Anticipatory Workstation

Responding to Stress through the Design of Smart Objects

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Abstract

This research explores the use of an anticipatory system involving smart objects as a vehicle for reducing stress within a workstation environment. Connected workplace technologies often demand our undivided attention, pushing us from one task to the next via hard-to-ignore notifications, alerts, buzzes, beeps, and alarms. While this constant demand for attention may potentially increase worker productivity, it simultaneously increases stress levels. Unobtrusive technology that operates on the periphery of the user's attention—or moves smoothly from periphery to center and back—could create more calming workplace environments, particularly if such technology anticipates and responds to user stress.

Through embedded means of input and output, smart objects promise more natural and seamless interactions. Mark Weiser and John Seely Brown discuss the idea of calm technology, wherein objects can engage both the center and the periphery of our attention, thereby behaving in a less obtrusive manner. Other researchers agree and have created their own frameworks for understanding user attention levels. This investigation considers focused, peripheral and implicit interactions through the lens of David Rose's "Designing for Subtlety" scale, which defines ways that smart objects can communicate with users while respecting the user's attention. As Rose suggests—and synesthetic research engineer Michael Haverkamp, describes—different bodily senses (modalities) can engage with data to produce peripheral and implicit interactions via connected devices. This study identifies opportunities for such ambient, anticipatory design interventions to redefine the workstation user experience in an attempt to lower stress via a more thoughtful engagement with human attention levels.

Anticipatory System
a system containing a predictive model of itself and/or of its environment that allows it to change state at an instant in accord with the model's predictions pertaining to a later state." (Rosen D. 339)

Calm Technology
"technology designed to engage both the center and the periphery of our attention, and in fact [move] back and forth between the two that changes perspectives in how users interact with technology" (Weiser, M. & Brown, J.S.)

Implicit Interaction
interactions with devices that do not require full attention (Bakker et al. 1)

Workstation
three dimensional space surrounding a worker (cubicle)

“We must **remember** that, in the real world of technology, **most people live and work under conditions** that are **not structured for their well-being.** ”

URSULA FRANKLIN, *THE REAL WORLD OF TECHNOLOGY*

Introduction

Around 1940, computers took up significant space in rooms. In order for these computers to function correctly, many people had to manage them at once. We then moved to one-to-one computing—humans accessed computers individually in specific confined spaces. (Case, A. 1). During the next era, personal computers appeared, soon giving way to wireless connected mobile devices. We watched our devices become smaller and more functional during this era, allowing us to connect with others quickly across the world, pack more into each day, and always be able to be contacted.

As technology progressed (quickly I might add), we found ourselves in a new technological era, where almost anything could be connected—cell phones, Apple watches, Fitbits, the possibilities were endless. Mark Weiser termed this era Ubiquitous Computing and predicted that in the 21st century the ratio of devices to people would be five to one (Case, A. 1). Explicitly, in the workplace, these connected devices have not only helped workers become more productive and efficient, but have also led to more work both inside and outside of the office.

I am thankful that I did not grow up in an entirely digital age. As a child, I used to venture off into the woods alone to find new critters, pick flowers and pretend that I was in a mystical kingdom. The only point of contact with society was my mom’s voice whistling through the trees, telling me to come inside. It was not until I was thirteen that my parents decided I needed a cell phone, and even at that, I only had a certain number of call time minutes. Texting was input through t9 word form and cost twenty-five cents per message. Internet through my phone was not even an option. These restrictions all seem far away even though I was only born in 1993 which—as much as I do not like to admit it—makes me a Millennial. It is important to put ourselves in the shoes of young Millennials and Generation Z that grew up with connected devices. Technology is what they know; it is a lifestyle that constantly demands their attention. We have devices that inform us of meetings, emails, and events. What we lack are technologies that empower our well-being and cater to the needs of every individual. The absence of stillness resulting from our technologies is why I decided to focus on designing ways to create interactions that resonate with the specific needs of the user. To ultimately, create calm.

Technology has impacted our lives in marvelous ways. However, the need for technology that calms users, instead of creating stress, is something designers need to consider more when creating the next big idea. Therefore, this investigation informs the design of smart objects’ potential for responding to stress and anxiety. What exactly are the possibilities of smart objects in the context of stress? How can we create a calm environment using smart objects? Devices could potentially give users the agency to develop the kind of personalized environment that they want in the workplace. However, for this to happen, designers and producers must first come to terms with products that are not continually the focus of their users’ attention.

Ubiquitous Computing

era of computing where many computers in the world serve each person but are not all necessarily connected to one another (Case, A. 1,2)

Context

The pervasive exchange of information via digital technology began with the development of the personal computer and is now a part of our lives 24/7 through the use of mobile devices. These devices enable us to search, explore, send and communicate at the speed of a keystroke. In fact, according to David Rose, “We spend most of our technology interaction time staring at little glass slabs, which are positioned right before our eyes and in the center of focus” (Rose, D. 157). Our devices scream at us through notifications about deadlines, appointments, and meetings, making it impossible to ignore pending stressors such as meeting deadlines, answering emails and preparing for meetings. In the workplace, young professionals often engage with technology as a productivity tool, rather than a means of improving quality of life. This investigation focuses on how designed objects and interactions—demanding various levels of attention--can provide a calming effect for users within their workstations. This exploration will reveal the potential of smart objects to respond to stress-inducing triggers in the workplace, thus altering the experience of young workers.

Justification

Within 20th-century workplace environments, the briefcase and the filing cabinet held the information that workers needed. Now, most workers use a computing device to store and interact with information. Through constant alerts, ambient sounds, notifications, buzzing and other distractions (known as "technostress"), computers replace older models for containing information while adding a new level of heightened workplace stress. Designers must begin to address this (Helge, D. 401).

The Internet of Things (IoT) is a growing trend (Greengard, S. 19). Mobile phones, laptops and automobiles are not only aware of their human owners' locations and movements, but they are also aware of other networked devices. Indeed, we have become quite dependent on these so-called "smart objects." Embedded with intelligence, they respond dynamically and conditionally—providing immediate access to information when we need it. There are currently dozens of IoT devices that are built into office environments, such as sensored lights and personalized thermostats. Most of these devices are designed to help employees remain productive. Through a customizable thermostat users are placed in a more comfortable setting based on their personal needs. While these current devices are valuable, there is a need for richer investigation into smart objects and their relationship to the non-productivity related needs of users.

Mark Wiser and John Seely Brown believe that technology should not force us into a panic state. To achieve a sense of calm, we need instead to design for the users' periphery (Weiser M. & Brown J.S.). According to Weiser and Brown, technology should easily shift from the periphery to the center focus of a user's attention, only revealing itself when it is actively required, therefore seamlessly blending into everyday life (Weiser M. & Brown J.S.). This investigation will utilize their approach to explore how technology could be used to reduce stressors through enchanted objects, thus potentially changing the human experience of the workstation environment.

Researchers suggest that calm technology should engage with the "smallest amount of attention possible" (Case, A. 16). To design interactions that demand less of our attention and create Weiser and Brown's "calm technology," designers should move beyond an exclusively visual focus, and instead explore multimodal interactions to create a low stress environment. Such multimodal interactions between user and objects need not require a fixed screen. For this calm environment to be developed, new ordinary objects embedded with technology will need to accommodate for the simultaneous use of different channels and modalities (Rose, D. 165). This idea of paralleling modalities to the use of objects around us is not something new to human nature. Before the rise of devices that constantly demand our attention, we received information through other stimuli in order to communicate. Today, vision is predominantly used.

> **"For much of our evolution, we received information directly from other humans and the environment. Our experience of receiving messages and information was tactile and rich with sensory information. It was also rich with human information — body language, status, and emotional tone, but also the briefest of emotive expressions. Our brains are uniquely evolved to attend to and comprehend this type of information and pay attention to the most important parts. We have changed our environment through technology, and we need to learn to refit our environment to us" (Case, A. 68).**

To utilize the rich sensory information that Case describes, designers need to incorporate tactility and motion back into the technology products users are interacting with today. Determining this multimodal process of communication would then allow humans to receive information directly from their environments in a way that our bodies find natural. One way of doing this would not only be through different modality interactions but also incorporating interaction types that do not entirely demand our attention.

This investigation will focus on two types of interactions. The most common interaction used today among computing devices is focused interaction. In a focused interaction, the device requires our complete attention. This is what David Rose refers to as "intrusive" (Bakker et al. 1). The second type of interaction, and what Weiser and Brown attest to as a peripheral interaction, is where the device lives seamlessly in the user's periphery and does not require attention explicitly (Bakker et al. 1). The first and second interaction types discussed are the most common and users understand their association within their environments. However, there is a third interaction type determined by researchers known as an implicit interaction. This interaction is completely unintentional—users do not consider that their actions trigger behaviors of the environment around them (Bakker & Niemantsverdriet 3). Implicit interaction relates directly to the collection of data, although the user does not consciously think about recorded actions and movements determining interface responses.

An Internet of Things system relating to the user's workstation environment could detect stressors before the user recognizes or interacts with items causing stress. This predictive function could help the user calmly and efficiently endure the moments that stressors occur to avoid extreme user anxiety. Essentially, the system could find the correlation between the stressor and anxiety and then reduce the anxiety before it begins. Such anticipation requires data input and output. Our mobile devices track data as we engage with them throughout the day. We leave behind so called digital footprints via app usage, Wi-Fi connections, and other devices that track our every move. "The digital footprints we leave in spaces teach our technologies about our behavior, and they report data, both overtly and covertly, to many archives" (McArthur, J.A. 92). Such data collection makes anticipation and response to workplace stressors attainable.

To investigate ways in which technology can decrease workplace stress, I have situated my investigation within a scenario that addresses a young professional in a cubicle environment. This environment is an ecosystem of smart objects that collect and send data amongst each other, learning the behaviors and needs of their user. To achieve this stress reducing environment, it is crucial for the objects involved to seamlessly blend into users' everyday lives, allowing information to be transferred smoothly from one interaction type to the other (Rose, D. 254). Utilizing calm communication between objects and users, the technology can then lead to better workplace quality of life overall.

Calm Technology

"technology designed to engage both the center and the periphery of our attention, and in fact [move] back and forth between the two that changes perspectives in how users interact with technology" (Weiser, M. & Brown, J.S.)

Workplace Stressors

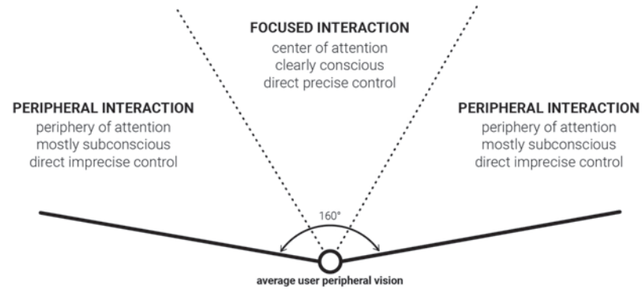
a biological response to physical mechanisms in the place of work (i.e. high work demands, performing multiple tasks, time pressure, etc.) (Nekoranec, J., Kmošena, M. 164)

Research Questions

How can the design of an **anticipatory system** of smart objects respond to stress to create a **calming work environment** for young professionals?

SQ1

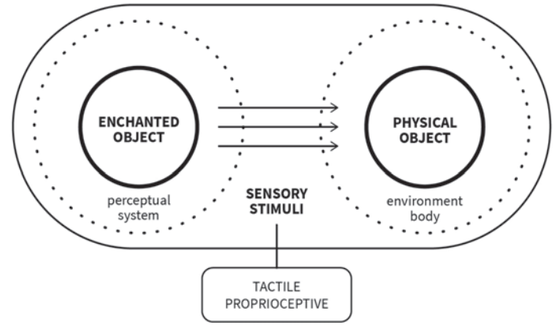
How can smart objects be designed to move smoothly from the periphery to center attention when relying on a user's vision?



