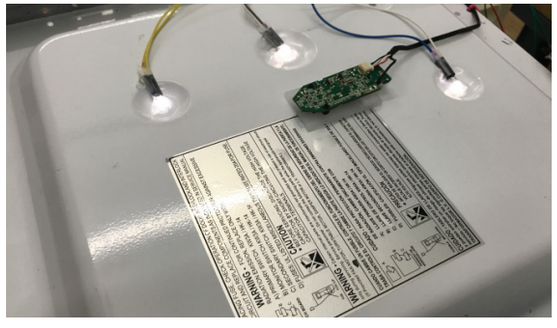





START
STOP








Magic Chef
STOP
START

Chapter Six

The Designed Object

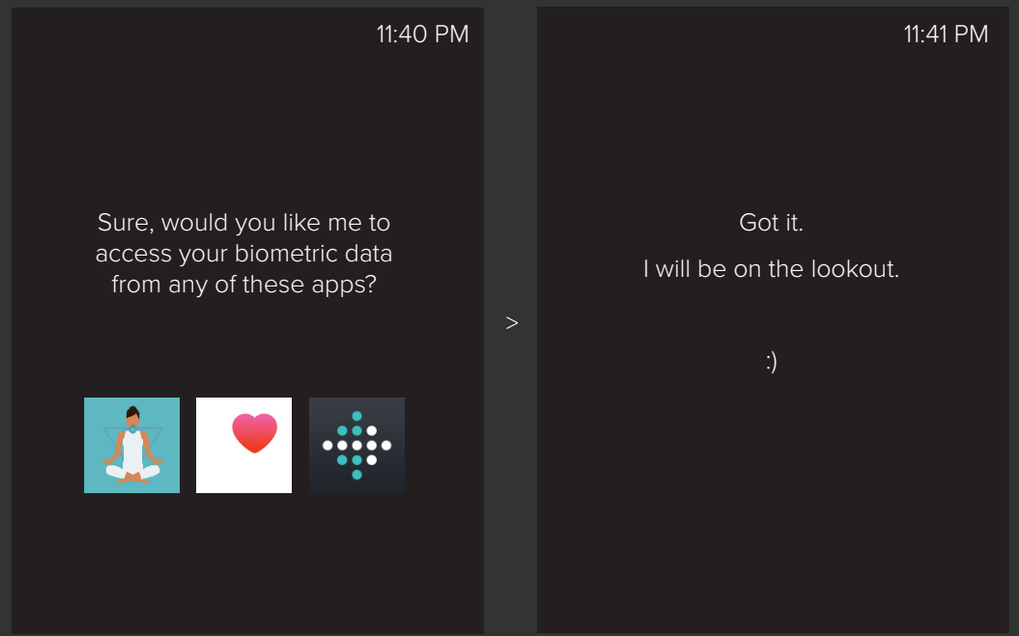
Programmed Emotional Intelligence Of The Microwave

Future year 20xx. J wears a wristband that helps him keep track of his physical activities, his mindfulness, and emotional conditions. His home has an emotionally intelligent network. Most of the appliances are automated and are connected with each other over the Internet.

It is 11.40 PM on a Sunday. He is tired but realizes that he has to probably work all night to get his tasks done. He thinks may be a snack will help him keep going through the night. He walks into his kitchen, pulls out a macaroni and cheese from the freezer and opens the package. Before putting it into the microwave he contemplates that his food choices have not been healthy lately. He says, *"Hey Microwave, can you help me make healthier food choices?"*

Microwave responds, *"Sure, would you like me to access your biometric data from any of these apps?"* He selects his wristband app. It affirms, *"Okay, I will be on the lookout. :)"* He grabs a bottle of water from the refrigerator and gets back to work.

Narrative film: vimeo.com/218616604



The design of emotionally intelligent machines could be approached by imagining a human being performing the task allotted to the machine. The characteristics required by the person to complete the job with utmost emotional intelligence such as kindness, forgiveness or, humility can be built into the machines.

