Hi, I'm Noura Howell, a PhD Candidate at the School of Information at UC Berkeley. Today I'd like to talk with you about Emotional Biosensory Data: Exploring Critical Alternatives.

My research investigates social dimensions of wearable and IoT systems. I study non-expert sense making with biosensory data—data about people's bodies, behaviors, thoughts, and feelings.

This is an exciting space to work in because biosensors are becoming more prevalent in everyday life - from Fitbit to Apple Watch to more emergent sensors embedded in underwear or remote sensors hidden in walls. There is a lot of positive potential for health and wellbeing, yet at

the same time there are also very real risks of reducing people to numbers and bolstering structural inequality through seemingly objective data-driven categories.

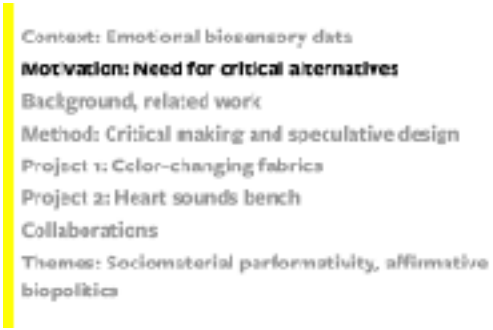
Intervening in this space, in my work I combine social behavioral studies with data and technology. I build custom biosensing technology - often wearable or embedded in furniture - and study people's experiences around these technologies.

My work is published at top tier venues in human-computer interaction, including CHI, CSCW, and Designing Interactive Systems. Through this, my work contributes alternative design tactics for supporting non-expert sense-making with biosensory data - sense-making that includes emotional, social, and embodied ways of knowing with data. My education and industry experience is in software engineering, and I leverage this

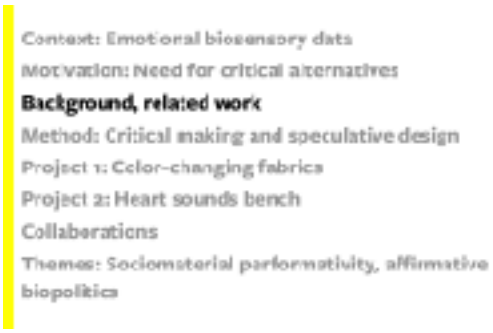
perspective to try to reshape the way we think about sensors and data.

Here is our roadmap for today.

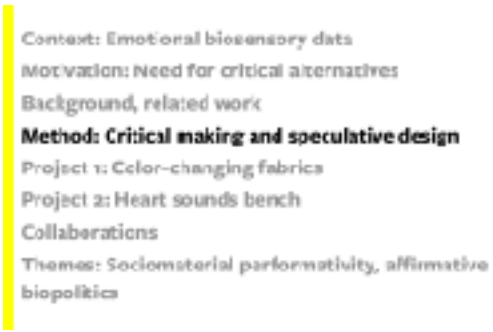
- First I'll introduce emotional biosensory data, sensors producing data about human bodies, behavior, thoughts, and feelings



- Why do we need to explore alternatives with biosensory data?



- Some background and what I draw from in my work



After setting up this space of emotional biosensing, I'll introduce a bit about my methods, critical making and speculative design, which are how I intervene in this space.

I use feminist and postcolonial theories to explore creative and critical possibilities with emotional biosensing. My work contributes design tactics for supporting social, emotional, and embodied ways of knowing with data.

Context: Emotional biosensory data
Motivation: Need for critical alternatives
Background, related work
Method: Critical making and speculative design
Project 1: Color-changing fabrics
Project 2: Heart sounds bench
Collaborations
Themes: Sociomaterial performativity, affirmative biopolitics

- For example, my work on color-changing fabrics explores a way of displaying biosensory data that invites more contextual, social, emotional engagements with data

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- And the Heart Sounds Bench enrolls biosensory data for an emotional experience of affirmation

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Then I will quickly describe some collaborative projects to give you a broader sense of where my work has been and where it's going. Or maybe cut this depending on time.

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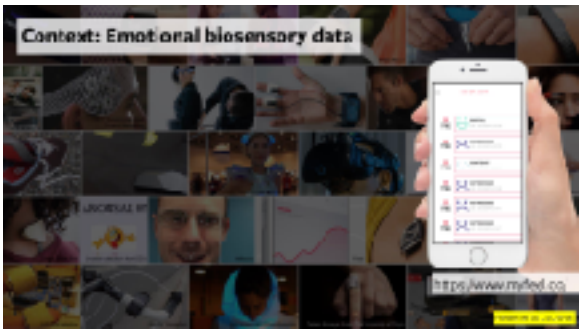
Finally, we'll reflect on some high level themes of my research.

My work is situated in the context of emotional biosensing. There are many wearable and biosensing technologies already on the market, some of them are emotional biosensing.