F1: VISION

SQ2

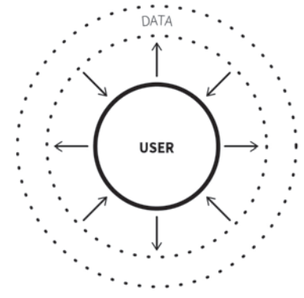
How can the design of smart objects communicate to users through tactile and proprioceptive sensory modalities?



F2: OBJECTS TO ENVIRONMENT

SQ3

How can the anticipatory system utilize data to anticipate and respond to workplace stressors?



F3: TRANSFER OF DATA

Assumptions

This study makes the following assumption. It is assumed that enchanted objects in the workplace are a normalized condition. Users are somewhat knowledgeable and aware of the enchanted objects around them. Users are willing to have their digital footprint and interactions in the workplace collected and read through data, allowing the networked technology in the office to anticipate and respond to personalized workplace stressors.

The environment in the investigation is equipped with networked technology that communicates information between the devices in the workstation.

Although not every potential user might have the complete spectrum of sensory abilities, it is assumed in this research that the main persona does.

Limitations

It is important to note that this exploration investigates only the workstation environments of young professionals. Workstation environments refer to those environments where job duties are processed and completed in a desk space. There are many types of workstation environments; however, this investigation solely focuses on the cubicle workstation. Further exploration of the concepts and prototyped ideas within other environments, such as a kitchen or coffee shop, and within different user groups, such as school teachers or doctors would be ideal, although, not explored in this thesis.

In regard to persona stress level, it is important to note that each person perceives stress differently. There are many different levels of psychological, emotional, and behavioral disorders, and therefore, ones relation to stress may be defined different than someone sitting next to them. Based on these differentiating levels of stress users will respond differently. The defined users for this investigation are not those who already seek professional help for stress from a psychologist. This research did not consider psychological testing of respondents.

Specific users identify a stressor based on each person's perceptions of environmental demands. The impact of stressors includes the specific user's psychological and biological make-up (stress-tolerance, lifestyle, etc.). Therefore, the persona and scenario in this investigation may not apply to all young professionals.

The physical stimuli in this research are limited to visual, tactile and proprioceptive. Excluded in this investigation were auditory, olfactory and thermoreceptive because of the public nature of the workplace environment. For example, when dealing with olfactory stimuli, there is no way to contain a scent (per se) in one specific area of the workplace, especially in a cubicle setting. Allergies and medical issues such as asthma also impose olfactory restrictions. Auditory, on the other hand, can be contained within a headset; however, not everyone wears a headset at all times. Therefore, the investigation excluded possibilities for auditory stimuli due to containment issues.

Due to the nature of this research, prototyped designed interactions are not embedded within the objects described and therefore, will not be able to be tested with certainty.

Young Professionals

persons within the ages 21-30 who are employed in a profession

Theoretical Framework

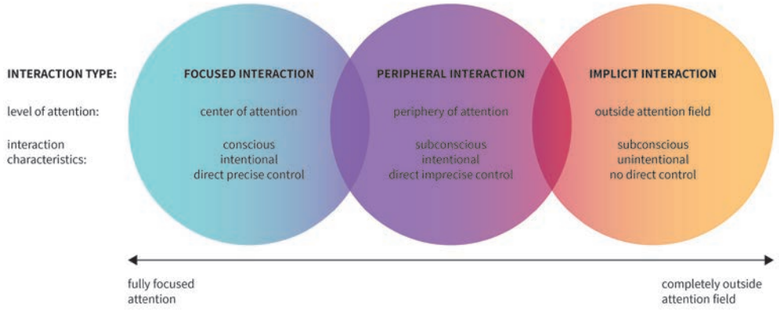
The framework for my investigation combines the Interaction-Attention Continuum (center and periphery focused design), designing for subtlety, unobtrusive design and an anticipation system that together could potentially influence the workplace quality of life.

DESIGNING FOR THE PERIPHERY

There are several levels of attention that a human uses: primary, secondary and tertiary. Primary attention, the most visual and direct focus of our lives, is the world with which we mainly interact. Secondary is more distant. Secondary attention grabbers, for example, could be vibrations or auditory cues that do not need to be in our direct attention for them to be noticed (Case 25). Lastly, there is tertiary attention, also known as the periphery attention. This includes cues such as light, subtle scents, temperature and changes in pattern. Many of the technologies that humans interact with everyday demand primary attention.

The same model applies to a person using their computer in a working environment. The Interaction-Attention Continuum framework discusses the varying levels of human attention. This model argues that there is more than one way to fit technology into everyday lives seamlessly. Interfaces can facilitate interaction on different levels of attention: focused, peripheral and implicit interactions. The Interaction-Attention Continuum suggests that interactive systems “can be operated at various levels of attention, enabling interactions to shift along the interaction-attention continuum as desired by the user or appropriate to the context” (Bakker, S. & Niemantsverdriet, K. 5). Designers need to consider these varying levels of attention when designing interactions between technology and humans for such interactions to become integrated into everyday environments.

Since this investigation not only focuses on visual interactions but also physical, the understanding of relationships



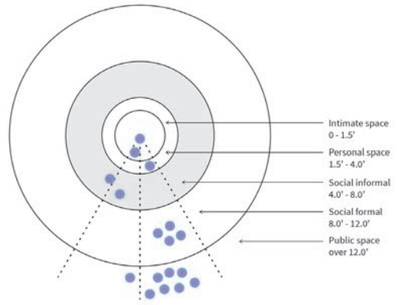
F4: INTERACTION-ATTENTION CONTINUUM ADAPTED FROM BAKKER & NIEMANTSVERDRIET (2016).

between people in space, based on human factors, helped to make sense of the radius of interaction when dealing with other senses, such as hearing and touch. In interior design, proxemics is a significant player when putting a space together. Four spatial or social distance zones are considered: intimate, personal, social and public (Nussbaumer, L.L. 10). Proxemics focuses on the distance between two (or more) people; however, there is also a relation to desk space when discussing economics. Therefore, this proxemics can apply to the distance between a user and the objects around them.

HUMAN COGNITIVE ACTIVITY

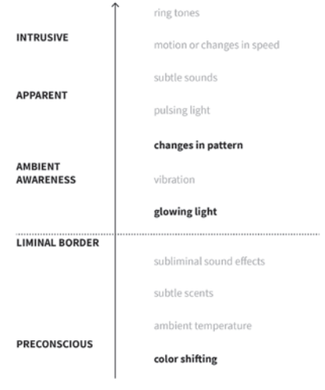
Every working environment has multisensory characteristics. Humans have different sensory channels that allow them to move within those environments (Haverkamp, M. 55). Michael Haverkamp, a synesthetic research engineer, discusses the possibilities for design to incorporate all five senses systematically, i.e., synesthetic design. We perceive other humans by judging and evaluating different situations constantly. When it comes to products we interact with, “perceiving and imaging an object in a conscious state is the basis of human cognitive activity. As a multisensory process, this never occurs with the participation of only one modality” (Haverkamp, M. 55). For humans to process and orient themselves within an environment, they acquire a vast amount of information through their sensory channels (Haverkamp, M. 55). The same goes for users interacting with objects. When a new object enters into the periphery of the user, acknowledgment happens through different sensory channels throughout the body. The response from the user to product needs to occur through as many sensory channels as possible for an overall calming experience which particular functions are based on the user.

These multisensory characteristics relate closely to David Rose’s idea of ways that smart objects can communicate with users. As Rose states, “Enchanted objects shouldn’t ever beep, buzz, or alarm. Instead they should respect your attention like a polite butler [clearing] his throat to get your attention” (129). His scale for designing subtlety demonstrates how objects should respect the user’s attention— from “preconscious” signaling to “intrusive.” For enchanted objects to be unobtrusive, yet unavoidable, according to Rose, they need to live just above or below the liminal border. This framework, much like Haverkamp’s highlights the use of visible, audible and tactile stimuli that designers can manipulate to create objects that blend into our everyday lives.



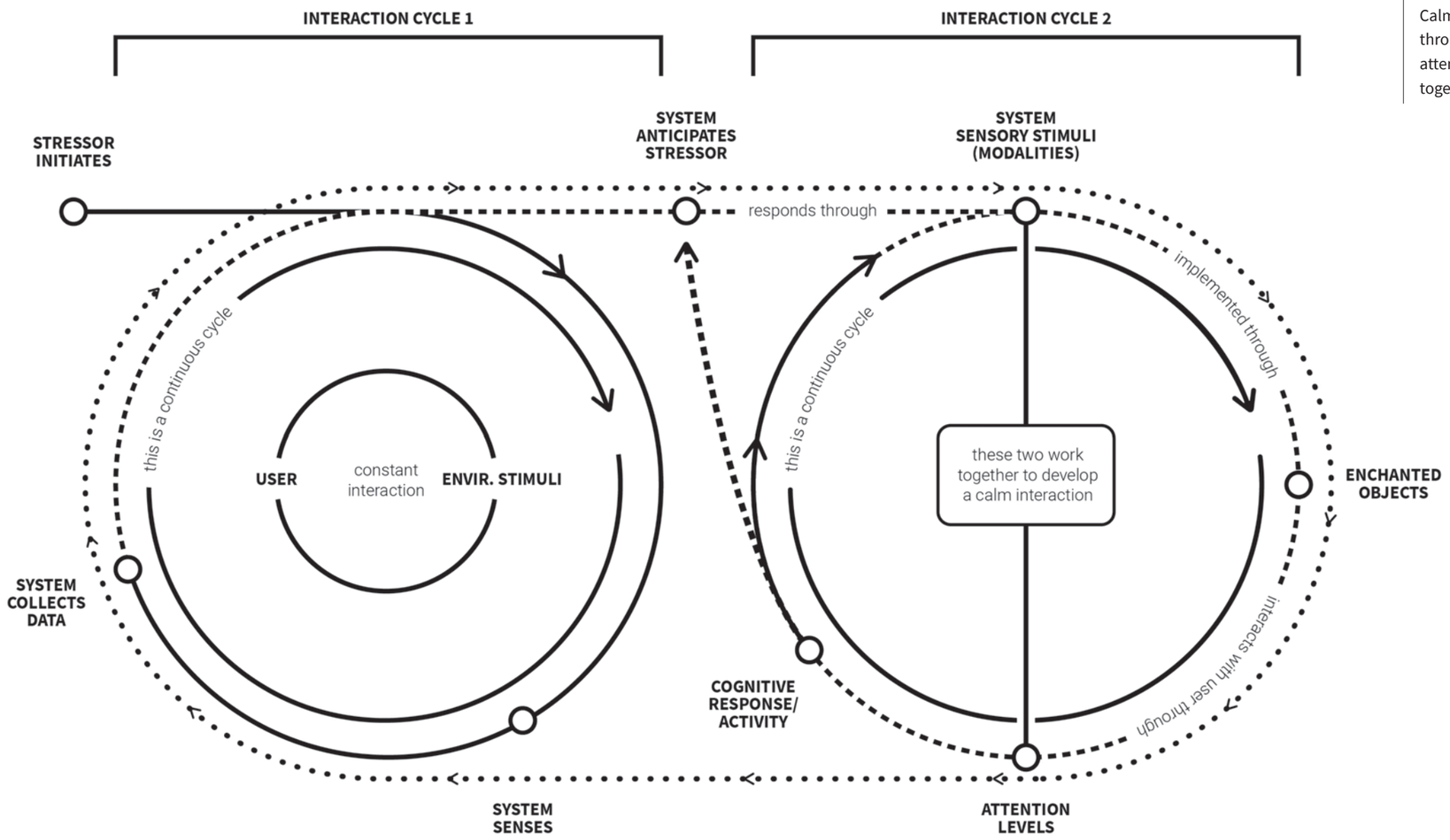
F5: PROXEMICS: MODEL ADAPTED FROM LINDA L. NUSSBAUMER (2014).

F6: SENSORY ORGANS & STIMULI: DIAGRAM ADAPTED FROM MICHAEL HAVERKAMP (2013).



F7: DESIGNING FOR SUBTLETY: DIAGRAM ADAPTED FROM DAVID ROSE (2015). BOLDED ITEMS ARE AREAS OF FOCUS FOR THIS INVESTIGATION.

