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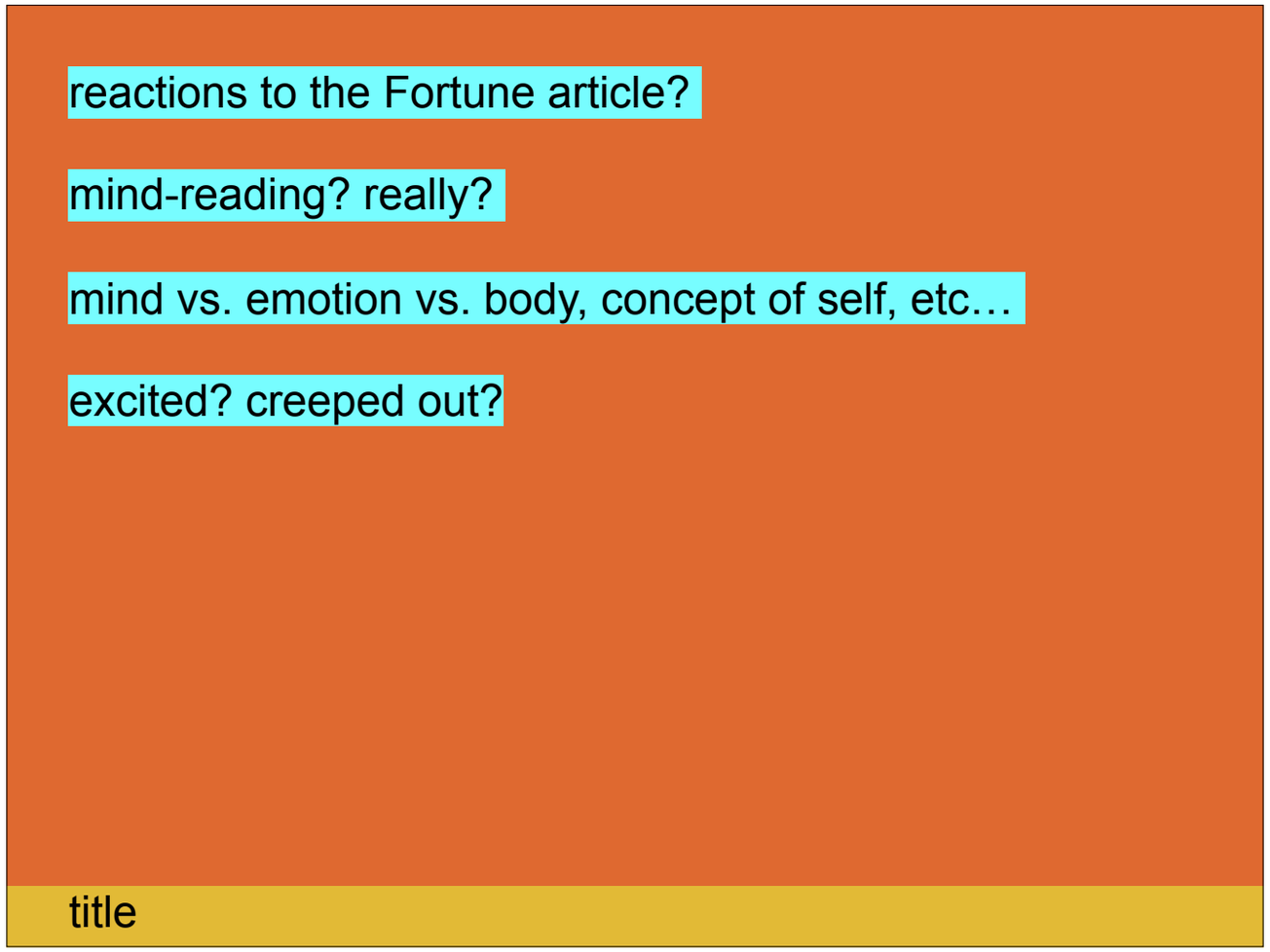
BioSENSE

title

Hi, I’m Noura Howell, a PhD Student at the Berkeley School of Information doing critical design and design research, also a member of the BioSENSE group here

OK, one thing first, has everyone figured out how to access the readings even when they are behind a journal’s paywall?

also, just going forward, feel free to interrupt AT ANY TIME. no one wants to just hear me talk nonstop for an hour and half. so please, it will be better for everyone if you chime in.



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OK, one thing first, has everyone figured out how to access the readings even when they are behind a journal’s paywall?

two ways of understanding affect

information model

`user.emotion = "happy"`

Kirsten Boehner, Rogério DePaula, Paul Dourish, and Phoebe Sengers. 2007. How emotion is made and measured. *International Journal of Human-Computer Studies*.

affect-as-information vs. affect-as-interaction

Drawn from the reading for today. There are different approaches to understanding affect.

At one end of the spectrum is the information model. computers treat emotion like any other kind of variable or state. Sensors and algorithms are used to detect emotions and categorize them into things like “happy,” “angry,” “sad,” etc. These kind of models measure emotion on the level of the individual and put these emotions into distinct categories. Context sort of gets flattened out here, “happy” in one context is assumed to be equivalent to “happy” in any other context.

two ways of understanding affect

Kirsten Boehner, Rogério DePaula, Paul Dourish, and Phoebe Sengers. 2007. How emotion is made and measured. *International Journal of Human-Computer Studies*.

affect-as-information vs. affect-as-interaction

On the other hand, the Interaction Model, treats emotions as emergent from interactions between people, socially experienced, and highly contextual and situated in interaction. Rather than trying to get machines to detect and categorize feelings, the focus is more on supporting reflection and interpretation by humans.

Affectiva: affect-as-information

Affectiva is a company that spun out of research at the MIT Media lab, founded by Rana el Kaliouby. It takes in video of a person's face and detects different parts of their facial expression, such as the shape of their mouth or their eyes, and uses machine learning to map combinations of those to different aspects related to emotion such as valence (positive or negative feelings), surprise, smiling, etc.

I went onto their website and tried out their demo, where they tracked my face while I watched an ad. You can see my "valence" graph in the bright blue. Apparently I really didn't like this ad because the valence went super negative. Evidently most people had a more positive valence toward the end of the ad.

So, you can see how advertisers would love this kind of information to help better sell to consumers. There are a lot of other possible applications too. I think Kaliouby initially wanted to help children with autism understand how others around them were feeling to help them socialize. You could also imagine online courses that offer special help when a student appears to be frustrated.

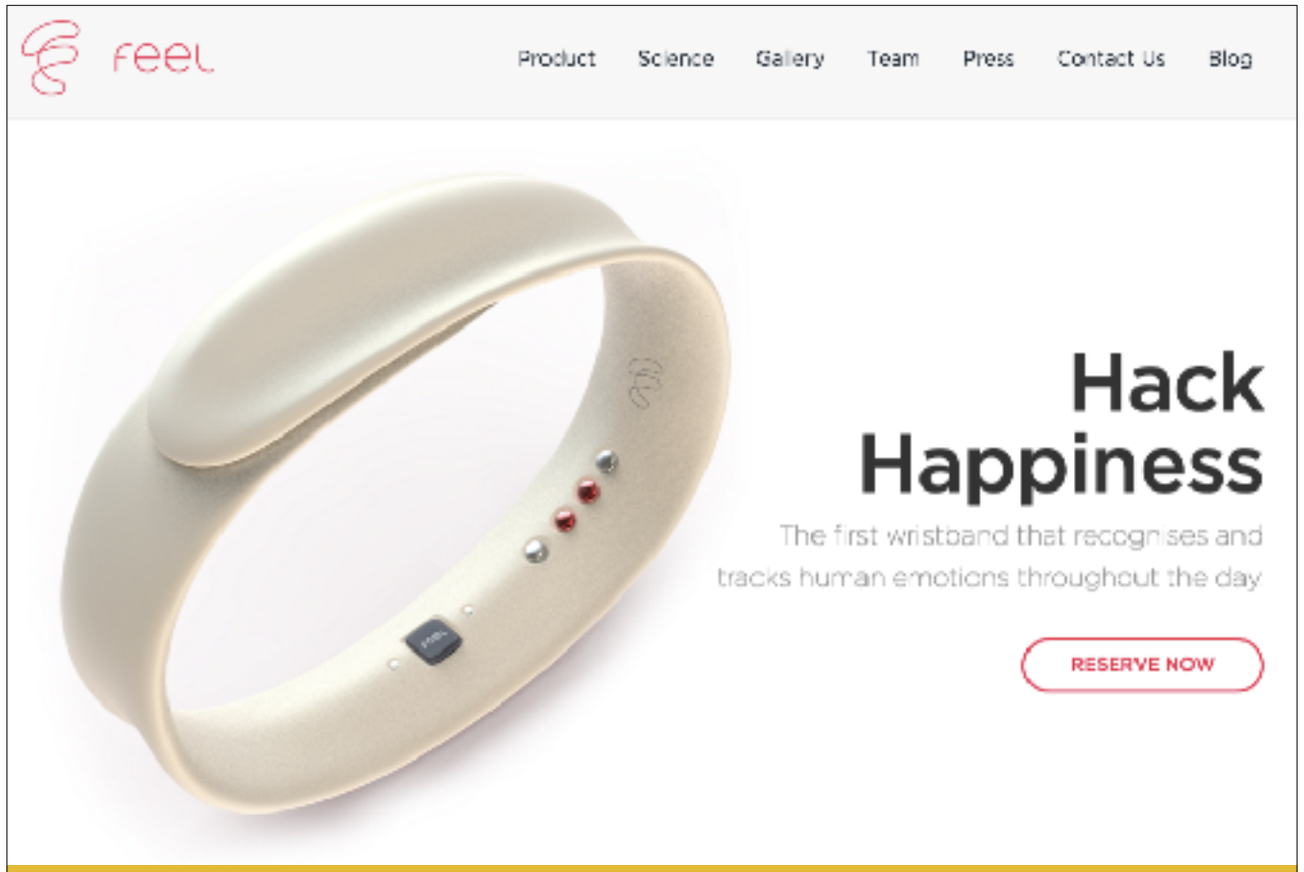
Also, this is focused on monitoring how people's faces change when they are alone watching a video. The way people express themselves in face to face social interaction is likely different. So just always be aware of how the data is gathered, what its ecological validity might be, etc.

go try out Affectiva’s online web demo

discuss amongst yourselves

time: 10 minutes

title



Feel: affect-as-information

Another example is the Feel wristband, that tracks the wearers' emotions throughout the day in order to help them "Hack Happiness".