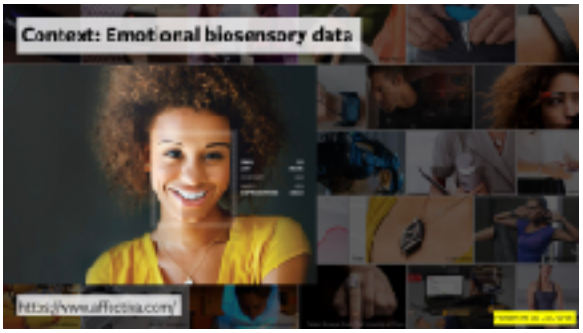
People can wear sensors on their bodies, such as in a wristband or waistband or underwear, or sensors can work remotely. Sensors can measure heart rate, skin conductance, brain waves, breathing, video of facial expression or posture or gait, audio of voices, etc.

There are many approaches to predict emotions from this. For example, video of the face might be used to detect smiling, or a sudden increase in heart rate might indicate fear or happiness. There are a lot of different ways of doing this, and plenty of open questions about what it might mean.

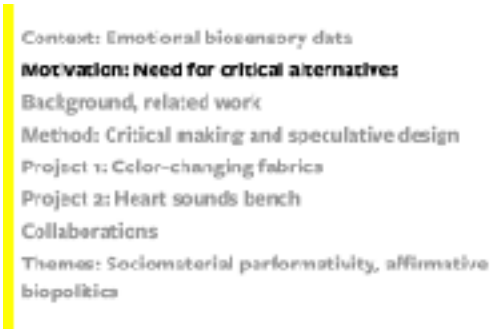
Actually one of the reasons I am so excited to speaking with you all today is that faculty in the department here are doing interesting work with mobile and Kinect sensors.



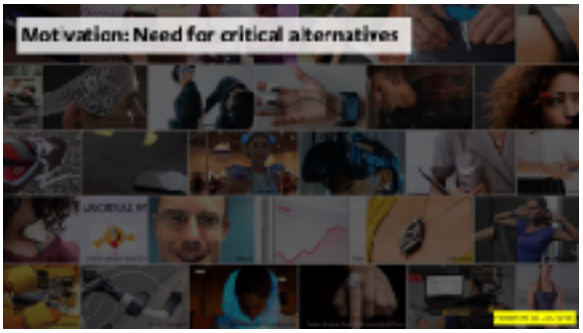
As one example of an emotional biosensing consumer product, the Feel wristband claims to be the “World’s First Emotion Sensor & Well-being Advisor” claims to automatically “detects” and tracks joy, stress, distress, content, and sadness to help you “monitor your weekly and monthly progress” and “discover key emotional patterns”. The mobile app provides automated behavior nudges to help “keep you on track towards meeting emotional well-being goals.” I’m just quoting from their home page here.



Affectiva uses video of faces to detect emotions like smile, joy, contempt, anger, to provide “unfiltered consumer emotional responses.” One of their earlier technical demos up on their website tracked emotional responses to advertisements.

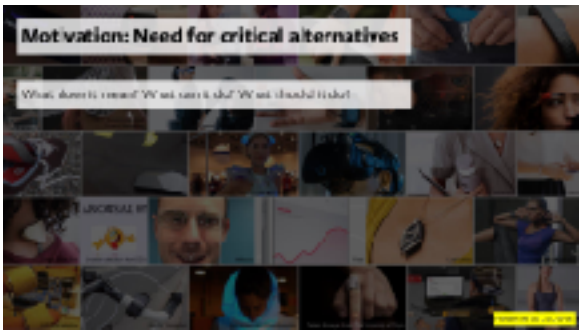


I think the popular consumer products with emotional biosensing are too limited, and we need to explore more critical alternatives.



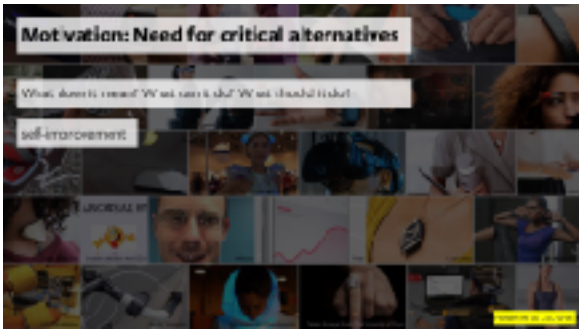
These sensors, data, and algorithms are being enrolled to ask very old, very human questions about our lives and making our lives meaningful.

Even something that might initially seem simple like counting the number of steps, is really part of a much bigger picture. It's about how much I walked today, which is kind of about if I exercise enough (short answer: no). That's about questions of if I feel like I am healthy or normal, if I'm 'living my best life' as all the startups and self-help magazines in Silicon Valley are phrasing it these days. Maybe I'm a bit jaded about California's obsession with "wellness," but more broadly these questions of how we want to live our lives, and whether we feel we are living it as we wish, are really important.