The microwave parses the query through its programmed intelligence to understand that a character of a *therapist* would be ideal to perform the task allotted.

A Therapist's Perspective:
A therapist is aware that they cannot act for you. They help you reflect on your actions and learn about the implications. They do not make decisions for you or push you towards a particular decision.

Usually our emotions can color how we view things and a therapist helps illuminate the situation and help gain insight into why we make certain choices. They help their patients to recognize patterns from the history of their behaviors and understand subsequent moods. They also motivate the patient to introspect about their subjective views of the situation, learn from the experience, and encourage them to make a more holistic decision.

Jessica Miller

Psychologist
Counseling and Psychological Services
Rhode Island School of Design

The sentences in the conversations between the Microwave and the user were composed with Jessica's guidance. She provided the therapist's viewpoint which was used to build the personality of the Microwave. The sentences were carefully formulated by paying attention to their implied meaning to achieve the intended design outcome.

J is keeping himself extremely busy lately. His busyness is reflecting on his emotions and the stress is making it harder for him to make better decisions about his health. He has been stress eating and resorting to carbohydrate-loaded meals.

A Tuesday night, 12:30 AM. He craves for a slice of pizza from his refrigerator. He puts it on a plate and places it in the Microwave. It senses the presence of food it takes the picture, communicates with a image-recognition API, and learns that it is a slice of pizza. It deduces that it could not be a healthier choice after referring to the diet database recommended for J and finds a contradiction with the active query of helping J make healthier food choices.

> *It decides that an intervention would be required then and chooses the first level of intervention - polite and self-reflective.*

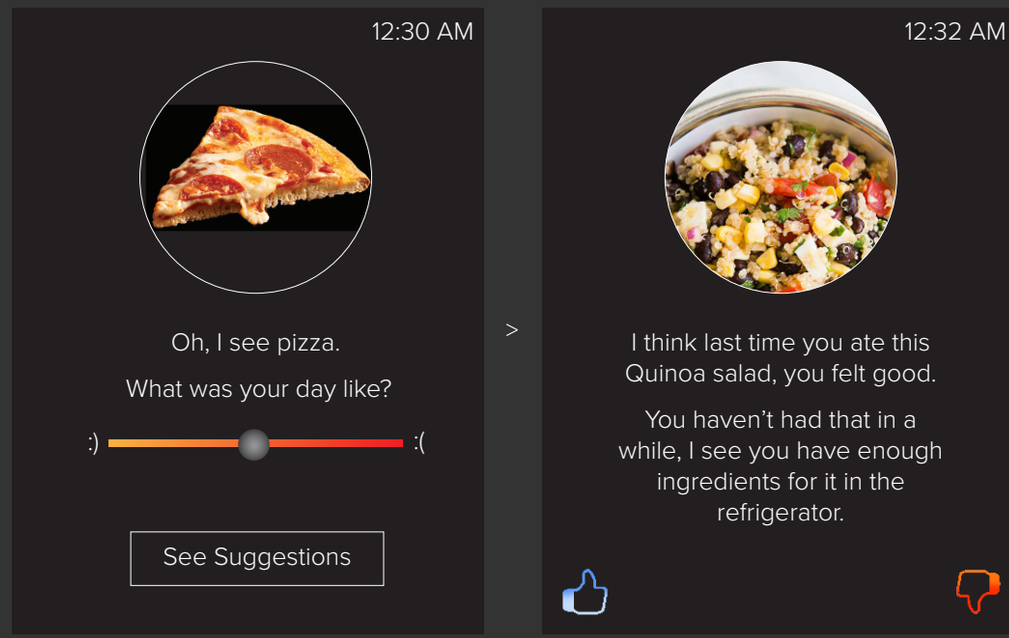
It says, *"Oh, I see pizza. What was your day like?"* and offers a slider to rate his day. As he chooses a value on the scale he realizes that he had a stressful one. The microwave offers him a suggestion.

"The last time you had this Quinoa salad you felt good."