They track galvanic skin response, pulse, and skin temperature. Galvanic skin response, also known as skin conductance, is a measure of how electrically conductive one's skin is. or basically how sweaty you are. but, like, micro-fluctations in that. a sudden increase in skin conductance is associated with excitement of various kinds. for example feeling nervous and having sweaty palms.

heart rate is also associated with emotions, perhaps we have more intuition about that. for example feeling afraid and your heart is pounding

Feel: affect-as-information

It comes with a mobile app to show you graphs of your “happiness”, “stress”, and “pleasure” over time.

So, it’s taking a quantified self approach to helping people be happy.

Lucian Leahu and Phoebe Sengers. 2014. Freaky: performing hybrid human-machine emotion. *DIS'14*

Freaky: affect-as-interaction

machine learning to detect fear
computer performing fear by
"freaking out"
hybrid human-machine emotion

One example that gets away from purely detecting emotions in the user is Freaky. Freaky is an alien larvae like creature worn in a baby carrier. It uses machine learning to detect fear in its person. When it detects fear, it "freaks out" by making noises and vibrating. Its person has to pet and rock Freaky to get it to calm down.

I mean, the form factor is obviously weird, but I think that serves to show that this is an "alien" machine interpretation rather than claiming that this is the "true value" for the human's current emotions. So the system accommodates both machine interpretation and human interpretation, rather than claiming they are the same.

So, I think it could be argued that Freaky is a hybrid approach. The information-centric part is that the alien larvae does make its own judgment about "fear" based on its informational measurements of the wearer's heart rate. But, rather than assigning that label of "fear" to the wearer, Freaky enacts that fear itself. Much of the meaning and interpretation comes out in the wearer's interaction with Freaky, and with other people who are around at the time.

What are some advantages or disadvantages of the different approaches to understanding emotion?

compare / contrast example technologies too

affect-as-information vs. affect-as-interaction

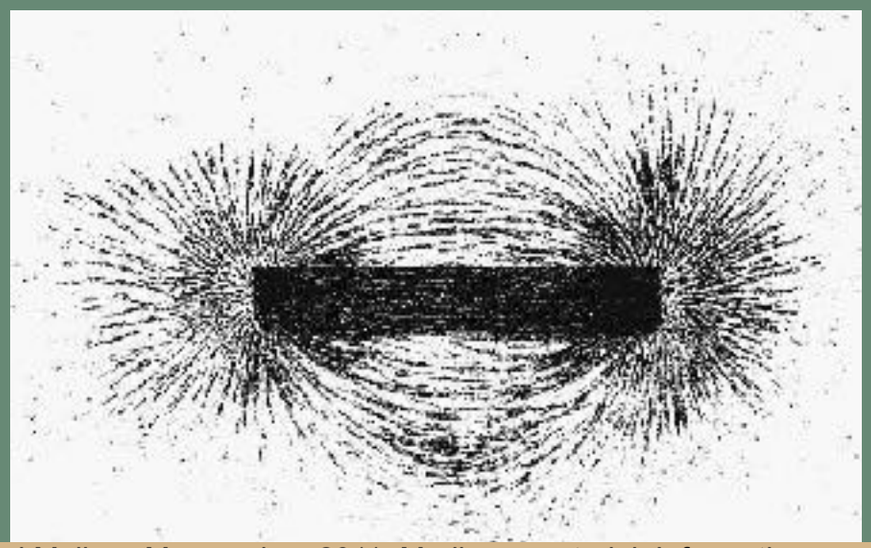
an anecdote

Paul Dourish and Melissa Mazmanian. 2011. Media as material: Information representations as material foundations for organizational practice. In *Third International Symposium on Process Organization Studies*.

data is material

So, this anecdote helps illustrate how data is material. Back in the days when data was encoded on tapes, a researcher Paul Dourish was working in the UK. He got sent a tape of data from the U.S. and wanted to read what was on it. So he tried it in all the different computers he could find, but none of them could read the tape. Finally someone suggested he take the tape to Harry who could “eyeball” it. He was kind of skeptical about this but was out of options.

an anecdote



Paul Dourish and Melissa Mazmanian. 2011. Media as material: Information representations as material foundations for organizational practice. In *Third International Symposium on Process Organization Studies*.

data is material

Harry took the tape, unwound some of the tape and laid it out on the table, and then put some iron filings around it. As you know, iron filings will align themselves with magnetic fields. So here the iron filings were responding to the magnetic tape.

Harry found the “empty spots” on the tape that marked the space between data records. By measuring the physical distance between two of these spots, he was able to determine how the data was encoded, and which computer needed to be used to read the tape.

Even though this is with an older technology, even with digital data, digital is still ultimately based in electrical circuits which are material. It all comes down to 0s and 1s, but then those really just represent high or low voltages on the hardware level… this physical structure has consequences for how we store data and query data.

other examples

- different practices in film vs. digital photography
- a graph on paper you can annotate vs. a website graph you can't
- One Wilshire street hosts physical servers for Version, AT&T, AWS, Netflix…
- geographic location of DNS servers
- ease of querying data depends on its structure (e.g., array vs. dictionary)

… other examples?

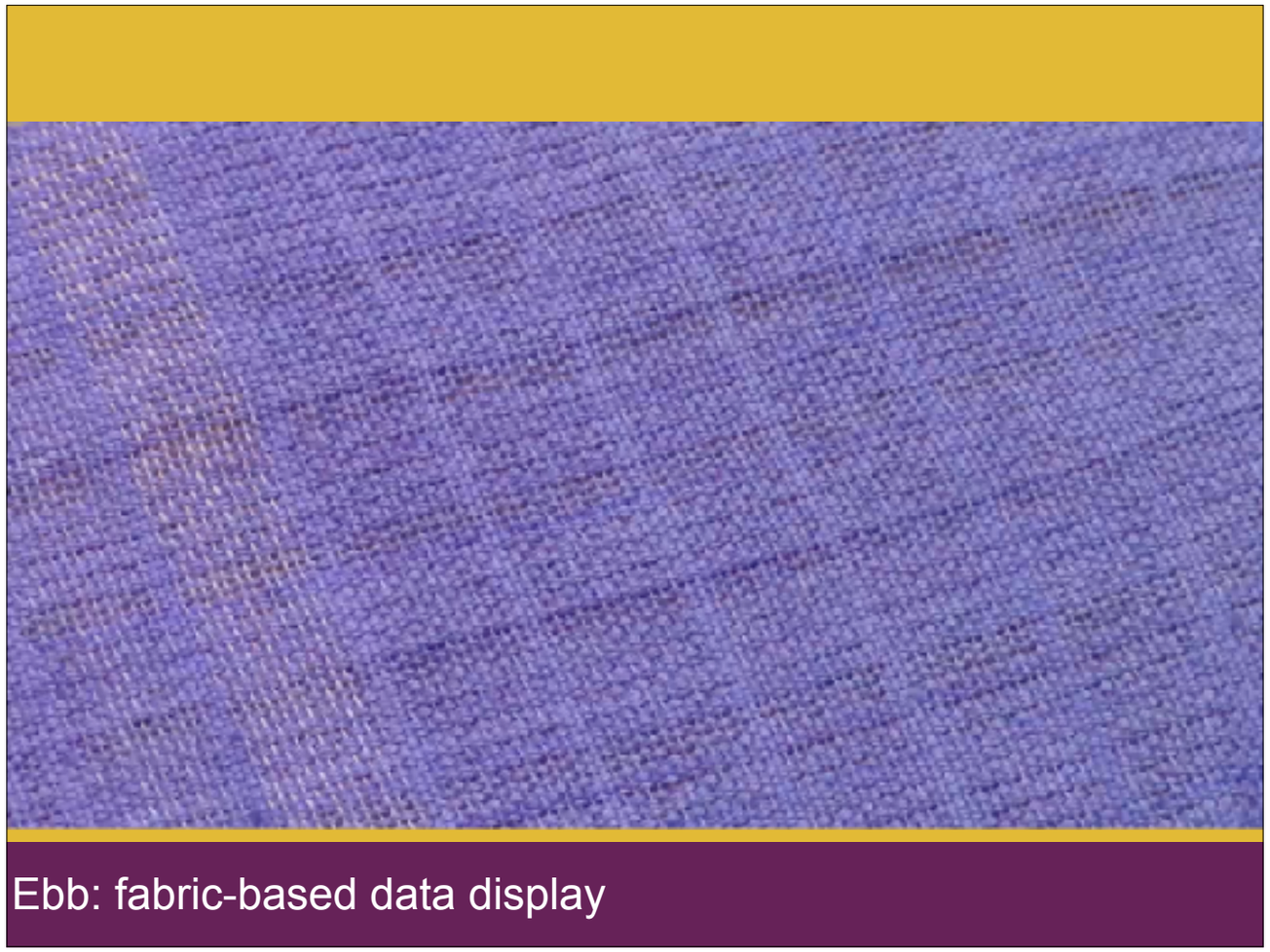
data is material

slowness and ambiguity as assets

Laura Devendorf, Joanne Lo, Noura Howell, Lin Lee Jung, Nan-Wei Gong, M. Emre Karagozler, Shiho Fukuhara, Ivan Poupyrev, Eric Paulos, Kimiko Ryokai. 2016. “I don’t want to wear a screen”: Probing perceptions of and possibilities for dynamic displays on clothing. *CHI’16*.