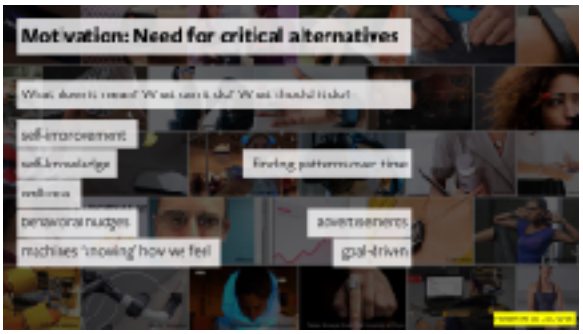


For the popular approaches to everyday emotional biosensing that are already out there in consumer products, what kind of insight or meaning are these claiming to support? What can these emotional

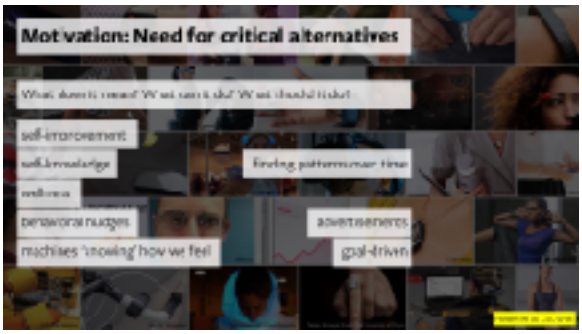
biosensing technologies do? What are they implying we should be doing?



Many of them are focused on supporting self-improvement —> gaining self-knowledge through data analysis and finding patterns over time, wellness or emotional wellness or mindfulness… in a goal-driven way guided by these automated behavioral nudges that tell us what to do… all of it kind of undergirded by this notion that machines can ‘know’ how we feel.



Many of them are focused on supporting self-improvement, ■ gaining self-knowledge through data analysis —> and finding patterns over time, wellness or emotional wellness or mindfulness… in a goal-driven way guided by these automated behavioral nudges that tell us what to do… all of it kind of undergirded by this notion that machines can ‘know’ how we feel.



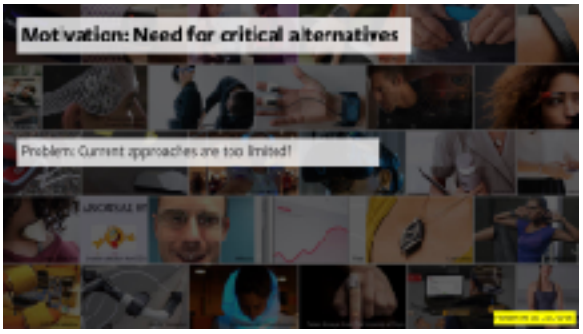
There is positive potential here, like helping people feel less stressed out, or helping people deal with their emotions in a guided way.

But there’s also problematic stuff happening here, like making advertisements more emotionally manipulative…

Or another thing, suggesting that we should be engaging in some kind of goal-driven emotional self-improvement regime. Maybe this is just me, but I'm not, uh, tracking towards my emotional self-improvement goals, I'm just trying to be be a kind person and work hard and feel OK at the end of the day so I can do it all over again tomorrow.

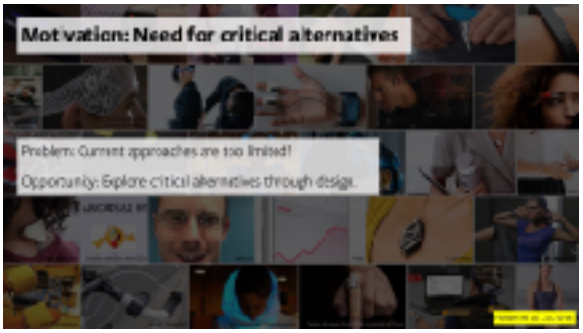
Another issue can be, the emphasis on individual stress management can over-emphasize that it's the individual's responsibility to deal with that stress. Sometimes there are social problems that are stressing people out - like the corona virus for example. Having a mobile app prompt you to take a few deep breaths can help in the short term, but it does not take away the source of the stress, and it is not your "fault" for being stressed - sometimes being stressed is perfectly normal!

Emotional biosensing is often used to place emotions into a few discrete categories that may initially seem neutral. While these categories are supported by experiments done in laboratory settings, when we start to look at how these data-driven insights get applied in the real world for personal wellness (as several consumer products do) we come across complex and important questions about how we want to live our lives. These systems embed ideas of how we *should* be feeling, and what counts as a normal range of emotion.



Overall, current prevalent approaches are too limited. In addition to sensors and data analysis, we need complementary interdisciplinary design and

humanistic approaches to understand how people make meaning with emotional biosensory data.



There is an opportunity to explore a broader range of critical alternatives with emotional biosensing design. So, in my work I use design and qualitative research to understand how people experience and interpret emotional biosensory data, and explore alternatives by designing and building biosensing technology.

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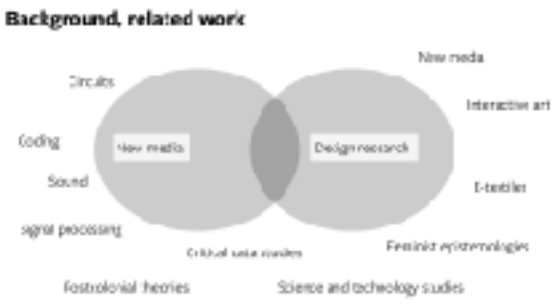
OK, so how do I approach this?