Conceptual Framework



F8: THE CALM TECHNOLOGY SYSTEM

THE CALM TECHNOLOGY SYSTEM

For the Calm Technology System to work in conjunction with the theoretical frameworks previously discussed, two interaction cycles must occur. Interaction Cycle 1 consists of the continuous collection of data between the user and their environment— the user's movements, tasks, and interactions with others. Interaction Cycle 1 informs Interaction Cycle 2. Interaction cycle two in response to the data collected. Using the information shared between the two cycles, the Calm Technology System can anticipate and respond to the stressor through enchanted objects in the workplace using different stimuli and attention levels. These two interaction cycles are continuously working together via constant data collection of user behavior.

Literature Review

CALM TECHNOLOGY

"Calm technology engages both the center and the periphery of our attention, and in fact moves back and forth between the two." (Weiser M. & Brown J.S.). This term, calm technology, coined by Mark Weiser and John Seely Brown, maintains that though humans are bombarded by notifications more than ever, we still have the same amount attention to give. Weiser and Brown propose that our devices blend seamlessly into our everyday lives instead of drawing more attention from us. Other researchers agree with Weiser and Brown's idea stating, "With the increasing ubiquity of technology, we believe that the vision of making interactive systems available in people's periphery of attention is of growing relevance to seamlessly integrate computing technology into people's everyday lives and environments (Bakker, S. & Niemantsverdriet, K. 2). Essentially, the goal of calm technology is to enable peripheral interaction with computing technology, which will allow users not to have their center of attention fixed on the technology "notifying" them of a certain action. The ideal calm technology system would be nonexistent until specifically required by the user. Therefore, the objects are indicators and reminders more than they are tangible representations of the information being displayed to the user.

Philips Scientific Program Director of Research, Emile Aarts, and Chief Creative Director of Philips Design, Stefano Marzano, state, "Perhaps calmer, smaller interventions are needed, ones that are based on real needs and have the potential to provide improvements" (195). For designers to embrace calm technology, they must consider the principles of calm technology.

The primary objective of calm technology is to "communicate information to the user without interrupting or distracting them from their primary goal." (Case, A. 17). This unobtrusive interaction will work within your environment causing the least amount of friction. "A calm [unobtrusive] experience is when you're performing a primary task, and an alert shows up in your periphery" (Case, A. 21). Essentially, a calm experience does not demand your attention. David Rose refers to this in enchanted objects as glanceability. He states, "Once we know the habits of the object (what information it provides, what color means what), which take little time, the information becomes an easy part of our lives" (Rose, D. 178).

Principles of Calm Technology

(Case, A. 16, 17)

TECHNOLOGY SHOULD REQUIRE THE SMALLEST POSSIBLE AMOUNT OF ATTENTION
TECHNOLOGY SHOULD INFORM AND CREATE CALM
TECHNOLOGY SHOULD MAKE USE OF THE PERIPHERY
TECHNOLOGY SHOULD AMPLIFY THE BEST OF TECHNOLOGY AND THE BEST OF HUMANITY
TECHNOLOGY CAN COMMUNICATE BUT DOESN'T NEED TO SPEAK
TECHNOLOGY SHOULD WORK EVEN WHEN IT FAILS
THE RIGHT AMOUNT OF TECHNOLOGY IS THE MINIMUM NEEDED TO SOLVE THE PROBLEM
TECHNOLOGY SHOULD RESPECT SOCIAL NORMS

ENCHANTED OBJECTS

We live in a world where we routinely rely on glass slabs to feed us information and direct us through our day-to-day. Manufacturers and leading tech brands strive to create the most innovative pixel surface, working toward the thinnest and cheapest functional device. While these devices allow users to continuously stay connected, they do not seamlessly blend into the environments of our everyday lives.

David Rose defines enchanted objects as, "Ordinary things made extraordinary" (Rose, D. 7). Everyday objects can become extraordinary through the use of sensors, actuators, wireless connection and embedded processing, allowing them to sense and obtain information without complete demands of our attention (Rose, D. 47). Enchanted objects can interact with humans without a screen. Instead, these enchanted objects can communicate in other tangible ways, like haptics such as proprioceptive and tactile. Enchanted objects can subtlety signal to their user without demanding attention.

Currently the devices that we interact with via screens live at the center of primarily visual attention. To tap into the other senses (touch, hearing, taste, and smell) for a more multimodal interaction, designers need to consider the periphery of attention. "The human set of sensory cells includes receptors for electromagnetic waves (vision), mechanoreceptors for mechanical quantities (touch, proprioception), receptors for mechanical waves (audition), and chemoreceptors (smell, taste)" (Haverkamp, M. 57). To enter the user's periphery in a calming way, the use of these other receptors will be valuable.

To create multimodal enchanted objects, designers must develop a system of these objects. This self regulating system uses feedback loops to communicate with objects in the system, allowing the system to learn and adapt as needed to specific user needs (Rose, D. 210).

BIG DATA

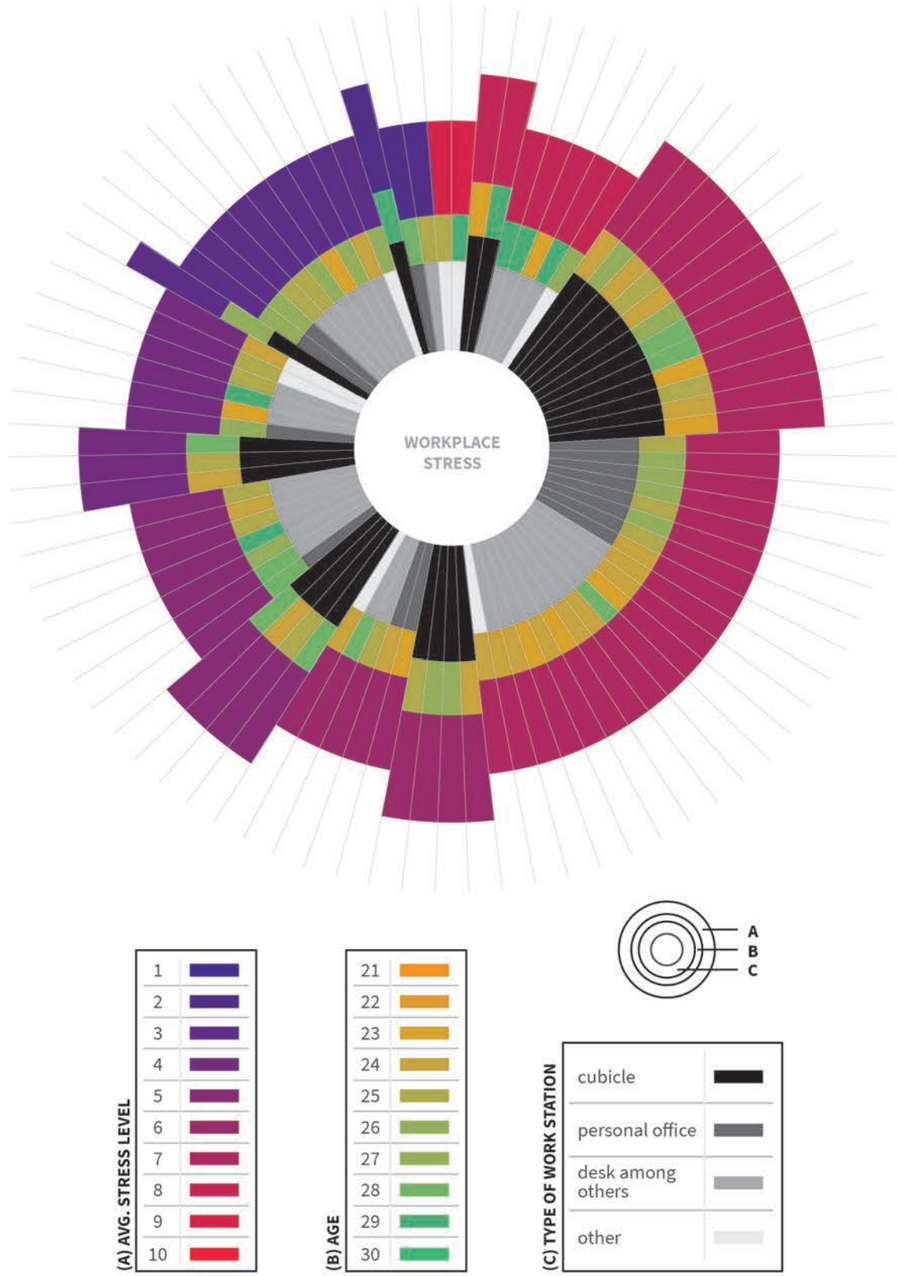
The concept of big data can be a hard concept to grasp because so much of what makes up big data is "invisible" by design (Greenfield, A. 31). Devices and objects with embedded sensors, memory chips, and processors do not alert us when they collect information from our everyday lives. However, this data is allowing the devices associated to function in ways that are more user-centered. Through the collection of data, patterns of user behavior, emotions, bodily status and others, can be detected throughout time. With this immense collection of pattern information, a more predicted future of user behavior can result.

INTERNET OF THINGS

The Internet of Things, or IoT, is the internetworking of physical devices that can collect and exchange data. First described and Ubiquitous Computing, the IoT now encompasses the "networked" stage that Ubiquitous Computing predicted would happen (Case, A. 2). This networked stage is the assumption that any object in the world may become wirelessly connected to a range of networked devices, "opening up a whole range of new functionality, data collection possibilities, and security risks" (Case, A. 3). Researchers discuss this internetworking of everyday objects changes the way data input happens. Instead of completely human-based input, now there are both human- and machine-based input (Greengard, S. 19). This dual-input module makes deeper insights on combined data possible. This development of connection of enchanted objects within the IoT will allow human-machine based input to deliver more (Rose, D. 189). In fact, in order for enchanted objects to anticipate and respond to data, they must first be connected to the Internet. "An Internet connection allows the transmission of sensing and signaling information, the processing and storage of information, and the delivery of new services" (Rose, D. 194-195). Due to the connectedness of everyday and the immense collection of data, devices within an IoT network can be designed to function with the purpose of serving users' needs, instead of being just a piece of hardware.

THE OFFICE CUBICLE

The office cubicle has been in existence for fifty-four years. The office cubicle, first known as the "Action Office," was first pioneered to empower people (Baer, D.). Though this "Action Office," designed by Robert Propst, was intended for corporate America, many officer managers saw the advantage of action offices as a way to provide a cheap alternative for individual offices. Over time, the office cubicle has become known as an uncomfortable environment, rather than one that stimulates innovation.



F9: WORKPLACE STRESS RESULTS: THE DATA SHOWN ABOVE HIGHLIGHTS THE AVERAGE STRESS LEVEL ASSOCIATED WITH THE TYPE OF OFFICE SETTING. THOSE REACHING FARTHER THAN THE AVERAGE CIRCLE ARE SURVEYORS WHO WORK IN A CUBICLE

Methodology

INTERVIEWS

To identify user pain points in workplace settings, I conducted semi-structured interviews. I reached out to young professionals to understand what in the workplace causes them stress. Not surprisingly, many of the responses aligned. However, in order to create a persona that genuinely defined a young professional I needed to dig deeper. Therefore, I contacted a young female professional who provided crucial insight into my user investigation. I asked her to create a diary of her workday detailing moments before a workplace stressor happens and her corresponding stress level.

GOOGLE SURVEY

This Google Survey identified common workstation environments, workplaces stressors, average stress levels and stress relievers in the workplace. I sought what other young professionals in the working world were dealing with in their personal environments and then incorporated common stressors into my investigation.

I limited the survey respondents to working professionals between the ages of 21-30. Over the course of two weeks I received 83 responses. These 83 responses are not representative of the overall young professional working population, but rather indicate what many may being dealing with at work.