Ebb: fabric-based data display

We made color-changing fabric swatches and asked fashion designers and everyday wearers to envision possible interactions with color-changing fabric in clothing in everyday life. Participants saw the slowness and ambiguity of this fabric as assets. They suggested ways that these color-changing fabrics could provide a very different experience as information displays than, say, screens.



Ebb: fabric-based data display

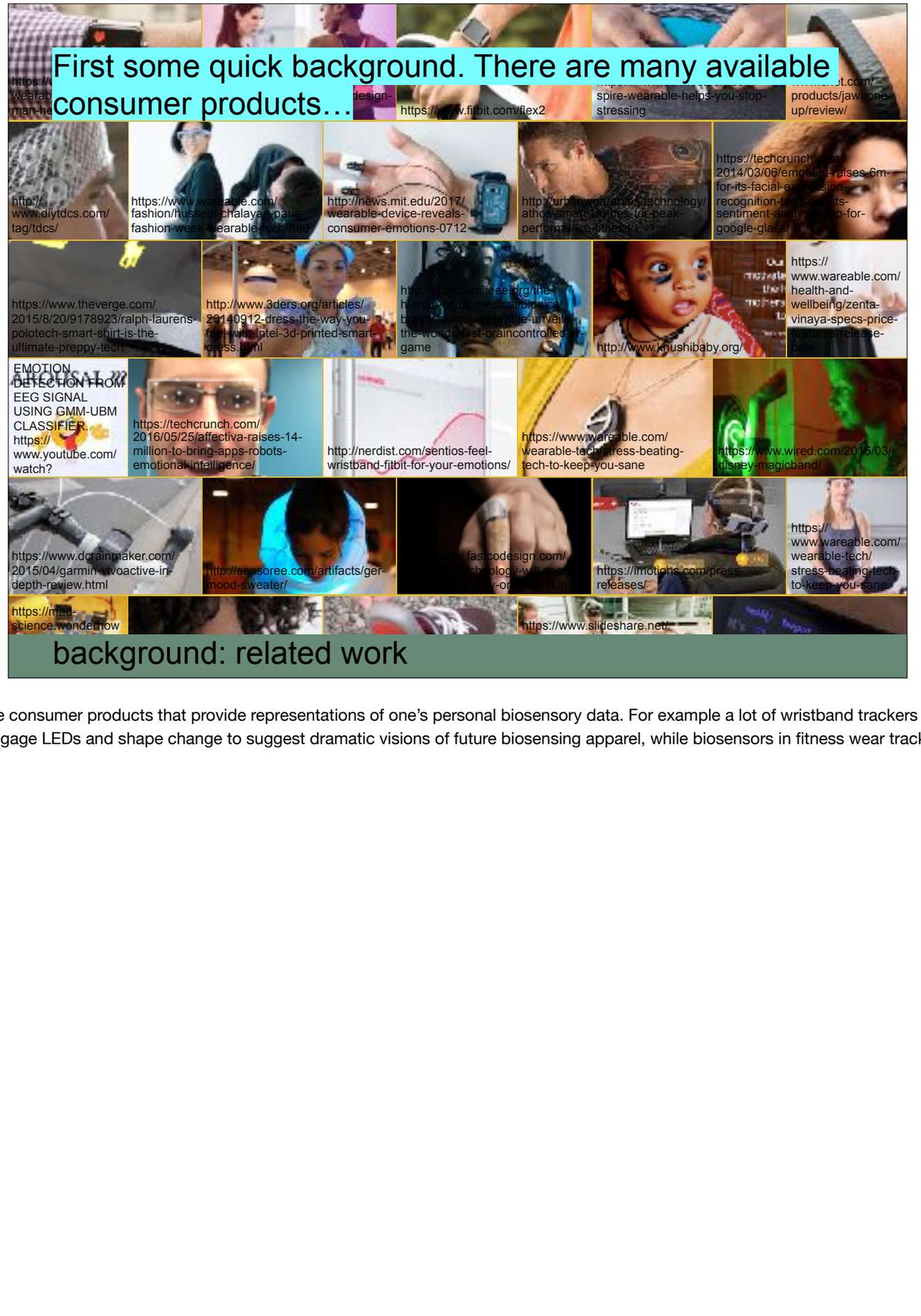
talk over the video about the different swatches…

title

OK, I recently gave this talk at this conference… thought it could be interesting to share this as an example me grappling with these issues in my own work…

intro

People are increasingly enrolling biosensing technologies to support everyday mindfulness and reflection upon their feelings. This paper draws tensions that emerged from a study of one such system: a shirt with patterns that change color in response to the wearer’s skin conductance. While we intended to support personal reflection by people wearing the shirts, and hoped they would form their own narratives of their data and question its relationships to their own feelings, our study findings surprised us and revealed tensions of leveraging biosensing for personal reflection.



First some quick background. There are many available consumer products that provide representations of one’s personal biosensory data. For example a lot of wristband trackers like Fitbit measure heart rate or step counts. In fashion, runway provocations and showcase pieces engage LEDs and shape change to suggest dramatic visions of future biosensing apparel, while biosensors in fitness wear track and optimize workouts.

Ripple is a shirt with three color-changing pinstripes on the upper left sleeve that respond to biosensory data.

design artifact

Ripple is a shirt with three color-changing pinstripes on its upper left sleeve. The pinstripes respond to biosensory data by gradually fading from gray to white over the course of about 10 minutes. I might also refer to these pinstripes as the “pattern” or “display” of the shirt.

It’s NOT a light-emitting display like LEDs sewn into the shirt, it’s a chemical based color change where the material itself is actually gradually changing color. We intentionally wanted to get away from screen-based representations that might seem like a “graph” or more typical “scientific” approaches to data analysis… clothing fosters different kinds of association drawing from fashion and self-presentation in daily life…

[show the color change on the slides]

Ripple is a shirt with three color-changing pinstripes on the upper left sleeve that respond to biosensory data.

design artifact

Here is what the display looks like when it’s changing.

Ripple is a shirt with three color-changing pinstripes on the upper left sleeve that respond to biosensory data.

design artifact

Ripple is a shirt with three color-changing pinstripes on the upper left sleeve that respond to biosensory data.

design artifact

We envisioned the color change as a “ripple effect” that could be part of the many rippling effects that occur in the ongoing “river” of emotions of daily life and social interactions, wherein our facial expressions, gestures, speech, thoughts, feelings, actions, etc., are continually acting and reacting with ourselves, one another, and the environment. Similar to how laughter, then a blush, might be effects rippling out from a teasing comment, Ripple’s color change adds another visual reaction that is observable by self and others.

Also, we wanted the shirts to blend in with everyday style.

I’ll quickly go through some of the key design elements.

The pattern changes color in response to the wearer’s skin conductance suddenly increasing.

design artifact: skin conductance

The pattern changes color in response to the wearer’s skin conductance suddenly increasing.

Skin conductance is essentially how sweaty the skin is, but micro fluctuations in this are associated with various kinds of excitement, including mental, emotional, and physical. Skin conductance gives an indication of excitement, but no indication of valence—both ‘positive’ and ‘negative’ kinds of excitement are associated with a sudden increase in skin conductance. For example, if you are really nervous, you might notice your palms getting sweaty. Or, if you are having a really engaging conversation, you might also notice slightly sweatier palms.

The display is subtle and ambiguous. In order to foster human-driven interpretation and critical questioning of biosensory data…

design artifact: subtle and ambiguous

The display is subtle and ambiguous. In order to foster human-driven interpretation and critical questioning of biosensory data despite prevalent cultural narratives of data as truth, we designed avenues for questioning or even disregarding the data by making the display subtle and ambiguous.

Subtlety stems from
- the display's small size
- its location in the periphery of where one typically looks
- the slow and gradual display changes
- the neutral colors
- the material that blends in with everyday clothing
- the non-light-emitting nature of the display, and
- hiding the sensor inside the garment.