My work is situated between design research and new media. I also draw from many other areas and consider myself an eternal student of these.

Moving on to my method

My method is a combination of critical making and speculative design research. Critical making lets me explore feminist and postcolonial theories through

design, and asks questions and forms critiques through the process of making computational sensing technologies.

Speculative design asks big “What if?” questions to spark discussion about sociotechnical futures, as a way of critiquing and reimagining sociotechnical imaginaries. By sociotechnical imaginary, I mean a socially and institutionally held shared vision of a desirable future that includes not only technology but also shared ways of living that go along with that technology.

I build sensing technology and study people’s experiences around these artifacts.

Through this, my designs prompt reflection in people experiencing the designs, and also prompt reflection in me as a designer.

One tactic for prompting reflection that I use a lot is ambiguity - my designs display data in fairly ambiguous ways. The ‘meaning’ of the data is intentionally left ambiguous and open-ended, to invite people to reflect on the data and form their own interpretations.

In relation to user centered design, this approach is a little bit different.
Instead of seeking to identify and support people’s values, I invite people to reflect on and question their values.

Instead of solving problems, I explore problem spaces.

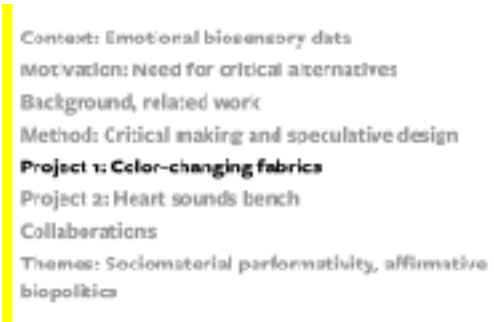
And instead of answering questions, I ask questions.

Before diving into two projects in more detail, a quick overview of some of my work.

Much of my work studies open-ended emotional interpretation with very ambiguous tangible data displays. I've worked on fabric that slowly changes colors in response to data in real time. Also detecting laughter from audio of conversations and representing that as lights, chocolate, and keepsake soundbites in a delicate bottle. Also embedding sensors in shirts with embroidered color-changing display elements that respond to emotional biosensory data and asking pairs of friends to wear these shirts in daily life and reflect on their feelings. Finally I tried to take a step back and reflect on this

work in a broader context and charted out some key conceptual moves and generative design directions.

OK, so from all this I got a handle on how we can have very tangible, embodied, emotional experiences with data, interpreting data, and ways of knowing with data. These are cutting edge real time data displays, but people aren't looking at a time series graph trying to find patterns. They're touching soft handwoven silk in between their fingers, or looking at a chocolate bar graph and remembering a conversation with their dad on the phone where they laughed, or noticing their friend's shirt and asking them how they are feeling.



Now, I'd like to dive into some of the work on color-changing fabrics

Along with collaborators, we used color-changing fabric to create real-time data displays. This is different from typical screen-based data displays in a few ways. Instead of emitting light, it gradually changes color. It's slow. It's subtle. It's low resolution. And it looks and feels just like regular fabric.

[Click to play. describe what is happening for part of the video]

We 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.

One kind of data I thought it would be interesting to display is skin conductance, also known as GSR or EDA. Skin conductance is kind of how sweaty you are, but micro-fluctuations in this are associated with emotional arousal such as being stressed or happily excited.

I wanted to try a design that would embrace the inherent ambiguity of skin conductance. See, skin conductance gives an indication of arousal, of level of excitement, but no indication of what kind of excitement - for example, one might get sweaty palms from being nervous giving a presentation, or

from being really engaged and having a lively fun conversation.

This project takes an alternative approach to sensing affect. When designing interactive systems for affect, there are different approaches…

At one end of the spectrum is the information model. Sensors and algorithms detect categorize emotions such as “happy,” “angry,” “sad,” etc. Emotion is modeled individually and put into distinct categories. Context sort of gets lost here, “happy” in one context is assumed to be equivalent to “happy” in any other context.

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.

I developed Hint, a t-shirt that changes color in response to the wearer's skin conductance. When the wearer's skin conductance spikes, small white rectangles gradually appear.

The display is abstract. Its color change indicates that something emotional *might* have changed in the wearer, but it doesn't give any clues as to what.

It’s up to the people in the context of the situation to interpret it.

For the purposes of this study, I wanted the shirts to look fairly ordinary, so I adapted store-bought t-shirts and used screen printing as it is a common technique for t-shirts. I placed the display up around the collarbones so that the display would be easily visible to those around the wearer.

I used a Bitalino skin conductance sensor worn on the back of the shoulder. Bitalino is made here in Lisbon and I was excited to visit their office on Monday.

I did a study on how pairs of friends wearing the shirts interpreted the displays during a social conversation. Participants associated a change in their t-shirt display with a variety of emotions that emerged in the context of their conversations, such as feeling empathy, stress, embarrassed, or passionate while debating.

A takeaway from this study was designing for biosignals as social cues. Social cues are public-facing communication about ourselves that we might give intentionally or unintentionally.