> *It refers to past evidence of a good choice for making suggestions and when it lacks a past experiences, it defaults to the pre-programmed ones.*

"You haven't had that in a while; (Talks to the refrigerator) I see some ingredients for it in the refrigerator."

He thinks he deserves the slice for the kind of day he's had. He rejects the suggestion and heats the slice anyway. The microwave learns that this intervention was ignored.



Friday, 2 AM. He is extremely stressed, chooses a macaroni and cheese from the freezer, and shoves it into the microwave.

The Microwave realizes the contradiction with the query, however, also learns that there is evidence of high stress levels from his wrist band.

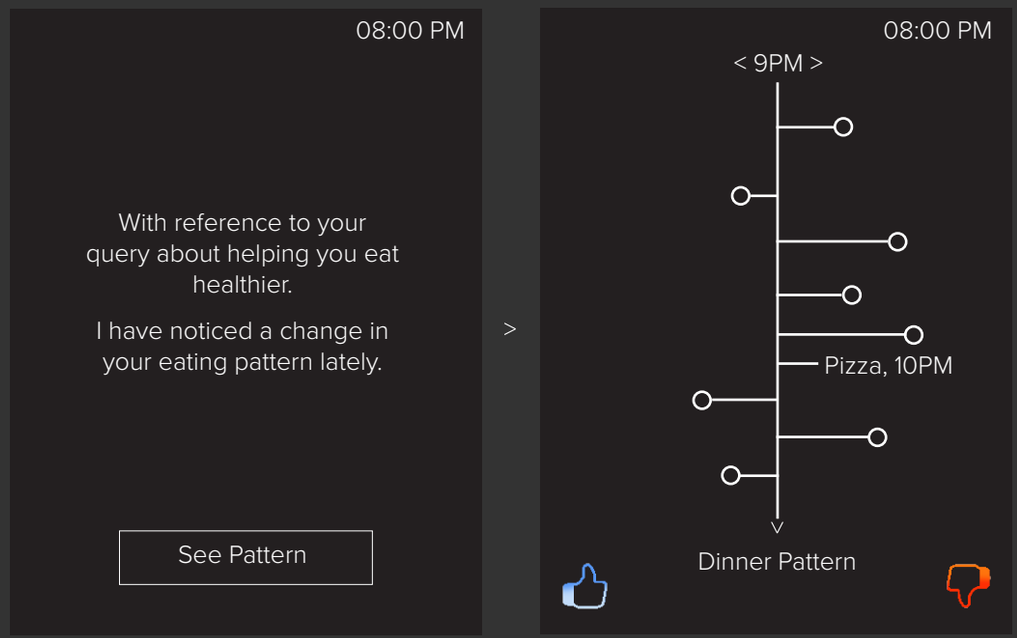
> *An emotionally intelligent machine is aware when to intervene and when to remain quiet. High stress impairs our abilities to accommodate for a lesson or to self-reflect. Timing responses to when they will be best received allows for ongoing positive reinforcement.*

The Microwave remains quiet this time and heats the meal.

On the next night it finds evidence of a pleasant mindset and when he approaches, it says, *"With reference to your query about helping you eat healthier. I have noticed a change in your eating pattern lately."*

> *The machine waited till it received an evidence of a pleasant state of mind which indicate a more accommodating mentality.*

It shows him the choices that he has made for the past week on a graph. It also offers some alternative healthier food choices. These choices are conditioned to his preferred flavor profiles which could motivate him to make those choices.



It has been a few days since he has been choosing meals that would not be recommended for his diet. One morning, as he walks over into the kitchen. His Microwave says, *"I see that, we aren't meeting your goal of making healthier food choices. Would it be better if I pushed you more next time?"*