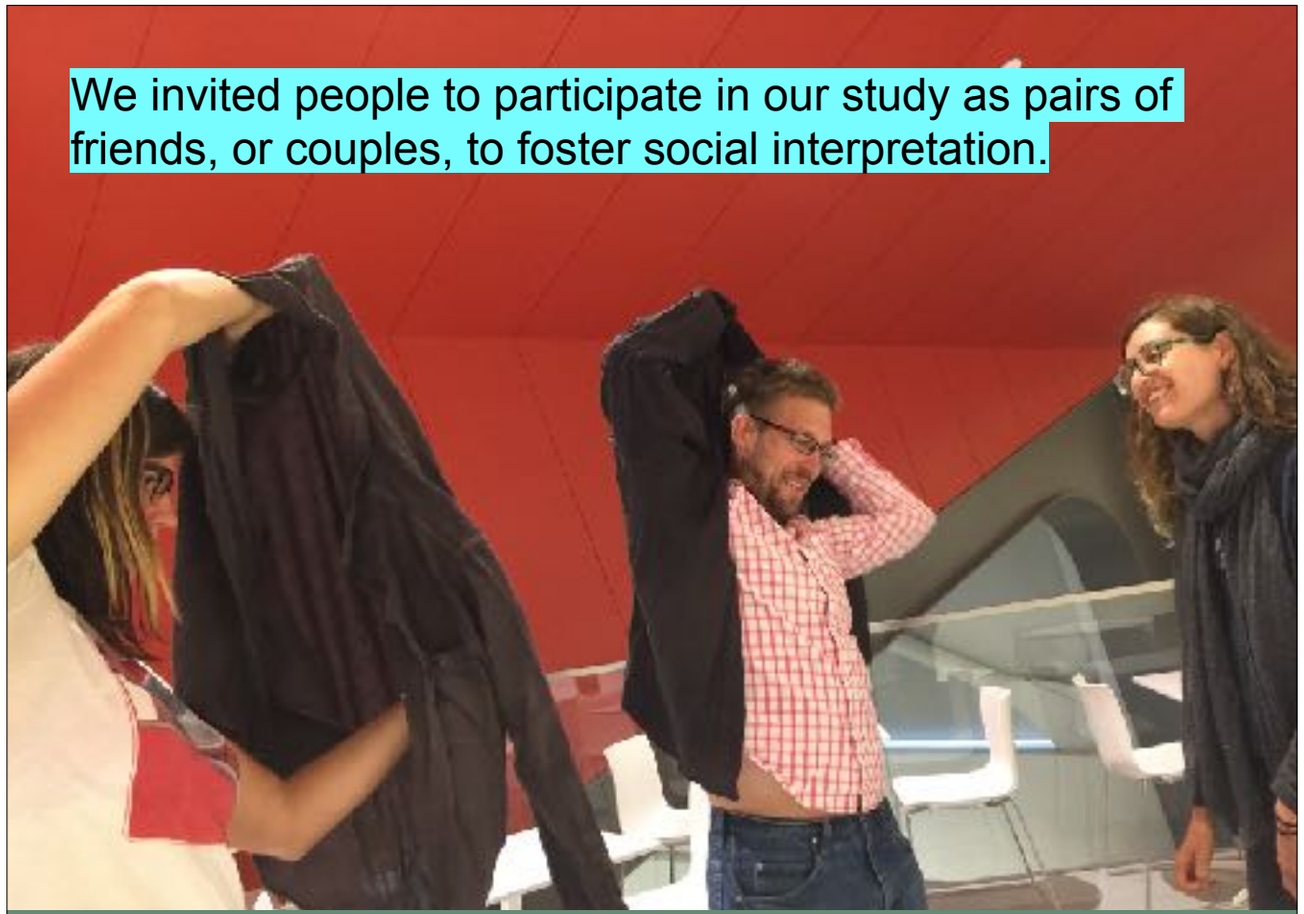
Ambiguity stems from a few different things.

First, skin conductance is inherently ambiguous because it can indicate both positive and negative kinds of excitement. Furthermore, our skin conductance sensor also responds to sweating from physical exertion.

Second, the color-changing material is thermochromic, so it also responds to any kind of temperature change like warm sunlight or a cool breeze. So, in interpreting the display or explaining it to others, the wearer could easily say that the display was responding to temperature, not their skin conductance.

Third, we added "override" features that enabled wearers to "fake" the display by forcing it to immediately respond or immediately cancel any display response.

By making the display subtle and ambiguous, our intention was to try to get away from this idea of data as truth and instead encourage people to make their own interpretations of the data display, or even disregard the data display if they so chose.



study procedure

We invited people to participate in our study as pairs of friends, or couples, to foster social interpretation.

After an introductory meeting, participants went about their daily lives wearing Ripple. For that period, they were given diary prompts asking them to document their experiences with text and photos.

The next day, they met again with a researcher for a semi-structured post-interview asking about their experiences with and interpretations of the display, which they had worn for about 8-20 hours.

Some participants related the display to their own feelings and experiences throughout daily life.

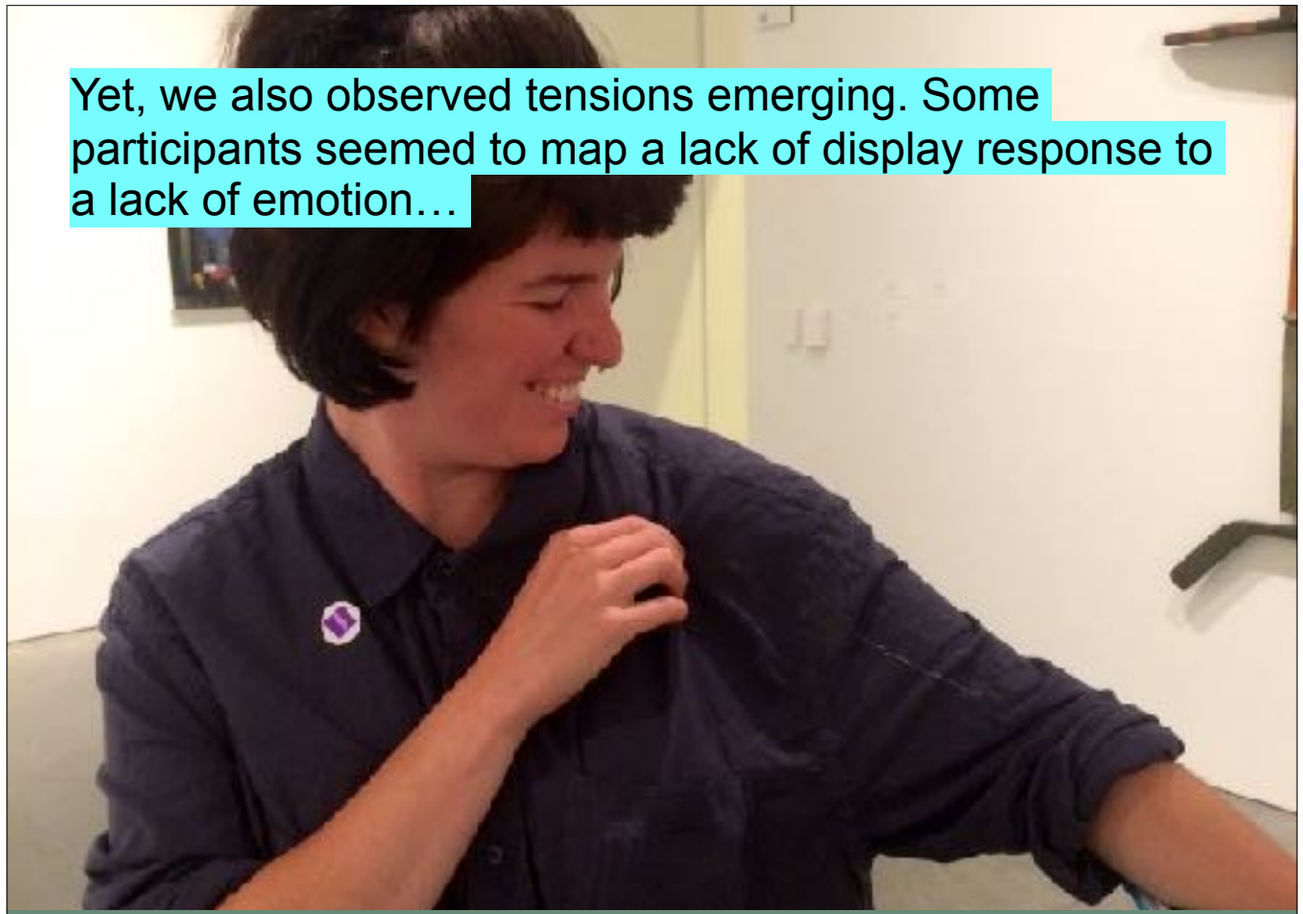
“It changes color when I get my adrenaline going, so it's kind of cool to see that in a physical way… I like that it connects my internal thoughts that are usually not on display with my body and me.”