Image source: https://knowledge-spa.blogspot.com/2012/11/image-transform.html

On the other hand, as we saw before a lot of work with biosensing tries to extract these “signals” of our “true state”. For example the Feel wristband and mobile app gives real time numerical estimates of one’s happiness, stress, and sadness.

In contrast to that, I think Hint provides something more like a bio-cue. It’s seen socially, the meaning is emergent in context, it can have multiple meanings, and above all the meaning is interpreted by humans.

The Hint study showed interesting potential for ambiguous displays of skin conductance. Building on that, I redesigned the shirts to be more robust, and studied them with pairs of friends wearing the shirts throughout two days of their daily lives. This iteration is called Ripple, because the color-changing threads make a sort of ripple effect as they change color one by one.

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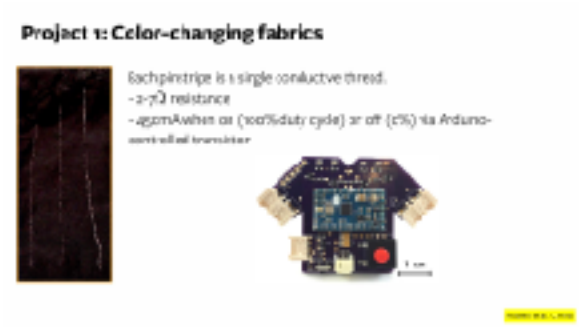


Another major design challenge for Ripple was that I wanted to study emotional interpretation in the context of participants' daily lives.

So, I made the technology lightweight and robust with a printed circuit board.

I chose a very ordinary, everyday style for the garment. Ripple is intentionally not a showcase fashion piece, it's very simple and unassuming, something people could wear throughout their daily lives without attracting unwanted attention. Study participants wore the shirts while biking, doing the dishes, petting the cat. People interpreted the display throughout the many varied contexts of their daily lives.

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

Participants wore the shirts for about two days. They were given diary prompts to document their experiences with text and photos.

Then I did a semi-structured interview asking about their experiences with and interpretations of the display.


Project 1: Color-changing fabrics
Connecting mind, body, emotions, environment

"I was calling my internet provider and I was pissed off, I was really angry. **It made me reflect on how situations are clearly transmitted intomybody**, you know, 'cause usually I think about emotion as somethingthat is not physical or non-tangible... but this was like,'No dude! These are emotions! They impose your body!"

Some participants seemed to value the shirts for helping them reflect on their feelings.

One participant enthusiastically described what he called a “philosophical moment” while wearing Ripple. He said

“I was calling my internet provider and I was pissed off, I was really angry... **It made me reflect on how situations are clearly transmitted into my body**, you know, ‘cause usually I think about emotion as something that is not physical or non-tangible... but this was like, ‘No, dude! These are emotions! They impact your body!’”

So, maybe something about the data being displayed on the shirt, which is on the body - clothes are literally the interface between our bodies and the world - helped him reflect on how emotions are embodied and physical. Ripple made the emotions more visible for him to reflect on

Sometimes the display prompted pairs to reflect on their feelings together. For example, this couple noticed her shirt changing colors and attributed it to her stress about their upcoming big move and change of jobs. The display prompted a conversation about how he can best support her through that stress. In contrast to individual-focused emotional biosensing technologies, Ripple prompted social interpretation and social support.

Yet, we also observed tensions emerging. Some participants compared their displays and wanted 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,'". On the other hand, Brant complained his display had changing too much.

suggest a desire for their displays to change about the same 'amount,' perhaps to support a sense of shared emotional experience over lunch.

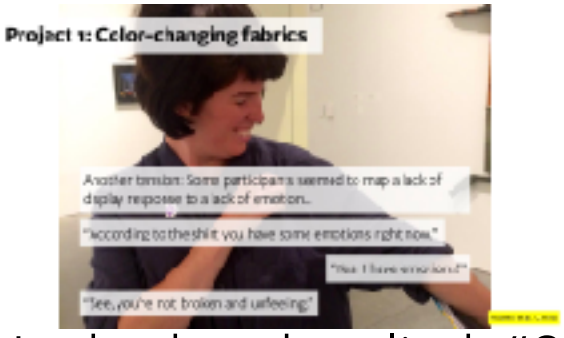
But they also raise a question about what is an 'amount' here anyway? As a designer I tried to move away from an easily 'quantifiable' display of emotion, but even with Ripple's highly ambiguous display people are making comparisons about 'amounts' of emotion…

Another tension that emerged: Some participants seemed to map a lack of display response to a lack

of emotion. One participant expressed concern that the shirt not responding might indicate that she was not a very emotional person.

When her 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! This is a pic of her in that moment, smiling and looking at the display.



Her husband replied, “See, you’re not broken and unfeeling.” And like, I got the sense that he was quoting back to her a phrase she had used, in order to reassure her.

She seemed to interpret a lack of display change as suggesting that she did not have feelings. She may have been having calm emotions the whole time, but Ripple didn’t respond to that - Even though the shirts was highly ambiguous about what it was displaying, it still seemed to have shifted what counts as “emotion” for some participants by only responding to some kinds of emotions and not others.