TOP 10 STRESSORS:

DEADLINES
OFFICE LIGHTING
NOT HAVING WINDOWS
PAPERWORK
EMAILS
LACK OF COMMUNICATION BETWEEN CO-WORKERS
CO-WORKERS NOT DOING THEIR JOB
PEOPLE WALKING UP BEHIND YOU
NOISE DISTRACTION
WORK AMOUNT

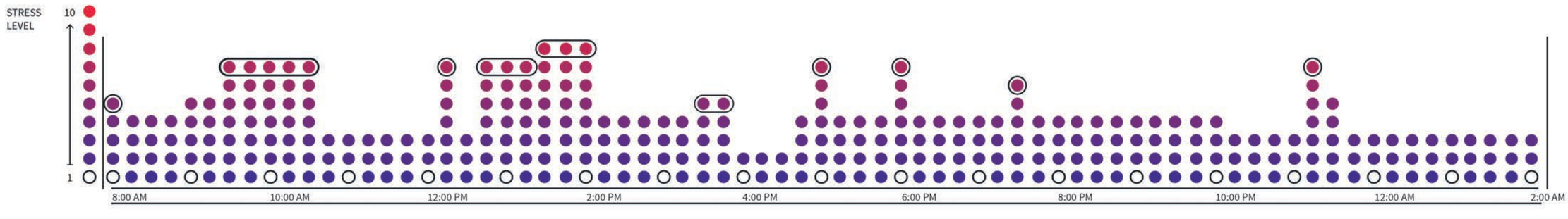
TOP 5 STRESS RELIEVERS:

TAKING WALKS
TAKING BREAKS
DRINKING WATER/TEA
CREATING TO-DO LISTS + ORGANIZING TASKS
LISTENING TO MUSIC

Persona & User Journey Map

MEG | 24

Meg works in a fast-paced environment in New York City. Her team room consists of cubicles, and there are no windows to be found. She is the go-to person in her office often causing her to be given her co-workers jobs when they don't have them done in time. Although Meg is the calmest person on her team, 80% of the time she is panicking internally. With an average stress level of 4, there are many moments throughout each day that send Meg's stress to an unwanted level.



PAIN POINTS

CALMER MOMENTS

8:00AM

ACTIVITY

Meg is the first one in and she sits down at her desk to check her email.

CONTEXT

Emails stress Meg our because that means she received them after she fell asleep, so the manager/ partner sent it super late, which usually **means it is urgent and much be addressed ASAP.** Simultaneously, she opens the program used to see if any of her work was sent back to her with notes/questions from her managers. At his point, Meg is not in a relaxed position, she is sitting on the edge of her chair, leaning forward, and her legs are bouncing up and down.

9:30AM

ACTIVITY

Every Monday at 9:30am, Meg and her team have their weekly "run down" meeting.

CONTEXT

This "run down" meeting consists of each member of the team **receiving their to-do list** for the week and see what items they have that are overdue to be completed. The lists contains 50-75 items for the week. This meeting is very stressful because the **managers can see everything that is overdue and they set expectations for what needs to be done ASAP.** They go down their list one by one and at this point Meg's legs are bouncing up and down as she waits for her turn to explain what something is not complete.

10:30AM-12:00PM

ACTIVITY

Meg returns to her desk to start answering the notes received back from her bosses.

CONTEXT

After the "burn down" meeting, Meg goes to get another cup of tea and usually a few co-workers join. Tea always helps Meg stay calm. She then proceeds to answer notes received from her bosses. This is very stressful because **there are usually many coaching notes to answer and Meg just received her to-do list for the week**, so she feels the pressure. She therefore, tries to get through the notes as quickly as possible so she can get started on her to-do list.

12:00PM

ACTIVITY

At 12:00PM everyone in the office heats up lunch as a group.

CONTEXT

Meg's **office has a rule that everyone must eat lunch** and continue drinking water throughout the day. Sometimes, Meg is so invested in her work that **she loses track of time** and therefore, mistakenly skips lunch. When this happens, Meg gets questioned as to why she is not eating, even though, if she does not work through her lunch break she gets questioned.

1:00PM

ACTIVITY

Meg leads a client meeting.

CONTEXT

Before Meg heads into her meeting, she takes time to review all materials, think of questions that might come up, and print out materials that she may need. While prepping, Meg's heart is racing, her legs are, again, bouncing up and down and she is sitting on the edge of her chair. **An additional co-worker attends** the meeting with Meg to talk to the client and take notes. This is stressful becuase the **other co-worker is sometimes late to meetings & not on the same page** as Meg.

4:30PM

ACTIVITY

Meg is working at her desk and a manager starts to walk towards her to give her an additional urgent task to do.

CONTEXT

About **4-8 times throughout the day, Meg's managers/partners ask her to do additional random tasks**. These tasks never have a set time and Meg must **stop everything she is doing and complete the additional task first**. When Meg sees a manager walking towards her desk, her stress level instantly increases. Manager tasks always are top priority and therefore should be completed first so while she is working on this task Meg finds her legs bouncing. She wears headphones so that no one else in the office can bother her.

7:00PM

ACTIVITY

This is the start of "airplane mode".

CONTEXT

Airplane mode is when everyone in Meg's office must turn their phones on airplane mode. **Meg and her co-workers are not allowed to ask each other questions**. It is a time for them to focus and get things done. Although this is one of the better times to complete tasks, Meg has to ensure that she has all of her outside questions answered before 7:00 PM hits.

9:30-10:00PM

ACTIVITY

Managers and partners leave the office for the day.

CONTEXT

Once the managers have left to go home, the office is very peaceful. This is one of Meg's favorite tomes of the day because it allows her to get through a lot of work.

F10: PERSONA USER JOURNEY MAP

“ The best technology, on the other hand, **amplifies** the **best parts** of **both machines and people.** ”

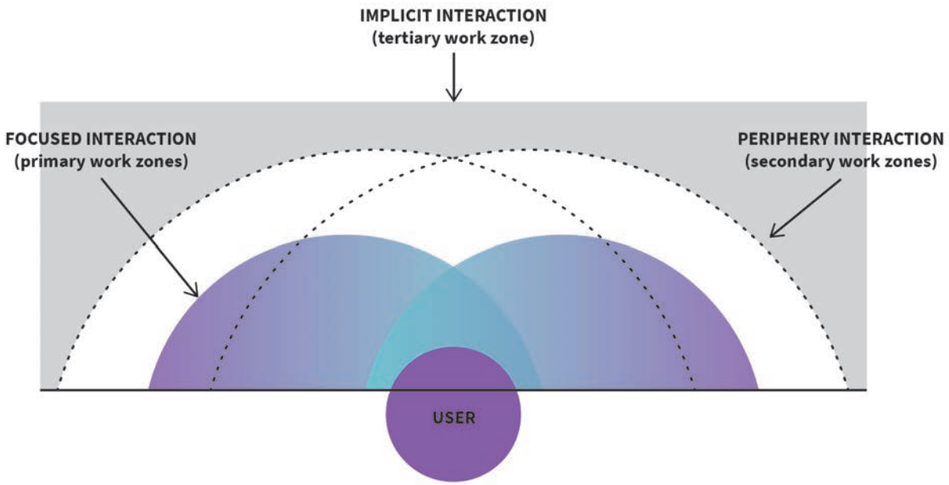
AMBER CASE, *CALM TECHNOLOGY: PRINCIPLES AND PATTERNS FOR NON-INTRUSIVE DESIGN*

Ideas to Connect the Unconnected

This investigation seeks to reduce stress to avoid negative user impact. The idea is not to completely eliminate stress in the workplace because some stress is considered good stress. The ideas presented in the following studies are external resources that could potentially reduce workplace stressors based on the persona identified. These external resources consist of the everyday objects that the personas interact with in their workstation environment.

WORKSTATION ERGONOMICS

The workstation space of a user has specific reach zones based on the position of their body. When sitting at a desk, the position of the user’s arms, body, and head are all due to the distance between the user and the working area. The reach zones work much like the multimodal interactions zones discussed previously. One, the primary work zone which is closest to the user and more than likely in the center of the table in the case of this investigation is the focused interaction zone (Lešková , A. 42). Both hands can work efficiently and requires fine motor movements (Lešková , A. 42). The secondary interaction zone holds objects that workers frequently grab with one hand. This zone is inherently where periphery interactions occur. This zone does require gross motor movements (Lešková , A. 42). The tertiary work zone holds implicit interactions. This zone is interacted with by the user only on occasion. Since this investigation focused on focused, periphery and implicit interactions, the mapping of work zones confirm territories of interactions the user will have with objects within their workstation.



F11: WORKSTATION ERGONOMICS

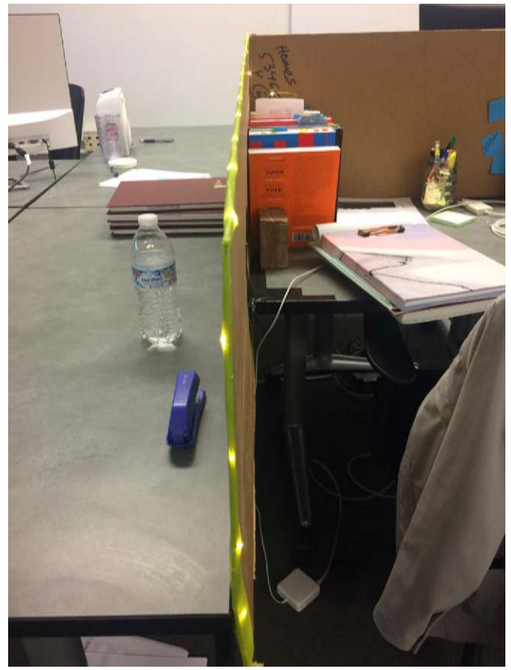
Body Storming

To investigate my research questions, I constructed a cubicle in our studio which I worked in throughout the semester. This bodystorming led to interesting ideas. However, I had to remind myself that the conditions in my environment were vastly different from that of my users. For example, my user's office space does not have windows. The studio space I worked in had a natural light. Another major difference was I was the only person in the studio that was working in a cubicle structure. Therefore communication between others, sound barriers and, of course, the overall design of the studio space differed immensely.

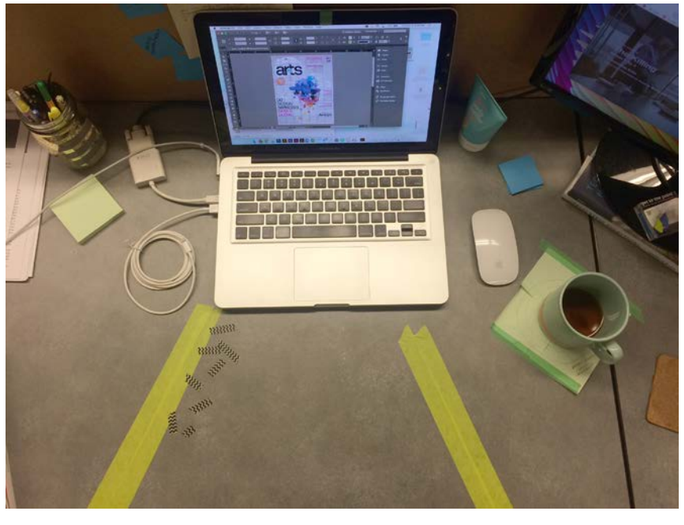
F12: STUDIO CUBICLE 1

F13: STUDIO CUBICLE 2

I used quick prototyping materials such as tape and lights to work through ideas for stress relieving objects. This not only allowed myself to physically interact with some of my ideas, but also allowed others in the room to experience them. For example, when the lights on my cubicle were turned on, this alerted others in the studio that I was not to be disturbed. Although this idea was not carried out further in the investigation, it surprisingly worked. There were multiple moments when others in the room turned to ask me a question or started walking to my desk and then realized on the way that my lights were on. I typically received an email from them instead, regarding what they needed.