findings: human-driven interpretation

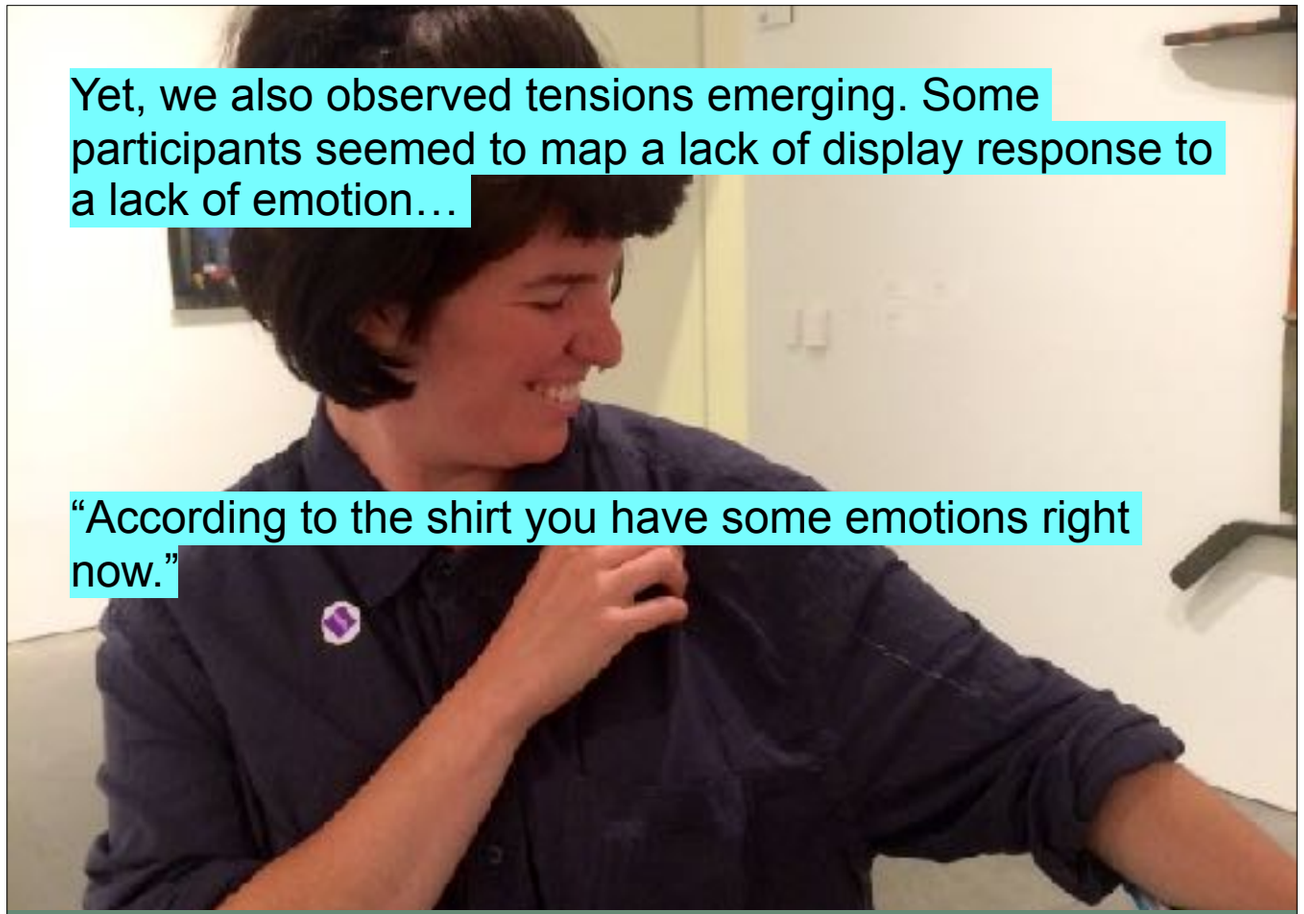
Some participants related the display to their own feelings and experiences throughout daily life, and described the display as highlighting connections between different facets of being such as mind, body, and emotions.

For example, Jennifer appreciated the physicality of the display saying, “It changes color when I get my adrenaline going, so it's kind of cool to see that in a physical way … I like that it connects my internal thoughts that are usually not on display with my body and me.”

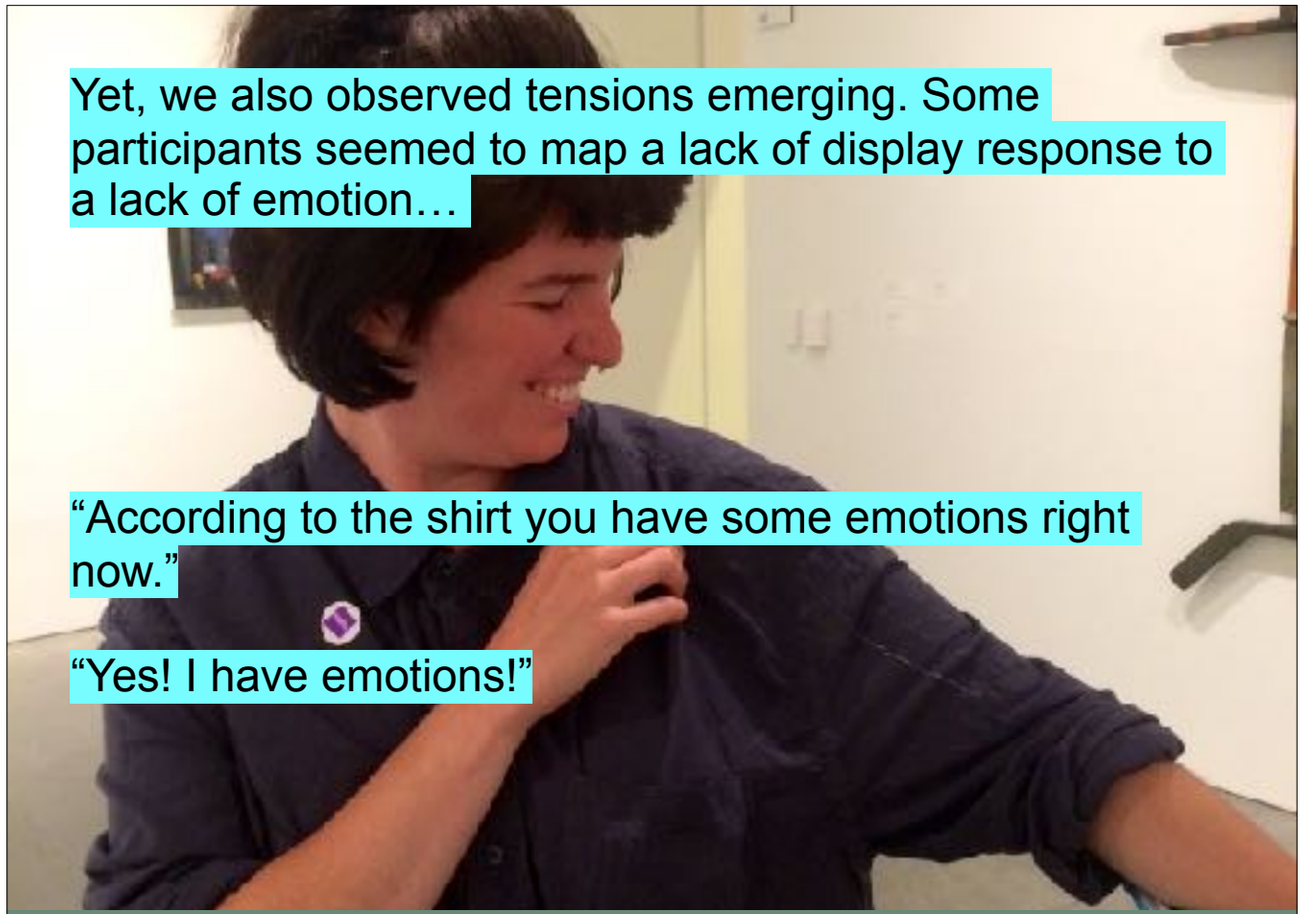
In one instance, she almost fell off the foam block, and attributed the displays’ color change at that point to her momentary fear of falling.



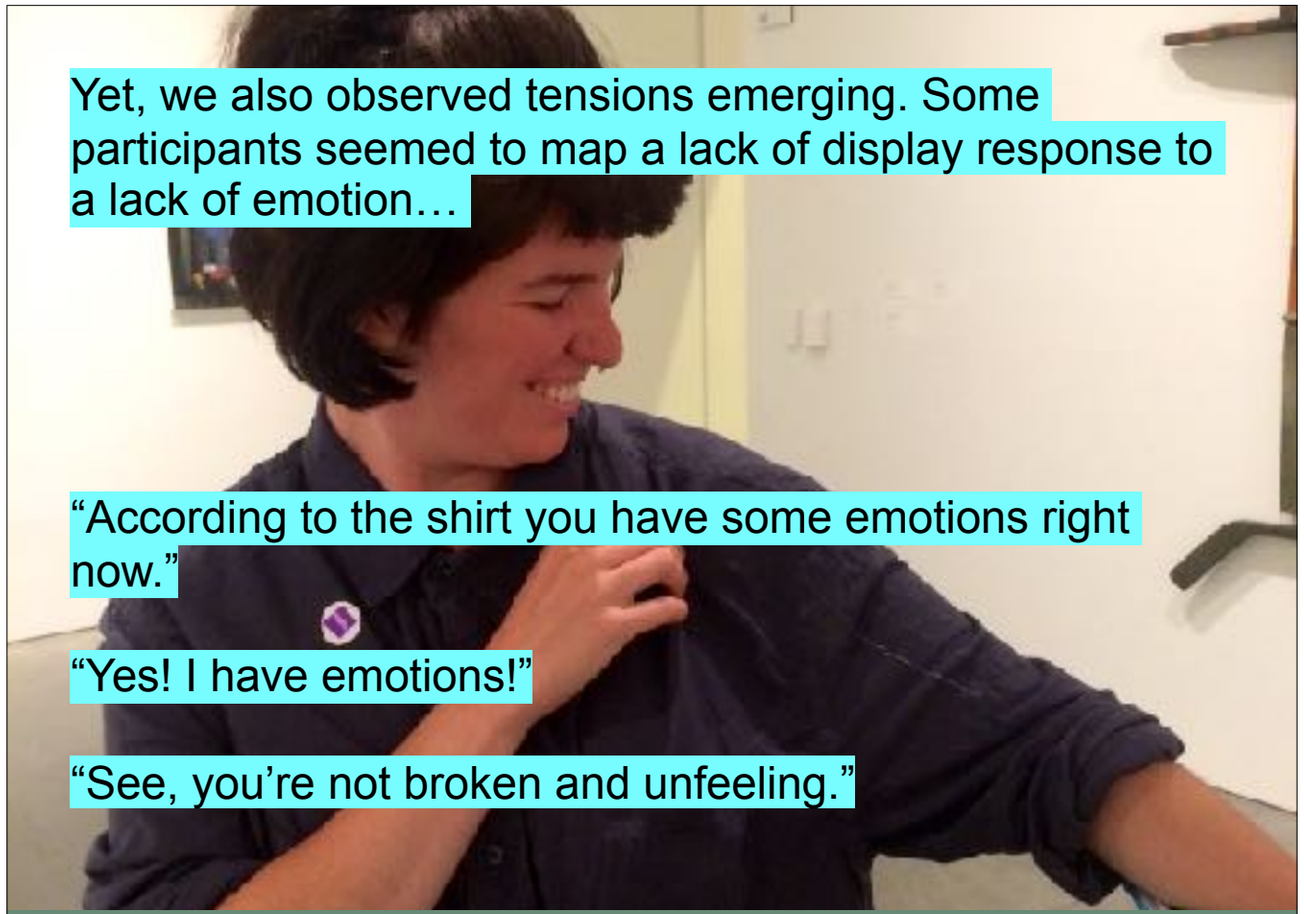
Yet, we also observed tensions emerging. Some participants seemed to map a lack of display response to a lack of emotion. Erika expressed concern that the shirt not responding might indicate that she was not a very emotional person.