So, reflecting on some of these findings,

While for some people Ripple prompted a kind of reflection they found valuable, for other people it seemed to have the potential to foster or aggravate insecurities.

So, I was pretty surprised at what happened with this study, and I definitely did not intend to foster this kind of upsetting interaction. But at the same time, it's this unexpectedness which is why it's valuable to study how these designs play out in daily life.

Despite my design efforts to the contrary, Ripple still held a surprising degree of authority for some participants. Why didn't Erika just dismiss the

display as completely wrong, instead of worrying that she was broken and unfeeling? I think it's related to the authority of data as a way of knowing.

The authority invested in biosensing technology and the data produced by it makes it all the more important to carefully consider how the design of these technologies influences emotional interpretation.

Even though I tried to downplay the authority of our design, Ripple still had a lot of power in the way users thought about and experienced emotions.

Ripple mediated perception of emotion. It made excited emotions more present by displaying them with color-changing threads. Ripple made calmer

emotions less present by not responding to them. 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, a lack of emotion.

Fostering open-ended interpretation made room for insecurities to come through, like people wondering if their feelings were normal or healthy. Maybe instead of fostering open ended interpretation, designs could explicitly promote alternative narratives? For instance, an alternative narrative could be something like, you're probably fine just the way you are?

Technologies help to shape what counts as ‘real’, and biosensing technologies have the potential to shape how we think about and experience emotions.

To summarize, these projects explored a few key design tactics for reimagining emotional biosensing.

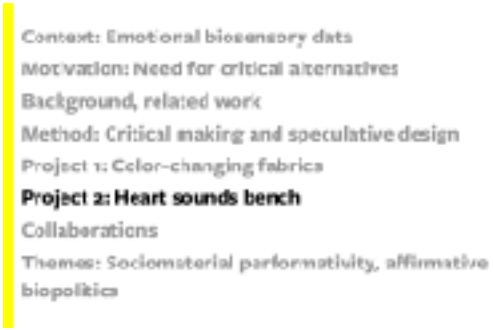
Instead of displaying data on a screen, they display data on fabric.

Instead of emphasizing precision, they welcome ambiguity to invite open interpretation.

Instead of showing data to an individual, they invite social interpretation.

Instead of treating data as digital and extracted from context, they treat data as material and entangled with our bodies and social and physical environment.

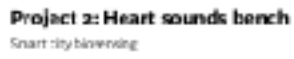
Instead of trying to detect and categorize emotion, they invite open-ended emotional reflection and mediate perception of emotion.



Although these projects on color-changing fabrics contribute some interesting design tactics, there were also tensions that emerged around the

perceived authority of data and the potential to aggravate insecurities.

I did some soul-searching after those studies, because I was very concerned about these tensions. For my next project the Heart Sounds Bench, I sought to design something that would feel more affirmative.



With this project, I shift away from thinking about about individually wearable biosensors, toward thinking about biosensors embedded in the ‘smart city’.

By “smart city”, I mean a collection of narratives, proposals, and ideas around using embedded sensors and data in the cityscape.

Of course, there are many different versions of the “smart city” vision, many different visions.

But I’m already short on time so I will just focus on one aspect of many - not all - smart city visions.

In this vision, with more sensors we can get more data to get more insights, to know more and more aspects of human behavior and daily life in the city.

By understanding more clearly, more transparently, through the use of computational models, cities can be made safer, and we can help people be more productive and healthier.

Maybe sounds good at first glance right?

But this can easily go awry. I'm going to argue that this is a flawed vision for the future of city living, and that we need to be exploring critical alternatives.

What data in the smart city can too easily turn into is surveillance. Surveillance is not safety. Surveillance is not applied to everyone equally, and there are many examples of seemingly objective data-driven insights that in practice reinforce societal bias against marginalized groups.

One surveillance issue I was reacting to is, Knightscope robots are designed to be autonomous security guard robots. With the goal of keeping public space “safe”, the computational model in the system says that people experiencing homeless people are the same thing as criminal activity. San Francisco has very high income inequality and a housing crisis, many many people are experiencing homelessness and there are not enough public resources, so this is particularly insensitive.

Instead of improving city living, the goal sometimes becomes policing and controlling public behavior to the point that, at least in this vision pictured here, there aren’t even any pedestrians at all, just a bleak gray empty cityscape.

My work joins calls to reimagine what smart urbanism means and create counter-narratives that open up space for alternative values, designs, and models.

This project takes up this call in reimagining the role of sensors and data in the smart city.

I want city living to feel more like this. Someone made a bench into the rocks by the sidewalk. You can just sit a while, for free, without paying any money or giving up any data. You don't have to

exercise or be productive either, just take a breather. Slow down.

There are so many benches in Lisbon I am noticing, but benches are actually becoming rarer in Berkeley and San Francisco.

This was the starting point for me thinking about affirmation as an alternative design goal for biosensing in smart cities.

Daily affirmations happen in public space. Benches affirm the needs of passerby to sit and rest. The bus driver who stops because they see someone running. The stranger on the bus who moves their bag to make room on the seat, or the one who provides directions.