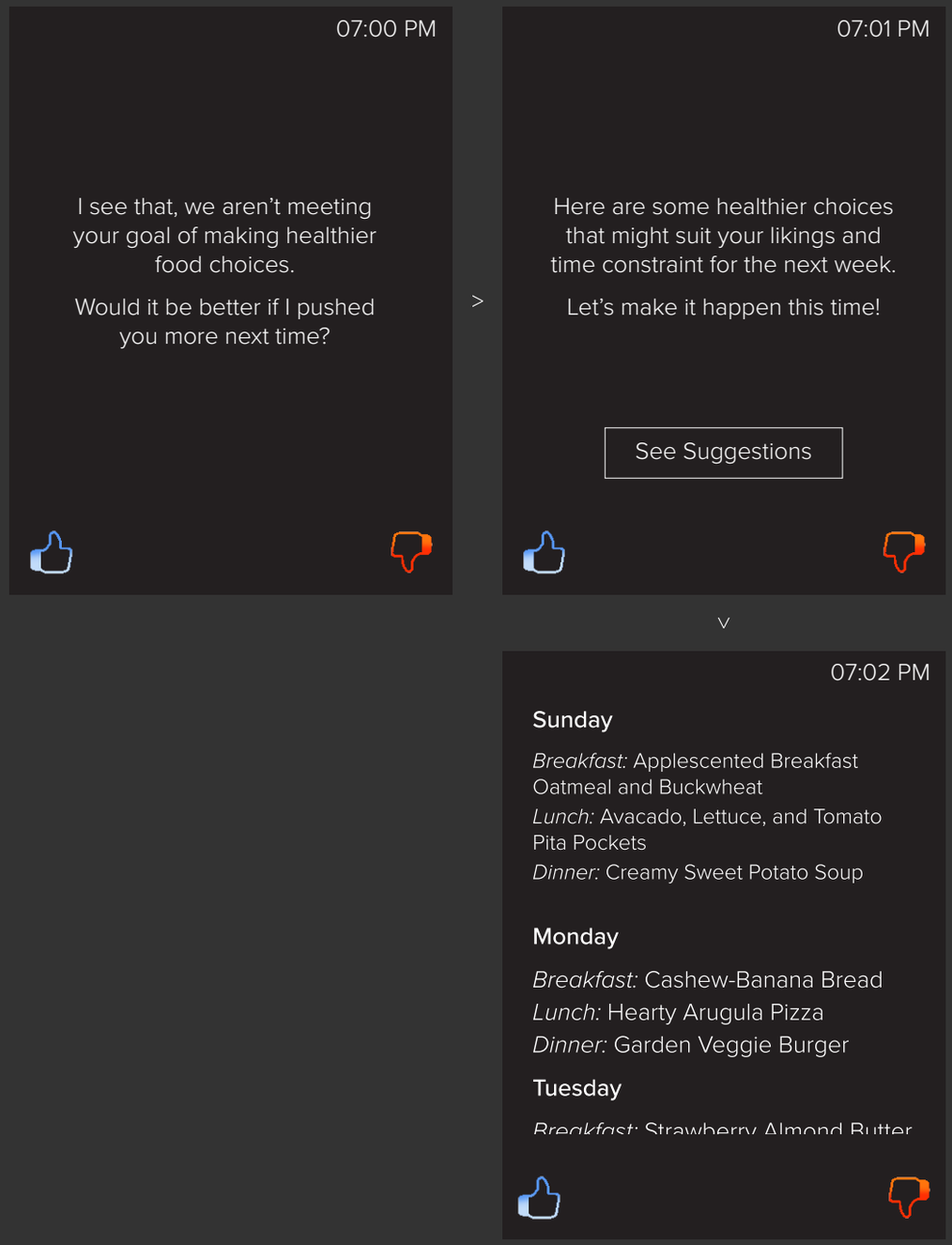
> ***The machine admits its failure graciously and suggests if it could be more stern.***

He agrees to that. Hence, the Microwave assumes a stricter role which would mean that the interventions will have a more stern tone.

It says, *"Here are some healthier choices that might suit your likings and time constraint for the next week. Let's make it happen this time!"*

He smiles, exclaims *"Okay!"*, sees the suggestions and leaves with a hint of delight on his face.

The Microwave continues to assess his meal choices for him, adopts new methods as per requirements and help him to make healthier food choices.