When Erika’s display changed at the end of the first meeting, her husband pointed it out by saying, “According to the shirt you have some emotions right now.”



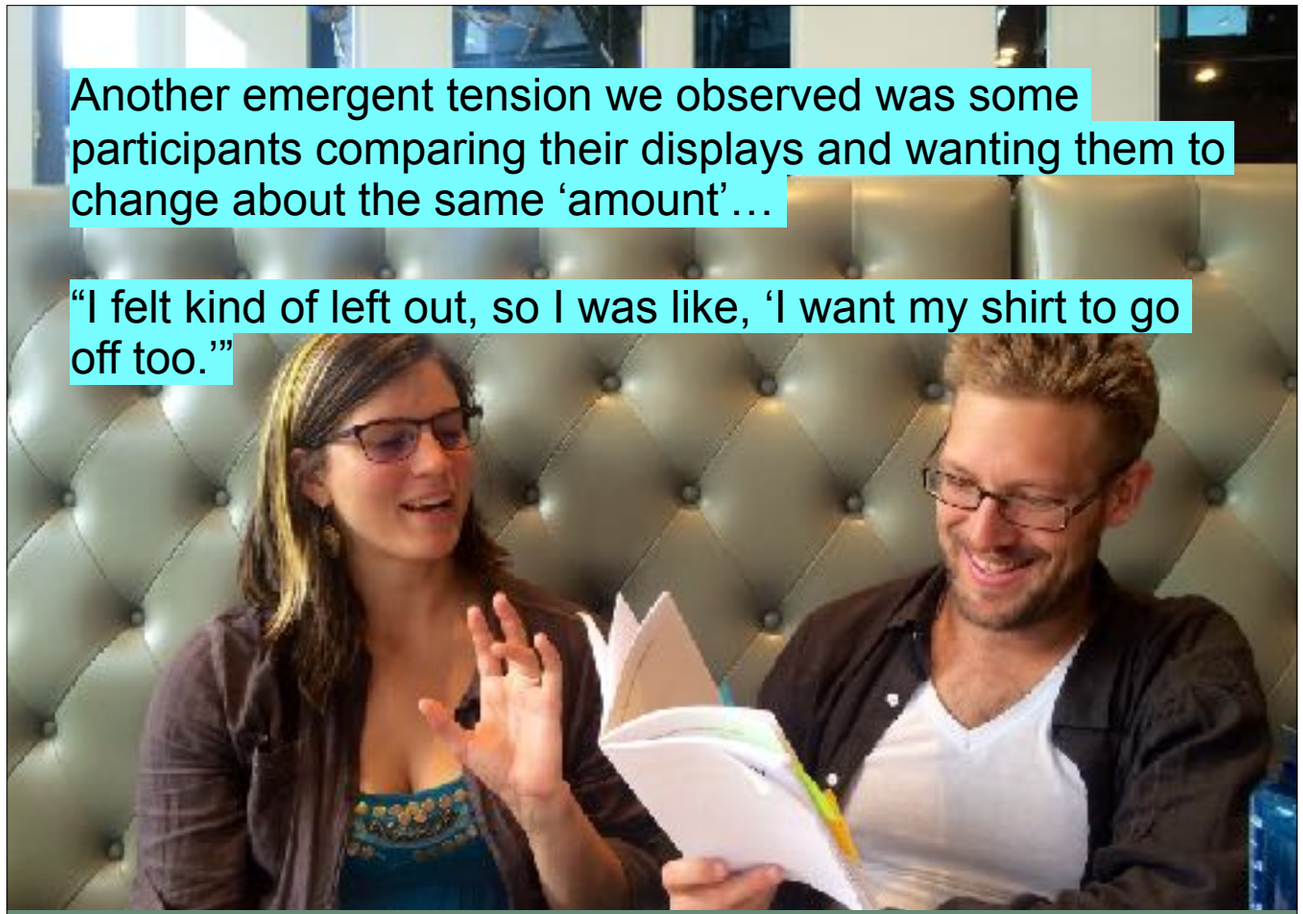
In response she broke into a huge smile and exclaimed, “Yes! I have emotions!”



Her husband replied, “See, you’re not broken and unfeeling.”

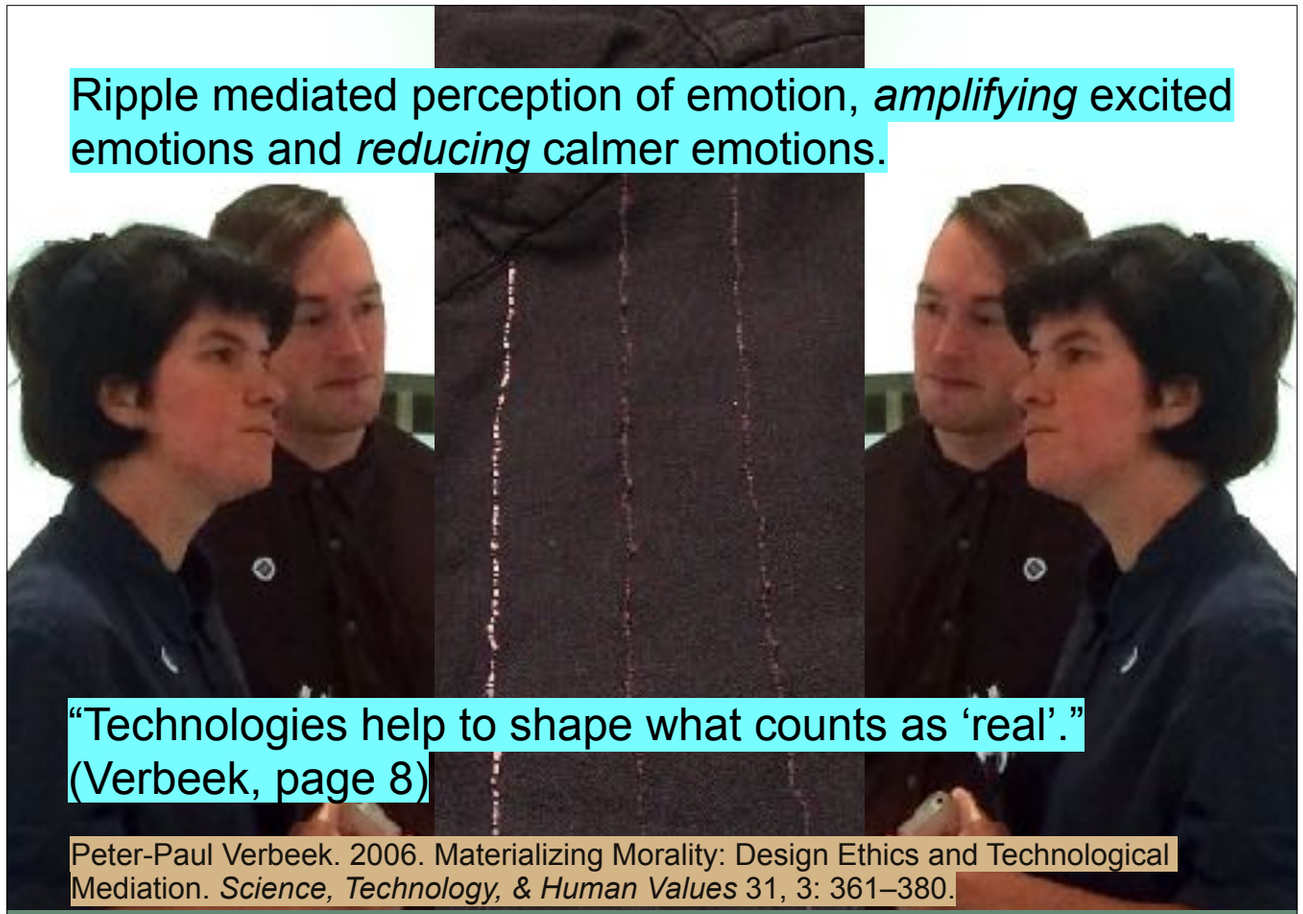
Erika seemed to interpret a lack of responsiveness in the display as suggesting that she did not have feelings.