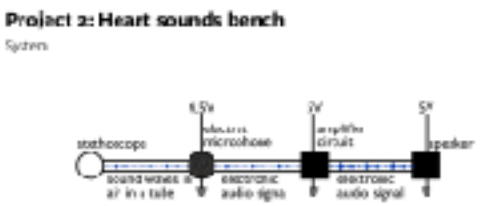
Some key reworkings of the smart city ideas here are that instead of surveillance, or sensing from above, people on benches see and sense each other and other people on the street level.

And instead of emphasizing efficiency or exercise or productivity, benches emphasize rest and slowing down.

With all that in mind, to rework the role of sensors and data in smart cities toward an experience of affirmation, I designed the heart sounds bench. It amplifies the heart sounds of bench sitters and invites a peaceful moment of rest and listening.

Here are two people experiencing the bench for the first time.

The two people just sit on the bench and listen to their heart sounds.



The technical setup is simple. A stethoscope connected to a microphone, connected to an amplifier, then to a speaker. The data is not saved, and it is displayed sonically not visually. Happy to talk shop offline. The technology is not new. The focus of this project is the new embodied experiences with data that this design explores, and

how that can help reconfigure the role of sensors and data in smart cities.

Because of my interest in the role of sensors and data in city living, I am interested not only in how people personally experience hearing their own heart sounds - but also and especially in how heart sounds might shape the experience of sharing space with another person. So, I invited participants to experience the bench in pairs to probe social experiences of hearing one's own and another's heart sounds. These were mostly pairs of strangers or distant acquaintances, sometimes coworkers. A few participated alone due to scheduling issues.

This study occurred indoors to help focus on the interactions and people's emotional reactions to

hearing their own and another's heart sounds. In April I finally have permission from City of Berkeley to study the bench in public space.

After a quick intro of the study, I left the two participants alone in a room together to experience the bench for about 20 minutes. Then I came in and conducted a post-interview probing their emotional reactions and experiences for about an hour.

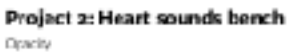
Many participants found listening to their own heart sounds to be a unique and compelling experience, and found it awkwardly intimate but also nice to hear another person's heart sounds. They often chatted while sitting together, or just sat quietly listening to their heart sounds.

One of the more surprising findings that emerged was that many participants described feeling a sense of shared life energy including them self, their study partner, and people across the world. As one participant described it,

[read quote]

She talks about appreciating hearing her study partner's heart sounds, and takes that as a reminder of what's pulsing through everybody. Other participants similarly talked about hearts beating together across the world or feeling more connected to a shared sense of being alive.

Although it’s factually obvious that she and her study partner are both alive - we’re not getting any data-driven insight here - taking a moment to appreciate that shared living and breathing seemed to be a positive experience for many participants.



Reflecting on this lack of insight from the heart sounds - there is some opacity here. For most people heart sounds are opaque because they did not really feel that they gained any specific insight about the other person by hearing their heart sounds - yet there was a sense of connection and maybe people came to accept and appreciate one another a little bit more.

This is quite different than the role of sensors and data we saw earlier, where sensors and data were used to get clear insights. Instead of this clarity or transparency, we have opacity.

Instead of using sensors and data to ‘know’ humans more and more transparently, to know and understand and categorize and analyze every part of human behavior via data and computational models, the Heart Sounds Bench presents a fairly opaque stream of data that doesn’t really result in insight or clarity.

Opacity pushes back against transparency, and this helps reimagine the role sensors and data in smart cities.

Opacity can be a way to challenge and rework ways of knowing, and what we can or should claim to be able to know about people through data. And to be clear, while the opacity of algorithms is laudably critiqued elsewhere, here I'm talking about something else - about the opacity of humans.

In thinking about opacity in these terms I'm drawing from Glissant, a postcolonial philosopher from Martinique who advocated for Creole languages from his position in a French colony.

Glissant analyzes language as a way of knowing, and the limits of translation, but I think his argument is also useful for thinking about how we try to understand people via data.

So, quoting Glissant here,

[read the quote]

Data-driven categories and models often try to understand people in terms of measuring them against an ideal scale embedded in the computational model to make comparisons and judgments. Data-driven categories have a tendency to reduce things into categorical norms, and something gets lost in translation.

So after outlining the problems with transparency, Glissant continues,

[read the rest of the quote]

Opacity pushes back against the transparency of this reductive way of knowing. It's much more respectful to acknowledge what we don't, and can't, understand about others.

Smart city visions, instead of pushing for the transparency of trying to know and model everyone perfectly, could instead use more of this respectful acknowledgment of difference and shared appreciation across difference.

To finish up, let's synthesize how the Heart Sounds Bench helps reimagine smart city biosensing.

Instead of an emphasis on efficiency, the Heart Sounds Bench invites people to sit still and rest.

Instead of surveillance, or seeing from above, there was a person-to-person sense of respectful intimacy.