F14: STUDIO CUBICLE 3



F15: STUDIO CUBICLE 4

Unfortunately, however, this prototyping method did not have an much of an impact. Several other ideas that I played out were "inside" my desk space so that only I could see. For example, I used tape to signify different response ideas for when the desk recognized a change in either my temperature or pulse. These ideas were not as easily able to be interacted with which forced me to body storm in a different mindset because of their stagnant nature. However, this was useful for ideation because it eliminate ideas that I discovered were not necessary. Such as the coffee mug reminder to grab more tea. I found myself knowing when I needed)or did not need) more tea. It was a personal preference, a time preference and I did not feel the imaginary interaction reminding me to grab tea was something that one needs to be informed of.

SIMPLE EXERCISE

Put down this book for glass slab reader.

Stand up.

Hold your arm straight out to your sides. Look straight ahead.

Can you see your hands? Not quite.

Move them forward slowly until you can see them. Just a few inches, right?

Your peripheral vision typically encompasses a 160-degree arc. This wide span of vision is an extraordinary human capability that can be leveraged—although it almost never is—in the design of enchanted objects.

Adapted from David Rose, *Enchanted Objects* (Rose, D. 158)

Visual Interaction

EARLY DESIGN EXPLORATIONS

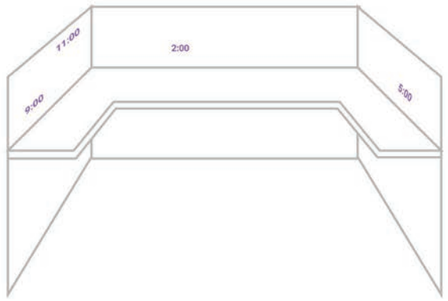
For these mini studies, I collected data from four people who are in the working environment every day. These initial participants are not in line with my specified user group. However, understanding the variances in options and stressors within their specific work environment was useful. Each participant has a very different workplace setting, ranging from a classroom to a doctor's office.

PROCESS

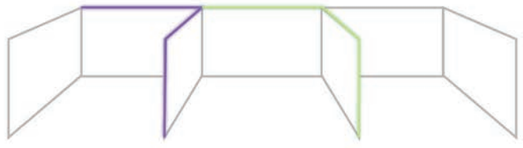
While all in the same room, I gave each participant a piece of paper and had them silently listen to me as I explained my thesis research. After I finished, I then asked all four participants to jot down anything and everything that stresses them at work. Then, I asked them to write or sketch ideas of things that they think would be most beneficial to help them deal with their stress.

REFLECTION

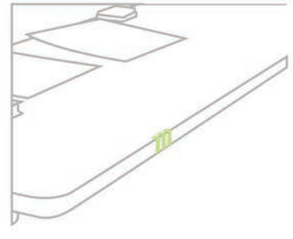
I realized after "finishing" these mini studies that there are many holes in regard to what actually would reduce stress for users in the workplace. For one, I needed a larger user group to cover the day in and day out workplace stressors that people come in contact with. I also knew that these were rough initial ideas and therefore I was not considering how exactly these interactions would move between attention levels. I also found that I was getting stuck between creating objects that helped one reduce stress or helped one complete a task. The two ideas for me were easy to cross connect, therefore, I knew for the next round I needed to purposefully focus on my main research question.



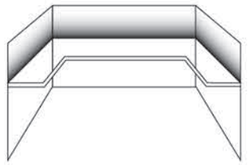
Dynamic cubicle walls: Clock fades in and out at the end of each hour changing orientation on cubicle walls. This calm interaction facilitates time passing



Instead of a ringing noise: while busy the "notification" shows on the edges of the desk subtlety by pulsating light.

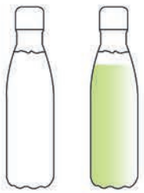


Ambient cubicle walls: Through a series of sensing behaviors (for example plugging in headphones) system will learn when user is busy and subtlety notify those around him so that they do not disturb him with unnecessary phone calls.

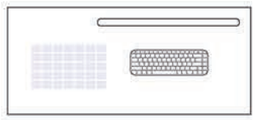


Cubicle walls are transparent when entering office then slowly becomes opaque slowly upon time to receiving the to-do list

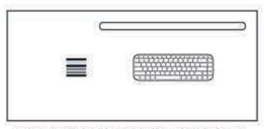
Biofeedback desk - arms pressure on the table, temperature of arms, perspiration, could all be signs for system to recognize which tasks create more stress. Desk color change..



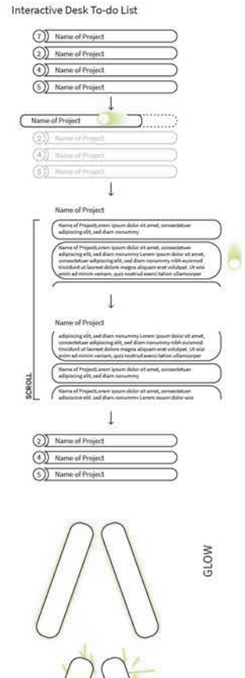
Turns a color to have you hydrate yourself/be awake, healthy.



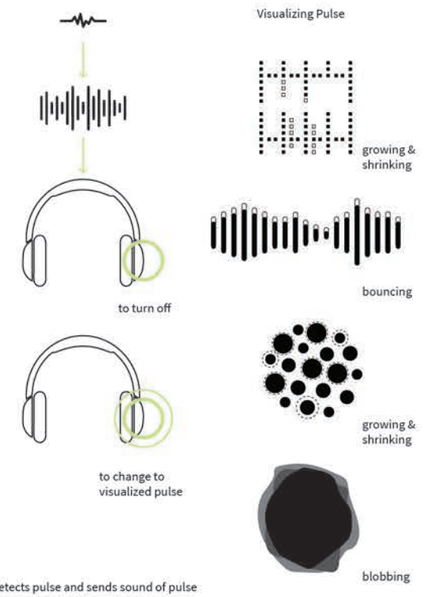
Interactive calendar senses and responds to emails, to-do lists, priorities throughout the day - rearranges to help lower stress based on most important



When receiving the to-do list...certain items on it pop up on smart desk to do first instead of overwhelming Jasper with the 50-75 items at once



Desk can detect pulse and show user a "notification" of the rise in pulse where the arms sit on the desk.

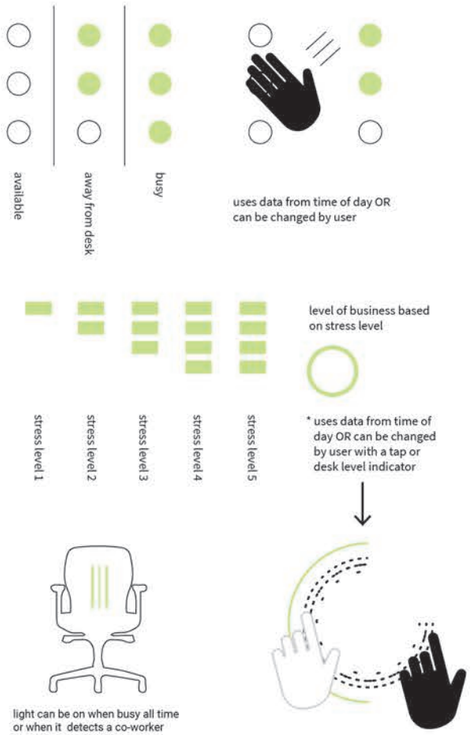


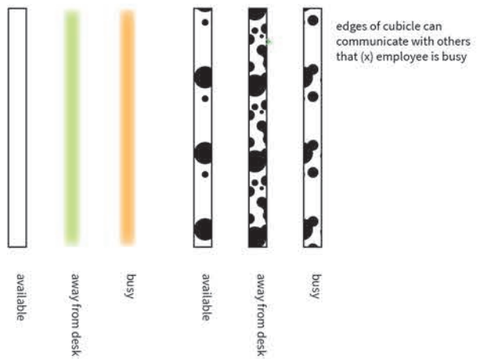
Detects pulse and sends sound of pulse to headphones to have your calm your breathing

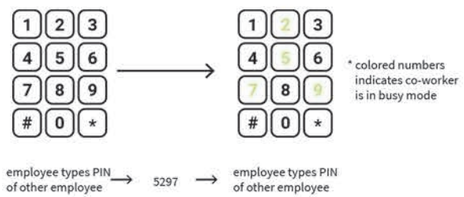
Light Going Down Inside Of (Or The Edge) Desk Based On Time Until Meeting

this could be at anytime during the day to remind before long periods of working or meetings to help reduce stress

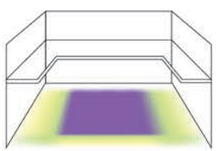
coaster could indicate a color of the tea is hot or cold







desk table top turns into an image that reminds the user of calm - like a kitchen counter top



desk floor indicates needing to take a break by lighting up

PROCESS

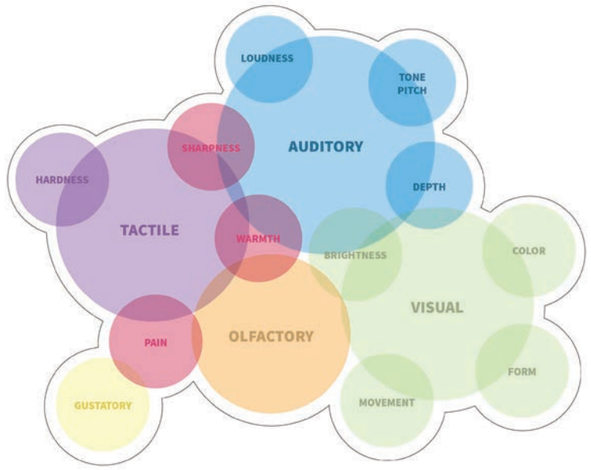
These mini studies were designed after I received the data from the Google survey. I sifted through all of the data and found three main themes that respondents wrote either cause them stress or relieve their stress. Being prepared and communication with other employees were two main stressors for my respondents. Taking breaks, was a main stress reliever across the board. I took these three themes and them tried to apply them specifically to my main user, Meg.

Although none of these studies ended up being part of the final system, I learned that I was not grounding my ideas in research enough in order to make this ecosystem of connected objects plausible for reducing stress in the workplace. I had some good ideas, but they were too broad and unspecific to the stress related context. There were moments when I found myself sliding back to the idea of creating an ecosystem that helped accomplish tasks and that was something I did not want. It seemed like each time this happened, I had to refocus my attention on my user, and try extremely hard to put myself in her setting.

REFLECTION

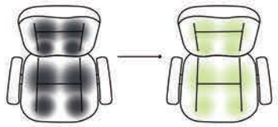
Routine ingrains workplace behaviors. Currently, most of the United States population carries a cellular device. Designers should elaborate on the everyday objects already in use when they embed objects with technology, rather than creating new objects that require a steeper learning threshold. Possibly, more importantly, designers need to consider what type of data exactly is being collected from the user into the system in order for it to learn and adapt. I came to realize that there were few times were I had interactions were the user could determine whether or not they needed a calming moment. The ability to essentially send a message to the system saying "I do not need this right now" was basically non-existent. There needs to be more consideration as to how the user can give feedback to the overall system in order for its data to be revised and respond as needed at the appropriate times.

Multimodal Interaction

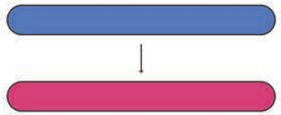


F16: MULTISENSORY PERCEPTUAL OBJECT: DIAGRAM ADAPTED FROM HAVERKAMP, 2013. THE MODEL PRESENTED SHOWS A REPRESENTATIONAL BREAKDOWN OF SENSORY STIMULI IN A PARTICULAR MULTISENSORY PERCEPTUAL OBJECT. (HAVERKAMP, M. 149)

Though most of the interactions we come in contact with are purely visual, the movement for more multisensory interactions needs to happen. As discussed throughout this investigation, many agree that in order to advance technology in a less obtrusive way, the incorporation of our four other senses needs to be investigated. Haverkamp discusses ten different stimuli that can be channeled into the interactions between humans and objects. For example, the model Multisensory Perceptual Object, was created by Haverkamp to show the quantities of how much each modality is used in this particular object example. In his research he is considering all of the modalities shown in his Sensory Organs & Stimuli diagram. Whereas, this investigation was designed to only focus on three of the modalities (visual, tactile & proprioceptive). As visual stimuli has already been discussed, this section focuses on the implementation of tactile and proprioceptive stimuli into objects.