Another emergent tension we observed was some participants comparing their displays and wanting them to change about the same ‘amount’.



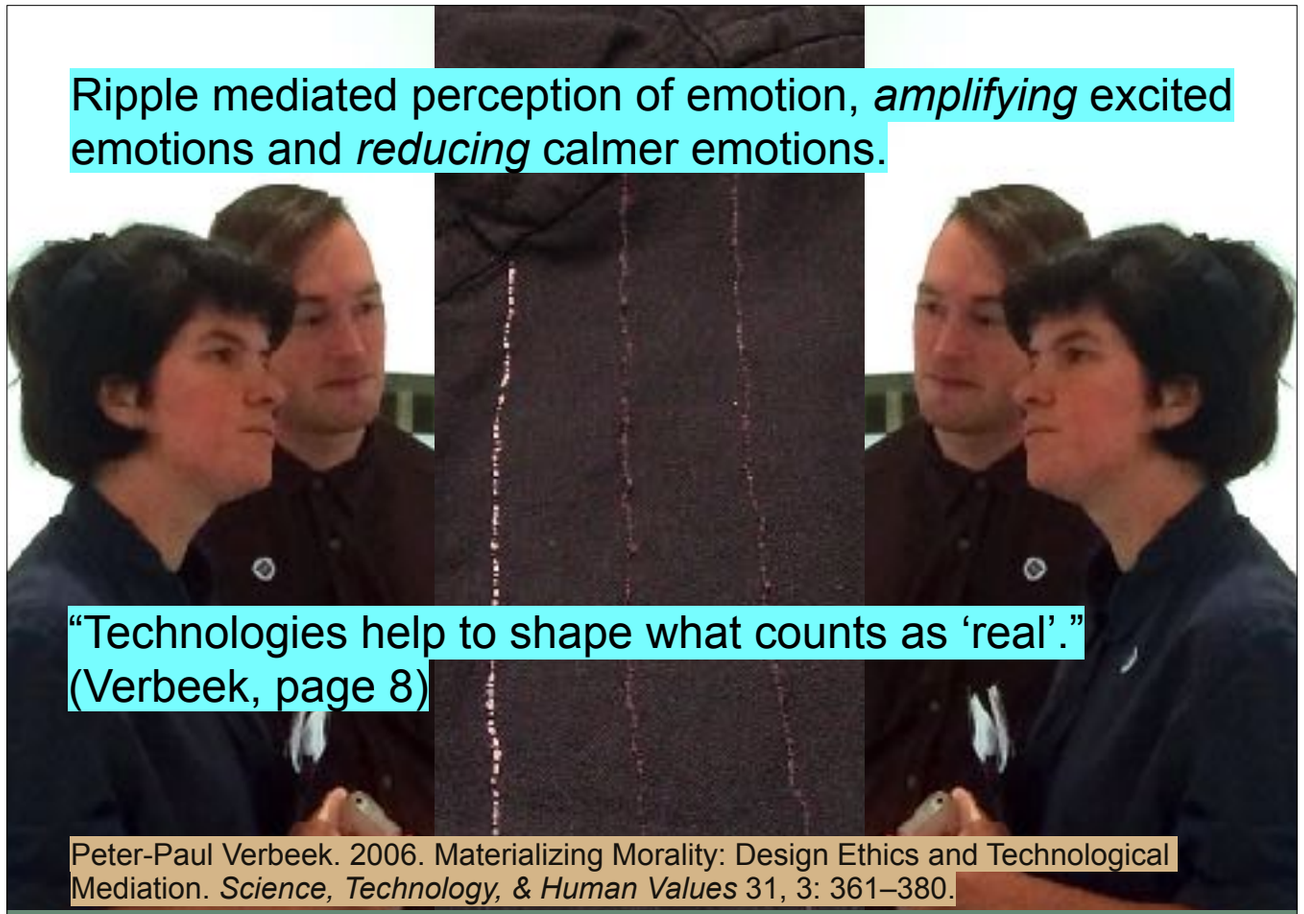
Over lunch Alva noticed that Brant’s shirt kept changing while hers did not. She said, “I felt kind of left out, so I was like, ‘I want my shirt to go off too,’” so she used the override on feature to manually initiate a change in her display. On the other hand, Brant said his display had been on nearly nonstop during all of lunch, so he used the override off feature.

Alva’s decision to create more display changes with the override on, and Brant’s decision to suppress display changes with the override off, suggest a desire for their displays to change about the same ‘amount,’ perhaps to support a sense of shared emotional experience over lunch.

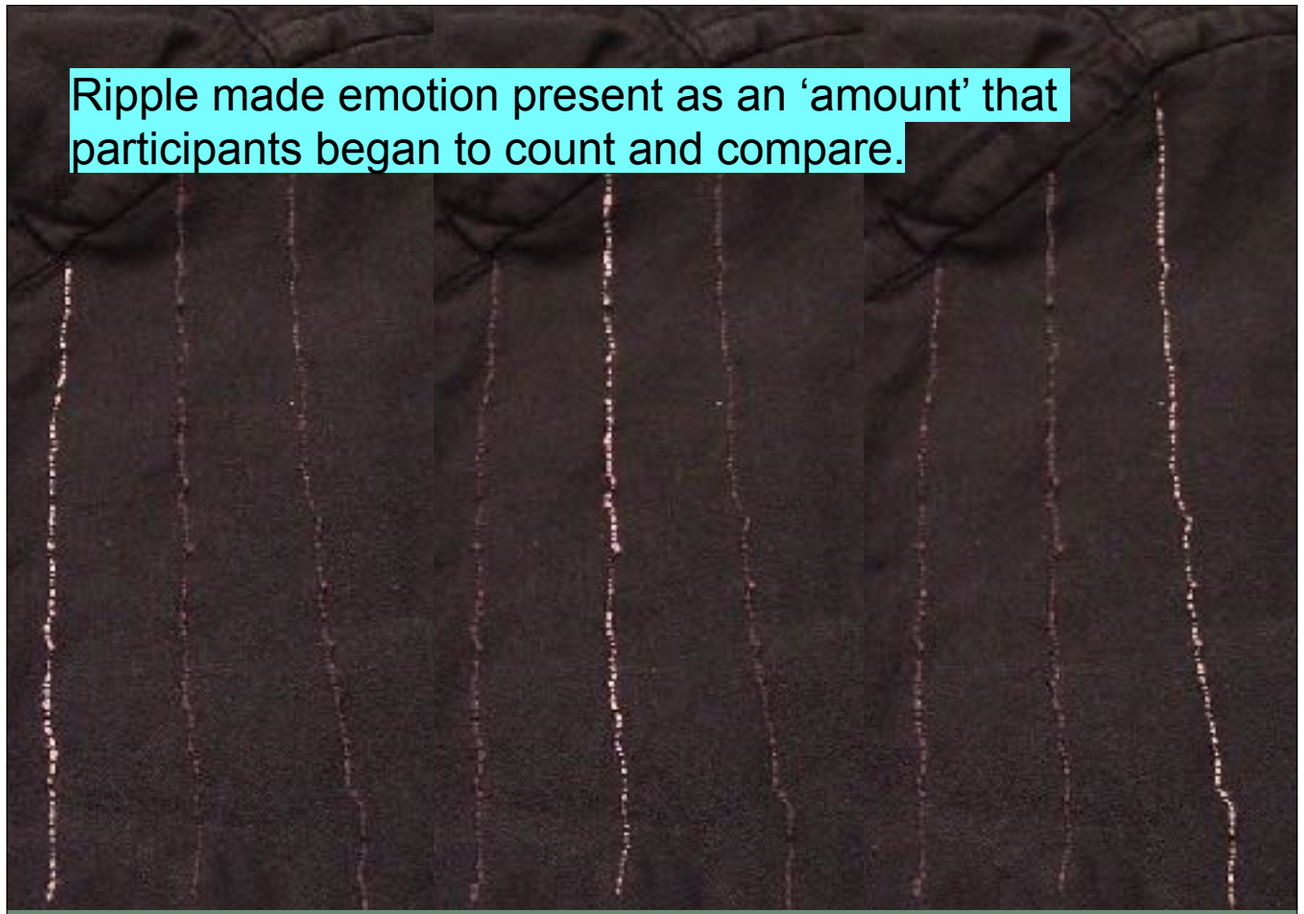


Ripple mediated perception of emotion, amplifying excited emotions and diminishing calmer emotions. In a sense, people were looking through the display back at themselves as they sought to enroll the display in emotional reflection.

Ripple made excited emotions more present for some participants by amplifying those moments with a display change. Ripple made calmer emotions less present by not responding in those moments. Further, for some participants it seems Ripple shifted their conception of emotion itself to be defined according to the display changes. Ripple’s display response was seen to indicate the presence of emotion, while a lack of response by Ripple was seen to indicate a lack of emotion.



Like other mediating technologies, Ripple “helps to shape was counts as ‘real’” for participants with regard to their emotions.