Chapter Seven

Claims

Conclusion

The Microwave is a vehicle to illustrate the theory of emotional intelligence of machines. The acquisition presented in the example is limited to information that the Microwave has access to.

> **However, I imagine a central intelligence system that has access to all the appliances and the information is gathered from all of them. For machines to truly be able to intervene will require more reliable and holistic data which can be gathered by fool-proof acquisition systems.**

The Microwave adopted a personality of a *therapist* to J's query of helping him with his food choices. Machines can have multiple personality traits programmed in them. A *butler* will be the quiet unintrusive helper when we have guests over and want the machines to be out of our conversations. A *nanny* when parents are out and the child wants to make their own breakfast. Perhaps even someone like *Weebo* from the movie *Flubber* who talks through television references.

> **The larger idea is to give meaning to the interactions, build trust in people for machines, and cultivate familiarity in how they interact with us. The right personality trait can be chosen based on the user's query type and can be adapted to user's past preferences.**

We walk over to a door handle and intuitively know how to open it. We know to be aware of sharp corners and find soft edges inviting. We have developed a shorthand for the physicality of objects. Today, a child walks over to a bright television screen and swipes their finger on it. How are we engraining a similar shorthand for digital objects in the next generations? Digital systems offer multiplicity in response platforms. The Microwave illustrates verbal personality expression. However, just like *Winki* (page 28) explores sleepy eyes, *Comfort Huggable* (page 22) utilizes warmth from a hug, machines can possibly produce light, sound, haptic and even olfactory or taste patterns based on the requirements.

> **Machines can possibly seem more dynamic, engaging, and intuitive with the use of right language.**

Digitalization demands a change in the way User-Centered Design is practiced today. The emergence of Affective Technologies and Artificial Intelligence has the capacity to enrich it.

We (designers) bear the responsibility to enhance and possess the strength to revolutionize human-machine interaction for the next generations.

Images Included

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Process Images: Qualitative Watch - Testing the function, Qualitative Watch- Soldering the electronic parts, Winki - Testing, WatchCase Iterations, FitBitMind - Vibration direction, FitBitMind - Working model.

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Staging of Comfort Huggable in use (Nora Cardini), Lokesh Zope, May 8, 2017.

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Staging of Emotion Feedback Bracelet in use (Jeremy Bass), Lokesh Zope, May 7, 2017.

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Staging of FitBitMind in use (Jeremy Bass), Lokesh Zope, May 7, 2017.

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Illustration 1,2, & 3: FitBitMind App Interface Model, Lokesh Zope, April 20, 2016.

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Staging of Winki in use (Ryan Ferguson), Lokesh Zope, May 7, 2017.

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Staging of Qualitative Watch in use (Ryan Ferguson), Lokesh Zope, May 5, 2017.

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Illustration: Stages of Qualitative Watch throughout the day, Lokesh Zope, April 20, 2017.

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Staging of Dexcom Ring in use (Ryan Ferguson), Lokesh Zope, May 5, 2017.

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Sims, Amanda, https://food52.com/blog/15860-5-less-boring-ways-to-pattern-subway-tiles-if-you-must-use-them, accessed May 5, 2017.

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Illustration: Emotional Intelligence Application Model, Lokesh Zope, April 23, 2016.

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Process Images: Microwave - Model1, User-testing, Augmented Microwave, At Devoxx US (San Jose, CA) Conference, Prototyping Microwave interface, MAX MSP code, Hacking in process.

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Process Images: Hacking in progress, Interface Testing with Jessica Miller, Interface testing model (2), Installation of Distance Sensor, Microwave interiors, Camera Installation, finished Interface.

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Microwave Interface Narrative Snapshot, Lokesh Zope, May 2, 2017.
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Illustration 1, 2: Microwave Interface wireframe, Lokesh Zope, May 2, 2017.

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Illustration 1, 2: Microwave Interface wireframe, Lokesh Zope, May 2, 2017.

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Illustration 1, 2, 3: Microwave Interface wireframe, Lokesh Zope, May 2, 2017.

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