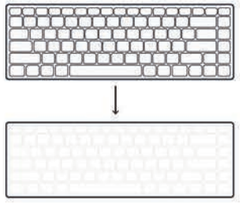
15 minutes before to-do list arrives
in inbox the chair softens



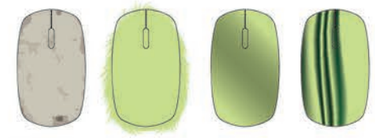
wrist cushion shift from cool to warm

desk opens air vent for breeze or
it could release a certain scent

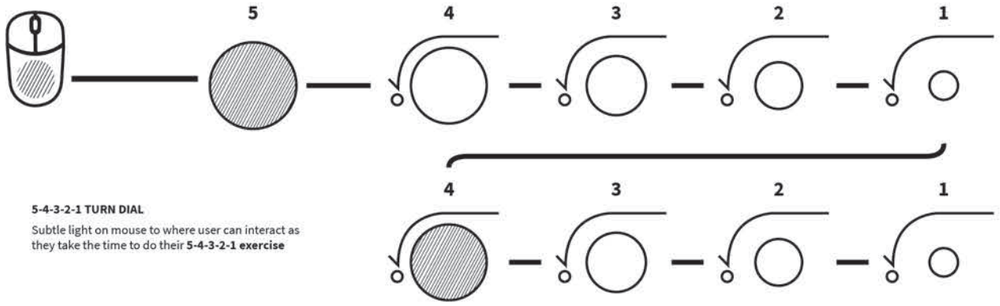
Chair expands to push user to sit up
straight to alert user of x email stressor



keyboard keys recede every so often for a short
amount of time to indicate taking a break

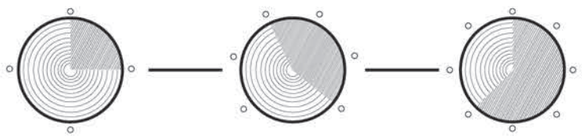


mouse could change into a certain texture as comfort

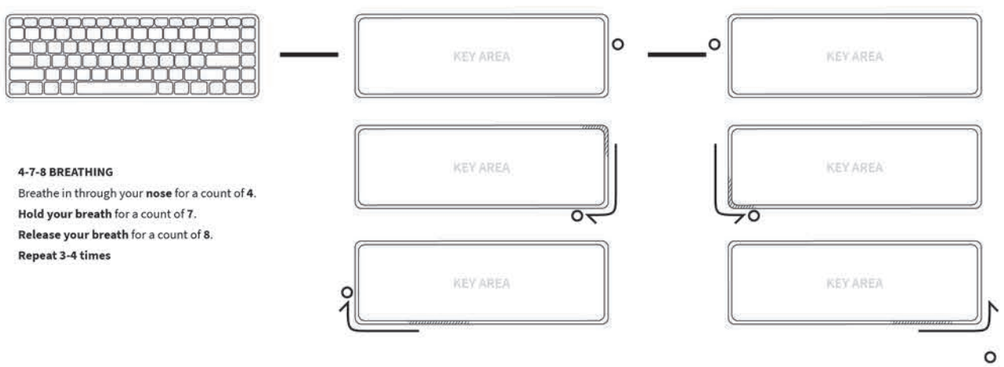


5-4-3-2-1 TURN DIAL

Subtle light on mouse to where user can interact as
they take the time to do their **5-4-3-2-1 exercise**



SYNCHRONIZED BREATHING
Inhale direction last for (x) amount of time clockwise
Exhale direction last for (x) amount of time counter-clockwise

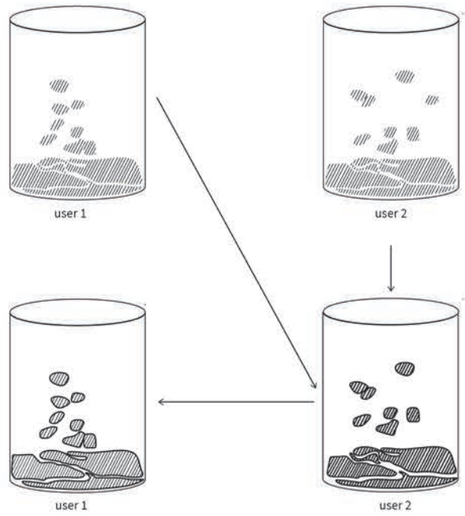


4-7-8 BREATHING

Breathe in through your **nose** for a count of **4**.
Hold your breath for a count of **7**.
Release your breath for a count of **8**.
Repeat 3-4 times

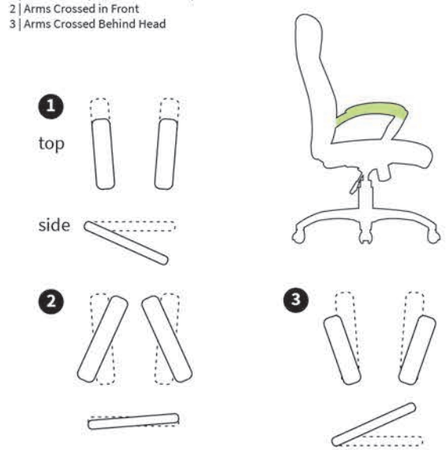
LIQUID DROP COLOR SIMINATOR

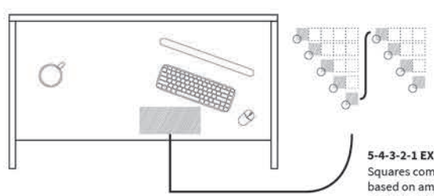
Liquid drop starts (x) time before meeting
Tap of the pencil holder will change colors to other employee to signal (x)



POWER POSE BY CHAIR

Chair arms move slowly to direct a power pose
1 | Hands on Hips (Wonder Woman)
2 | Arms Crossed in Front
3 | Arms Crossed Behind Head





5-4-3-2-1 EXERCISE
Squares come and go
based on amount of time
user takes to tap them

PROCESS

The previous mini studies led to a focus on professionally researched anxiety exercises, specifically synchronized breathing and cognitive exercises. My research indicated that such exercises would be an effective way to reduce workplace stress (Hasson, G., 12). Therefore, I started incorporating different breathing and cognitive thinking exercises into ordinary objects.

One coping exercise, called the "5-4-3-2-1," focuses the user's attention on something other than a stressor. When the object displays the exercise, the users do the following: think of and/or say five things they can see, four things they can touch, three things they can hear, two things they can smell and one thing they can taste ("5-4-3-2-1 [...]").

Another exercise explores synchronized breathing, or also known as deep breathing. Exercises like these are common when dealing with anxiety. One such exercise called 4-7-8, asks the user to breathe in for four seconds, hold for seven and breathe out for eight. According to researchers, your breath is the control of mindfulness (Hasson, G., 14). When concentrating on your body you can control your mind and body to reduce anxiety in the present (Hasson, G., 14).

Along with different psychological exercises, there are other exercises researchers claim will positively decrease users' anxieties. Amy Cuddy, a social psychologist, speaks on behalf of "power posing" (Cuddy, A). She states, "We know that our minds change our bodies, but it is also true that our bodies change our minds" (Cuddy, A.). Therefore, during my investigations, I thought of different proprioceptive ways that, "power posing" could be implemented into objects to relieve user stress.

REFLECTION

I found that some non-visual sensory modalities are difficult to explore. How can a designer incorporate a squish tactile feel into a two-dimensional form. More importantly, how do you show that to someone without them being able to experience it via touch? This could potentially be a reason most of the devices we interact with today focus on the visual stimuli. The ability to test these multi sensory objects is difficult due to time and money, as I experienced first hand. Overall, is easier to identify ideas that engage with our vision. Approaches that involve our physical abilities such as the re-positioning of our body are more laborious to iterate for the generalized public.

Archiving Us

When designing for an ecosystem of this sort, knowing every move that the persona makes in the office is essential for data collection in order for the devices to respond and anticipate the users' needs. This system uses feedback loops (refer to The Calm Technology System) to learn and adapt to the specific user. This is vital because the technology needs to respond to changes in patterns of user behavior. The collection of data in order for the system to adapt will vary based on the person mainly due to their genetic mold. For example, Meg, my user, may be a person who generally speaks loudly. The system may recognize this at first as a moment of stress. Over time, however, the system will understand that a specific tone of voice represents Meg's normalized state.

These types of data input and output, or feedback loops, is an essential part for this system. Over a period of time, Meg may find that the stressor that once hindered her, no longer exists. If the system is still responding to that once stressor the same way over and over again, then its use to Meg is insignificant. I imagine at this point the system may even be interrupting Meg of her work instead of helping her get through it. What may have been beneficial to Meg six months ago, may not be beneficial to her today which is why the opportunity of a feedback loop throughout this continual collection of data is incredibly important.

“People **experience** design in relation to their own bodies. The **things and space we use are extensions of our proportions, perceptions, abilities and limitations.** ”

ELLEN LUPTON, *BEAUTIFUL USERS: DESIGNING FOR PEOPLE*

VIA PIECE

For my final design I focused on the branding of the overall system of connected objects. The brand name, VIA PIECE, was inspired by the overall idea of this investigation, reducing workplace stress via enchanted objects. “PIECE” was acquired through the idea that this ecosystem of connectedness corresponds through pieces, also known as, objects.
The wordplay for these objects was a major factor when determining a brand name that suggested the overall idea of peace through pieces. In attempt to make the brand gender neutral, the development of the logo design was decided.

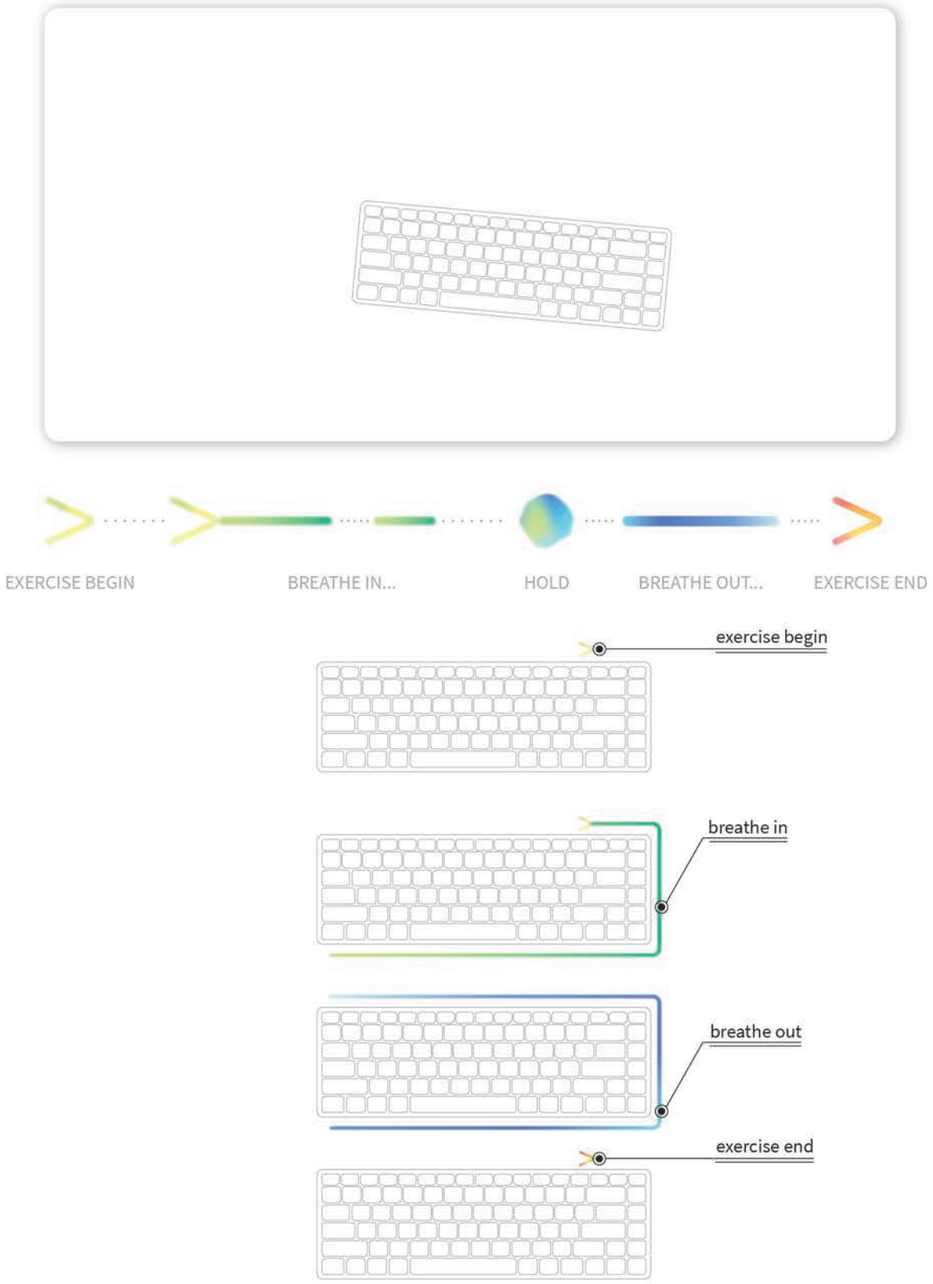
Throughout discussion of the manufacturing of my ideas, it was decided that in order for these items to be purchased they needed to be designed in a more accessible way than per se having to buy a completely new cubicle system. Therefore, the final connected objects are the pencil holder and a desk mat. A pencil holder is utilized by most in the office, as for the desk mat, this seemed to be the most logical way for the desktop space to be simulated without the purchase of a new desk. By selecting two objects that could be sold together, this allowed for the start of the connected ecosystem of calm objects. Exercises are not only confined to one object, but can also move back and forth between each other seamlessly changing interaction attention levels.