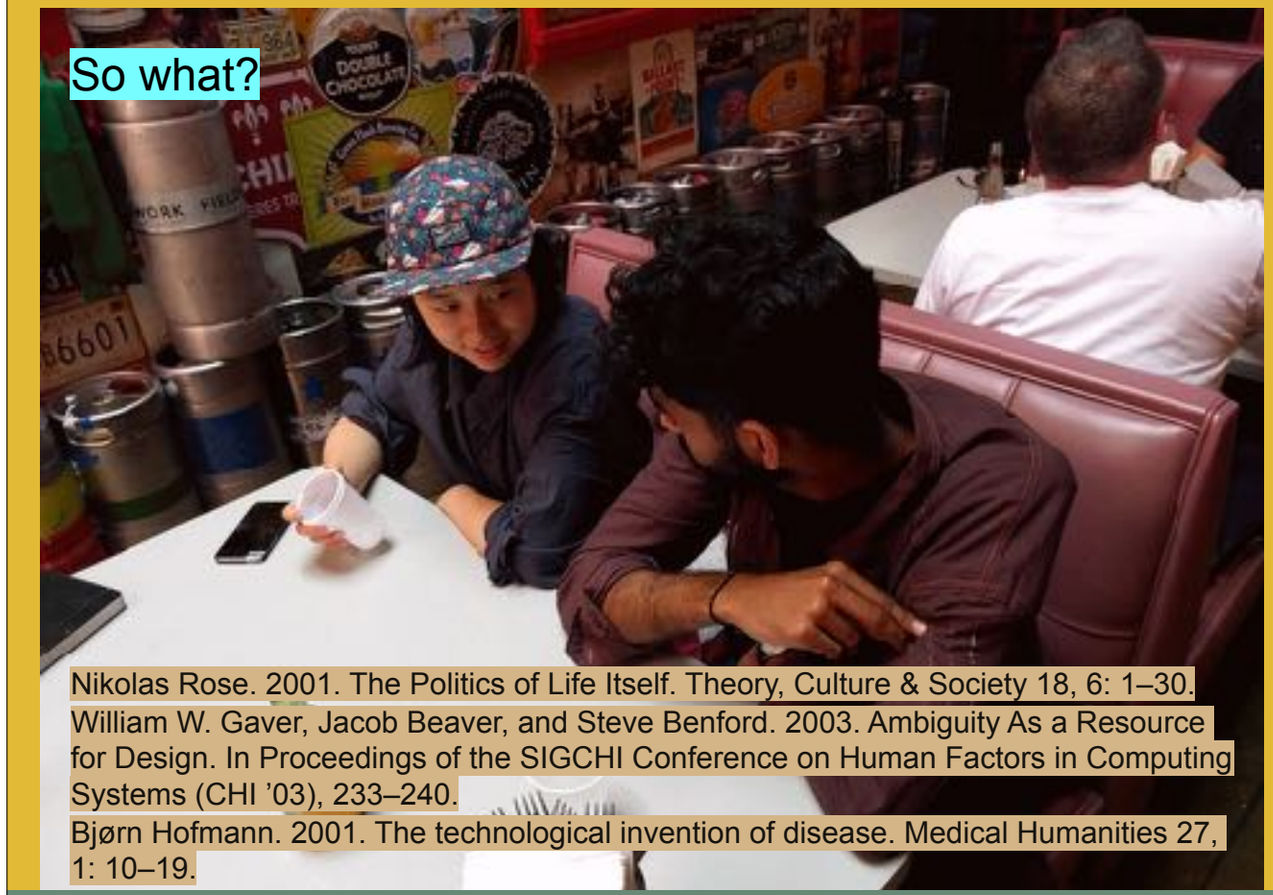
discussion: counting emotions

Ripple made emotion present as an ‘amount’ that participants began to count and compare.

Participants also seem to have begun ‘counting’ the number of instances of display changes, or duration of display change. Erika, wanting to observe a display change, saw the difference between zero display changes and more than one display change as significant, indicating whether they were “a very emotional person” or “broken and unfeeling.” Alva and Brant compared whose display was changing more, and sought to make their displays change about the same amount.

This calls out multiple meanings of ‘count’, where it means
- something that falls into a category
- something good or valuable in a moral sense
- the idea of counting as assigning quantities or ‘values’

Thus, Ripple not only shifted some participants’ conception of emotion, it made emotion present as an ordinal variable. By ordinal we mean participants made comparisons about more or less, but they did not specifically count numerically the number of display changes.



conclusion: some tentative thoughts…

So, what?… well, I was pretty surprised how it turned out… I'm still thinking through all this, so I'm very grateful for the opportunity to share these early stage thoughts with you all in the hopes of getting feedback…

So, we really sought to get away from issues like this, issues of defining our own categories of emotion, issues of thinking about quantities of emotion, but they were still present in the experiences some participants had with our design.

On the one hand, maybe we just designed it wrong… could have some "implications for design" on how to avoid these mistakes in the future, … on the other hand, maybe there is something a bit more here that could be interesting.

Kind of one line of speculation I have is, My hunch is that participants felt insecure about their feelings, and so they wanted to invest a kind of benevolent authority in Ripple so that for them Ripple and its data and display could provide "insights" or "truth," which could provide a sense of security…

We designed Ripple to support open-ended reflection. We hoped that this would foster human-driven interpretation by participants. But I think what it did was open the door for some prevalent (and I think problematic) societal discourse around emotions to come through in participants' reflections.

Specifically, I'm thinking about Rose's ideas around biopolitics, how health is increasingly seen as the responsibility of the individual, and health is increasingly seen as constantly under threat of disease or proclivity toward getting a disease in the future. Where health includes physical, mental, emotional… and not only is health constantly at risk, but one is also taught to "optimize" for health, or fitness, or happiness, for "living one's best life"…

So, with this biomedicalization of emotion comes insecurities around our own lived experience of emotion - How am I feeling right now, and how *should* I be feeling right now? And how will other people around me react to the way that they think I'm feeling?

And, as was discussed in the Techno-Optimism Panel on Friday afternoon, there is this desire to be optimistic about technology's ability to solve our problems and improve our lives… technology makes healthcare seem more legitimate…

OK so that's kind of one line of speculation, also another line of thought, … drawing on Gaver, thinking about Ambiguity as a Resource for Design, I think ambiguity can be a way to encourage critical reflection… but maybe we went overboard and made Ripple too ambiguous? So in the face of so much uncertainty, people feel back on the very societal narratives we were trying to contest…

ethical issues of Ripple?

why this push by participants to quantify and compare?

what should designs do differently in the future?

data is material

summarizes psychological theory debates

Parkinson - Emotions in Interpersonal Life

Usually when you get into the theory of something, everyone is just arguing with each other… publishing papers back and forth with critiques of each other's work, proposing alternatives, etc….

summarizes psychological theory debates

relation-alignment approach - Parkinson's favorite

- not separable cause/effect
- instead, orientations toward 'objects'

Parkinson - Emotions in Interpersonal Life

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- deciding how to orient ourselves to 'objects'
- can be influenced by others, society, group identities, etc.

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socialized cultural display rules

Parkinson - Emotions in Interpersonal Life

interpersonal emotion transfer

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empathy

Parkinson - Emotions in Interpersonal Life

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mimicry

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interpersonal attunement - liking the mimicker?

Parkinson - Emotions in Interpersonal Life

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contagion - mimicking facilitating empathy?

Parkinson - Emotions in Interpersonal Life

interpersonal emotion transfer

empathy

mimicry

interpersonal attunement - liking the mimicker?

contagion - mimicking facilitating empathy?

a critique - assumes specific bodily postures / facial expressions map to categorical emotions independent of **context**

Parkinson - Emotions in Interpersonal Life

social appraisal theory vs. mimicry, contagion, empathy

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social appraisal - orienting ourselves based on **interpretation** of object and others' orientations

Parkinson - Emotions in Interpersonal Life

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Parkinson - Emotions in Interpersonal Life

social appraisal theory vs. mimicry, contagion, empathy

social appraisal - orienting ourselves based on **interpretation** of object and others' orientations

mimicry, contagion, empathy - more like **direct** embodied transfer, not much role for interpretation

… probably a bit of both is happening

what approach would you want to use and why?

what influences interpretations people form?

data is material

media and computer-mediated communication

Parkinson - Emotions in Interpersonal Life

media and computer-mediated communication

richness - amount of information transfer ?

Parkinson - Emotions in Interpersonal Life

media and computer-mediated communication

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Parkinson - Emotions in Interpersonal Life

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do richer media support more rapport, mutual affection?

Parkinson - Emotions in Interpersonal Life

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Parkinson - Emotions in Interpersonal Life

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media and computer-mediated communication

richness - amount of information transfer ?

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well, sometimes people have intimate talks on web chat

… probably different media have different affordances

Parkinson - Emotions in Interpersonal Life

what communication media do you like to use and why?

what do see as the affordances of each?

which ones seem well suited to mind-reading and why?

data is material

affective computing

Parkinson - Emotions in Interpersonal Life

affective computing

using physiological sensors to detect discrete emotional states in an individual

Parkinson - Emotions in Interpersonal Life

affective computing

using physiological sensors to detect discrete emotional states in an individual

critiques

- interpersonal relational processes matter too

Parkinson - Emotions in Interpersonal Life

affective computing

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critiques

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affective computing

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but what if more direct interpersonal adjustments are occurring, not ‘mediated by extraction of represented meaning’?

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pick your lens with care

what does your lens help you see?

what does your lens help you not see?

big takeaway