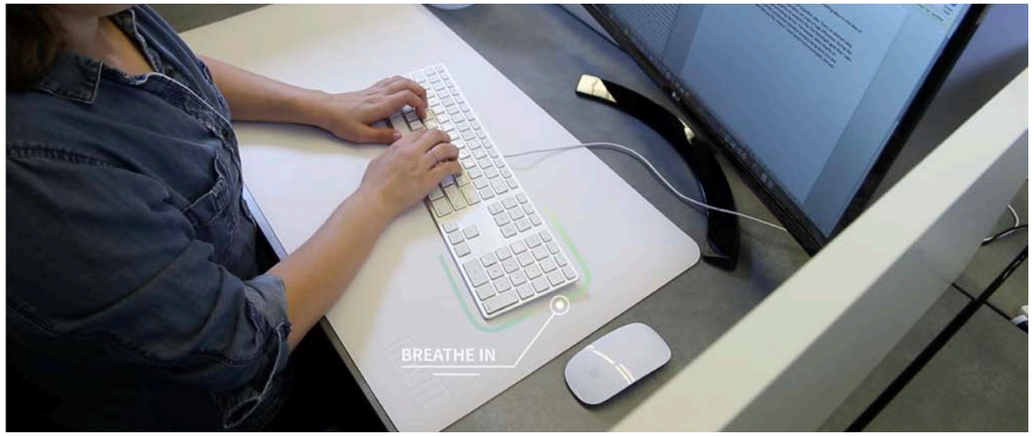
The color palette chosen for the final system may have been the most difficult part. I struggled to create a system of colors that not only suggested parts of the exercise happening, but also could be relatable as calming amongst genders. Softer cooler colors seemed to be the fad when researching color palettes. However, in attempt for noticeable variation, I included warmer hues. These decisions were also influenced by my previous research of stress relievers. For example, liquid drop, is used to calm those with disabilities and therefore, I implemented a variation of such into my final system shapes. The other shapes came from the branding itself in order to package the overall look together into one cohesive system.

Each decision made for this overall branding was inspired by the idea of a delightful, calming experience. The visual imagery ultimately dominated the design of these interactions. However, through vision, proprioceptive movements and tactile associations were derived. Combining the three sensories ultimately created three multisensory interactions as shown in the following pages.

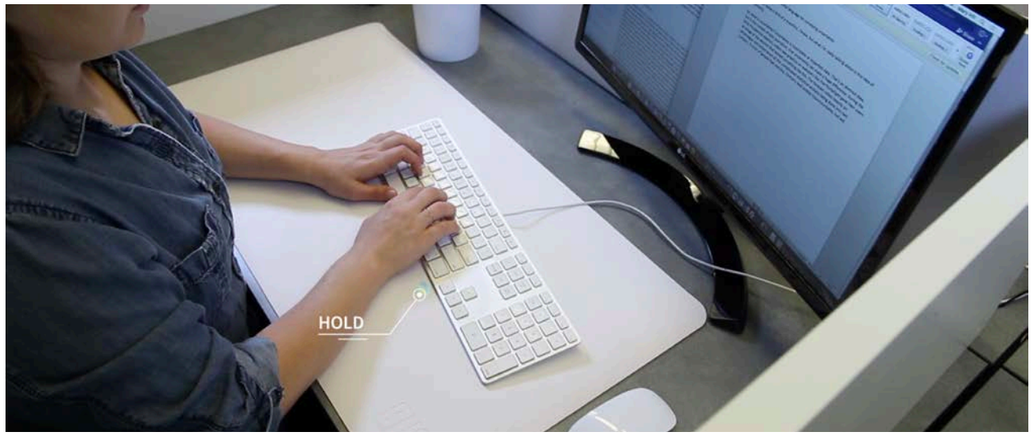
F17: VIA PIECE KEY FOR COLOR COMBINATIONS

4-7-8 BREATHING





F18: 4-7-8 EXERCISE VIDEO SCREEN CAPTURE 1

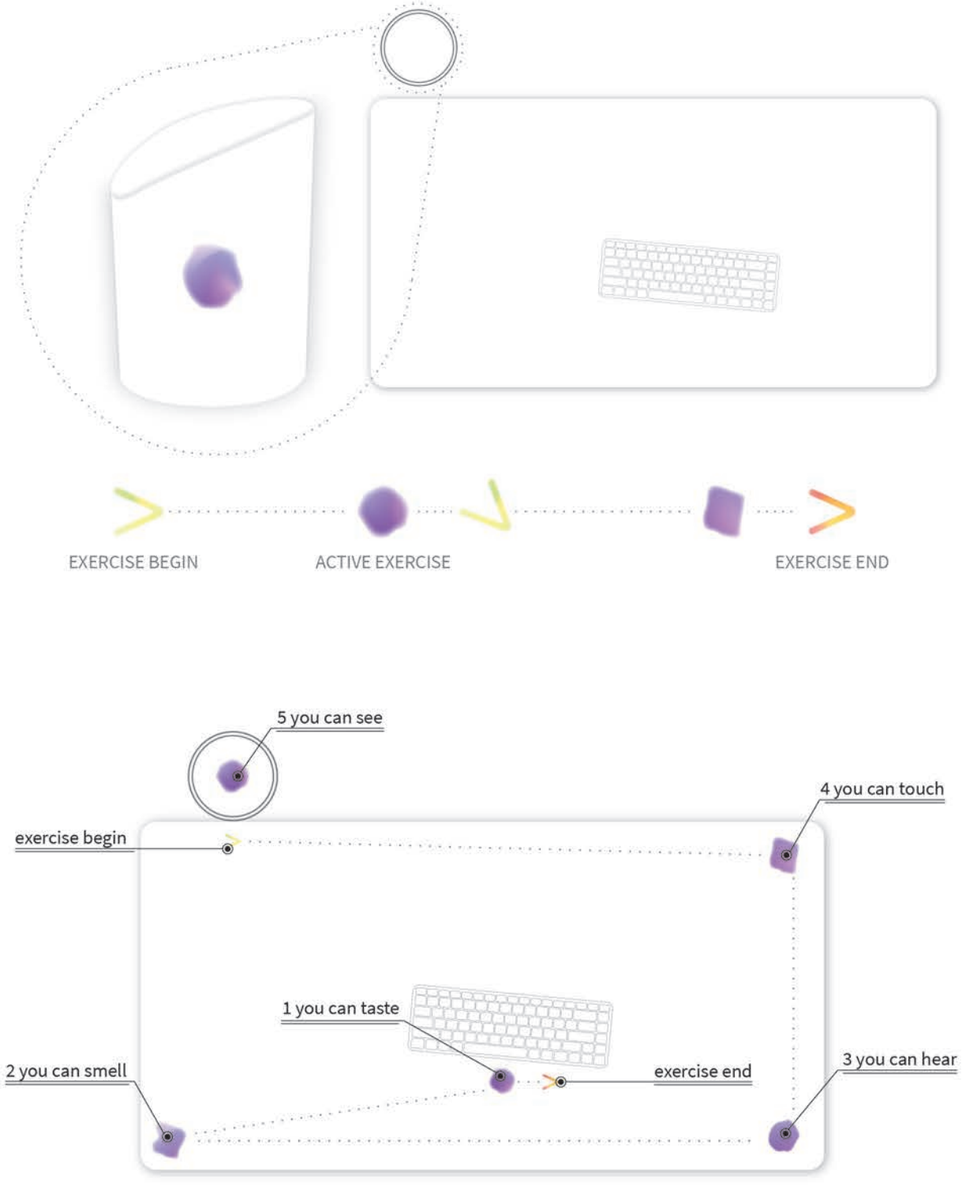


F19: 4-7-8 EXERCISE VIDEO SCREEN CAPTURE 2

F20: 4-7-8 EXERCISE VIDEO SCREEN CAPTURE 3

HTTP://DESIGN.NCSU.EDU/THENFINALLY/INGRAM/VIA-PIECE-VIDEO.MOV

5-4-3-2-1



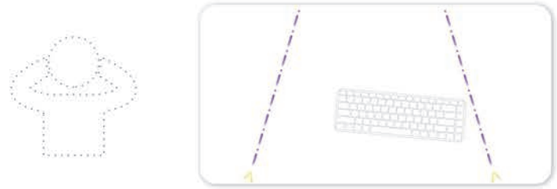
F21: 5-4-3-2-1 EXERCISE VIDEO SCREEN CAPTURE 1

F22: 5-4-3-2-1 EXERCISE VIDEO SCREEN CAPTURE 2

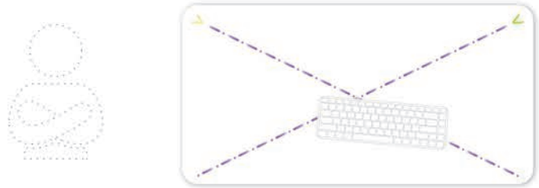
HTTP://DESIGN.NCSU.EDU/THENFINALLY/INGRAM/VIA-PIECE-VIDEO.MOV

POWER POSES

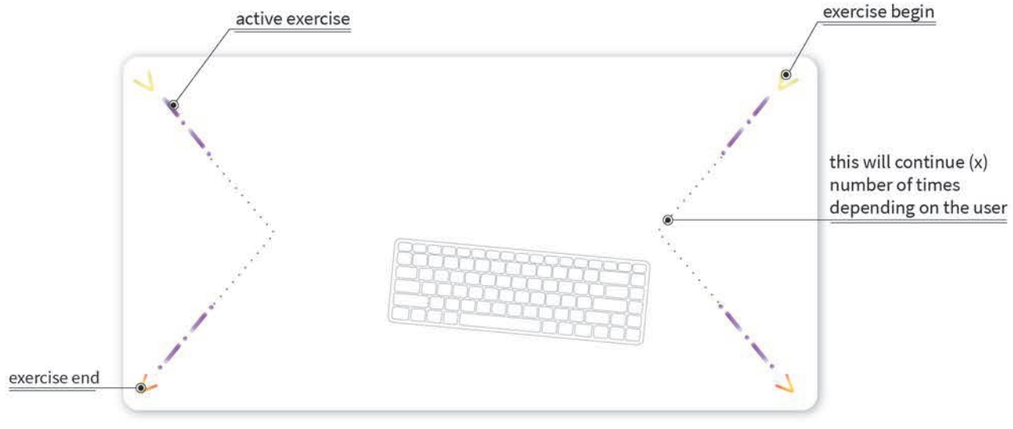
HANDS BEHIND HEAD

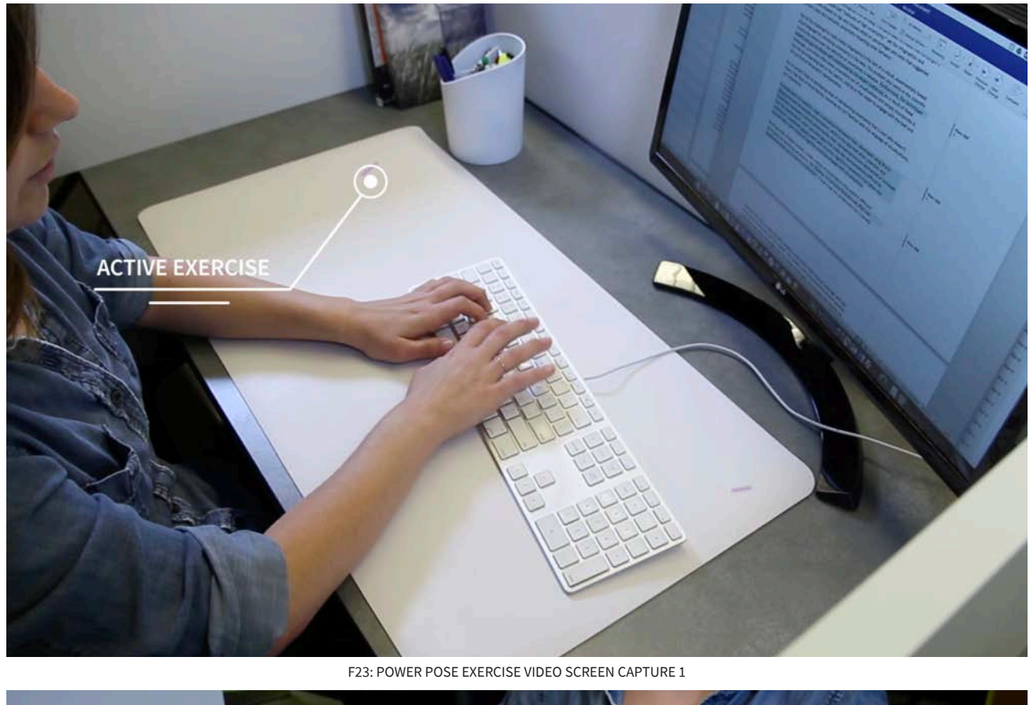


ARMS CROSSED IN FRONT

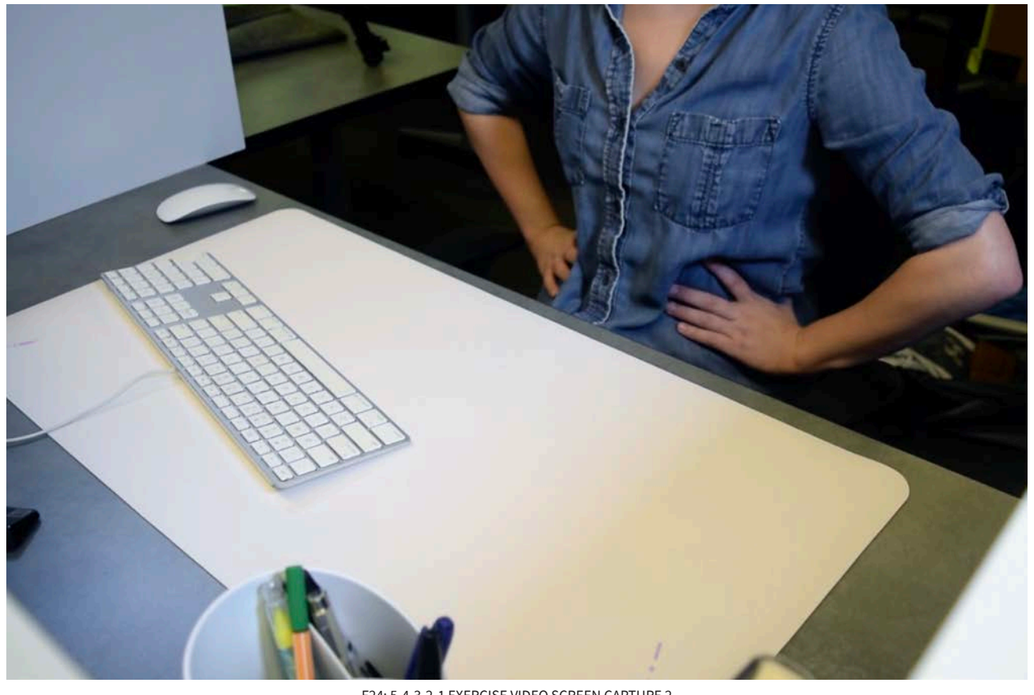


HANDS ON HIPS





F23: POWER POSE EXERCISE VIDEO SCREEN CAPTURE 1



F24: 5-4-3-2-1 EXERCISE VIDEO SCREEN CAPTURE 2

HTTP://DESIGN.NCSU.EDU/THENFINALLY/INGRAM/VIA-PIECE-VIDEO.MOV

> “ The designers creating enchanted objects must, therefore, think of themselves as something more than manipulators of materials and masters of form. They must t**hink beyond pixels, connectivity, miniaturists, and the cloud.** Our training may be as engineers and scientists, but we must also **see ourselves as wizards and artists, enchanters and storytellers, psychologists and behaviorists.** ”

DAVID ROSE, *ENCHANTED OBJECTS*

Conclusions & The Future

This investigation exposes the capabilities of enchanted objects to respond to stress. The concept of calm technology, originated in the 1950s, yet there just now seems to be an emerging trend of stress related applications and objects being produced. As enchanted objects become less conspicuous in the periphery, it will be interesting to see where and by whom such devices are manufactured. Will there be guidelines and limitations to , “calm technology standards”? Will users ultimately determine what data smart objects can access to meet their specific needs, or will big data become so normalized in society that there is no opt out? The system I have designed learns and adjusts to the user’s behavior, allowing it to change based on the user, but not it does not specifically encourage the user to change themselves. This however, could all change, depending on the limitations (or no limitations) that are decided upon as the use of these smart objects increases.

There is a considerable need for interdisciplinary design research to investigate possibilities further. Graphic designers are vital to understanding user and context and interaction design. However, industrial designers can help design the look and feel of these objects in order to present the best tactile objects. The combination of the two is critical when developing the overall ecosystem of interaction. Not only will graphic designers need to work with other design fields, but also, different schools of thought. Not every person has a full spectrum of sensory abilities. Further research should consider interaction for blind or visually impaired users. This would require more research of different sensory stimuli. Stress, in this case, would best be researched and discussed with professionals in the field, such as psychologists. Psychologists, therapists and color theorists could also provide useful insight into color in relation to disability and cultural associations.

While disabilities and cultural associations are vital in continuing this research, the area of most concern is privacy. First, the location of the objects. Currently, my system is contained within two objects in the workstation (a pencil holder and a desk mat). Because of this containment the user interacts with these objects in a confined space, where others may not notice. Future designed interactions could be more useful at a larger scale, say by using the cubicle walls or the floor. More substantial interactions would ultimately take away some privacy of the user because others in the workplace would have the ability to see that the user is in a state of stress. However, if using calm technology in the workplace to reduce stress becomes normalized, recognition of a state of stress may not be as noticeable.

The second question about privacy deals with input and data storage. Privacy is one of the most critical issues that is asked about new technology devices today. Since the system I am proposing has to collect information about the user to learn and respond, we must address the location of the data collection and the privacy of the user thoroughly. Could this collected data information be stored anonymously so that personal information will not be shared? It is no surprise that in today’s world the possibilities of being hacked are not a matter of how, but when. Therefore, when designing these devices, the question of privacy needs to be considered throughout the entire process. Once decided, it will allow the users to feel at ease while knowing this system is collecting their every move. They will understand they have options as to when and where they can see the data collection. Addressing if this information is shared to a more extensive system or not could determine many factors, such as, who will have access to this system of collected personal data. It is inevitable that the use of cloud-connected objects will result in questions of privacy;and, therefore, actions will need to be taken to determine what can and cannot be done to ensure users’ privacy.

Eventually, these ideas could be applied to a broader spectrum. If workers do not use the same desk environment each day, specific desk related enchanted objects would not be effective. Instead of purchasing dedicated calm objects, worker could engage with a system that uses augmented reality to achieve the same calming effect. A wearable AR product—in the vein of Google Glass— could also help with privacy. Viewers could more inconspicuously calm themselves. However, I speculate that AR would not engage as easily with different sensory modalities as dedicated enchanted objects could.

This research only begins to scratch the surface of reducing stress in the workplace through objects. In the future we may not work at desks or cubicles which calls for investigating multiple combinations of calming objects. Designers should collaborate further with experts on anxiety and workplace environments to design these systems and test their efficacy.

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Appendices

SPECIAL VIDEO MUSIC

Produced and discussed by Ellis Anderson

The soundtrack is inspired by the work of Brian Eno and the pioneers of ambient music. “Ambient Music must be able to accommodate many levels of listening attention without enforcing one in particular; it must be as ignorable as it is interesting (Eno, 1978).” While this music may not follow Eno’s standards to a T, it is drawn from similar principles: to ease and position the listener deep within their own space.

LIST OF FIGURES

DEFINITION OF TERMS

ambient awareness - “a principle that says, when possible, load things into the environment so that all of the attention doesn’t need to be constantly checking for a state change” (Case, A. 68)

anticipatory system- “a system containing a predictive model of itself and/or of its environment that allows it to change state at an instant in accord with the model’s predictions pertaining to a later state.” (Rosen D. 339)

anxiety – a physical feeling or troubled state of mind caused from a certain person or situation

calm technology – “technology designed to engage both the center and the periphery of our attention, and in fact [move] back and forth between the two that changes perspectives in how users interact with technology” (Weiser, M. & Brown, J.S.)

environments - “the circumstances, objects, or conditions by which one is surrounded” (“Environment.”)

enchanted’ objects – “ordinary things [objects] made extraordinary” (Rose, D. 7)

focused interactions – interactions with devices that require the user’s undivided attention (Bakker et al. 1)

intimate interfaces - “mobile interfaces that are discrete and unobtrusive” (Costanza et al.)

implicit interactions – interactions with devices that do not require full attention (Bakker et al. 1)

proxemics - the study of cultural, behavioral, and sociological aspects of spatial distance between humans (Nussbaumer, L.L., 355)

workplace stressors - a biological response to physical mechanisms in the place of work (i.e. high work demands, performing multiple tasks, time pressure, etc.) (Nekoranec, J., Kmošena, M. 164)

ubiquitous computing - era of computing where many computers in the world serve each person but are not all necessarily connected to one another (Case, A. 1,2)

workstation - three dimensional space surrounding a worker (cubicle)

young professionals – persons within the ages 21-30 who are employed in a profession

SURVEY QUESTIONS

Name (your identification and information input into this form will be confidential - please only give your name if you are willing to possibly receive follow-up questions from me)

Email (I will not spam you! This is in case I need to ask you follow-up questions or further clarification if you choose to be contacted)

What is your age?

What is your occupation?

What type of office workstation setting do you have?

How many people work in the same room as you?

Briefly tell me what kind of environment you work in:

On a scale from 1-10, on average, what is your stress level through the workday? (1 being the least - 10 being the max)

What kind of stressors do you have at work? Anything is applicable, I want to know all of them! Please also indicate a number next to each one determining level of stress (1 being the least - 10 being the max).

What relieves your stress at work?

What kind of device/assistant do you wish you had to help manage your stress? (this can be completely futuristic)

Is there anything else you would like to say about your experience in your workstation/ workplace environment?