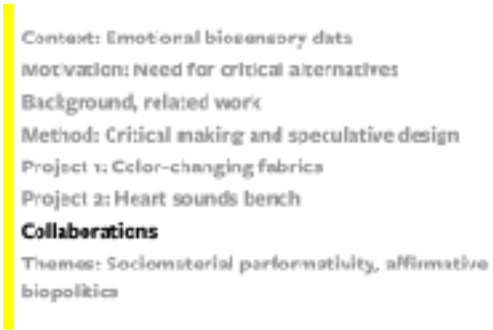
Instead of a more typical notion of data as digital numbers or visual figures, the data is experienced as sound.

Instead of analysis, it’s about listening.

And instead of some clear actionable insight, what occurs is an experience of affirmation - perhaps a kind of emotional insight - something we already logically knew - we’re alive, duh! - but this time with

feeling. This is respectfully tempered with an acknowledgment of the opacity, the limitations of what we can really know about another person from their heart sounds. It's appreciating someone without needing to understand them perfectly.

To re-imagine the role of sensors and data in smart cities, I'm reworking things at every level of the design - from what counts as data, to ways of knowing, to what counts as insight. Trying to hold space for the embodied, social, emotional complexity of human experience.



A super quick peek at just a couple collaborations

Project-based approach combining design theory, design practice, programming, electronics, and soldering

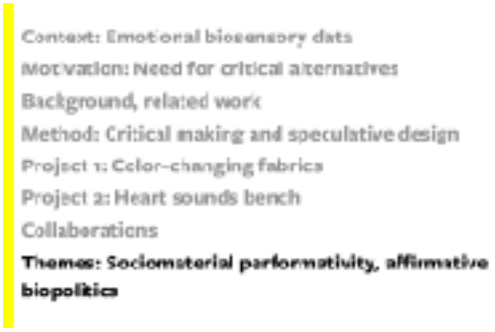
Wearables and embodied interactions

Teaching that “failure” when programming is part of professional practice

Some more examples of an aesthetic interaction with a pulse sensor, more architectural installations,

and experimenting with sound and taste perception with sugar and lemons

The integrated studio approach of the HCI programs here really resonates with me, I bring this to my teaching currently at Berkeley



Now let's take a step back and reflect on some of the themes emerging from this work.

Sociomaterial performativity (Howell et al. 2018) emphasizes the material, embodied, and socioculturally situated qualities of data. Biosensory

data has material qualities—it is often produced by physical and electrical responses of sensors with people's bodies and the environment. Data has social aspects, from the many people doing data collection and analysis to the social impacts of resulting insights. Data has performative aspects: Whenever people engage it, data becomes enrolled in ongoing social enactments of sense-making. Data insights are not only objective, but also subjective: They present a view from somewhere (Haraway 1988), from the many people and materials entangled in their creation and proliferation.

My work on sociomaterial performativity invites designers and computer scientists working with biosensory data to more broadly consider many social and material factors that influence data insights. These considerations strengthen and clarify data insights by adding contextual nuance. They also diversify the kinds of insights that are

considered valid with biosensory data to include emotional, embodied, and social ways of knowing.

My dissertation work on color-changing garments began to explore supporting sociomaterial performativity through design, but only marks the beginning. My research agenda will explore questions around balancing ambiguity with interpretability, supporting situated social performances, and supporting more diverse ways of knowing with biosensory data.


Themes: Sociomaterial performativity, affirmative biopolitics

Sociomaterial performativity: material, embodied, and sociculturaly situated qualities of data; balancing ambiguity with interpretability; supporting situated social performances

Affirmative biopolitics: who/what has authority to produce knowledge about health and life

As biosensory data is enrolled to address questions of how to live ‘well’, this raises biopolitical issues of who or what is granted the authority to produce knowledge about health and life (Rabinow & Rose 2006, Rose 2001). Data-driven categorization is a

common approach to knowledge production with biosensory data, yet these categories are not neutral. They can embed ideas about who or what is normal or not normal. Categorization creates 'others' (Bowker & Star 1999), and such relational markers of difference can be closely linked to oppression.

Although my work does not focus on a particular marginalized group or identity, I am deeply invested in resisting these processes of otherization. There are many important works coming out these days around calling out instances of bias in existing algorithmic systems. Oh, this machine learning system is reinforcing structural racism, and that system encodes gender essentialism, and this other one over here is problematic too….. This kind of work is so so important in calling out problems and making them impossible to ignore.

But just to be clear, I'm doing something slightly different. Instead of calling out problems with existing systems, I'm trying to fundamentally rework how data-driven systems are built, to try and avoid these issues in the first place. Doing conceptual shifts through design, I'm exploring alternative tactics for designing and building technology with sensors and data.

An affirmative biopolitics resists the othering potential of categorization to support belonging. Affirmation still values critique, contestation, and acknowledging social issues, yet it emphasizes the creative potential of enduring these difficult times. My dissertation work on the Heart Sounds Bench began exploring affirmation as a design goal (Howell et al. 2019), but there is much more work to be done.

My research agenda will explore, what if designs prioritized care and affirmation over self-improvement? What if knowledge claims with biosensory data were more humble, to hold space for other ways of knowing and for respecting the complexity of human experiences? What if designs enrolled biosensory data to invite appreciation of our bodies, other animals and plants, and how our bodies are inextricable from the environment?

Themes: Sociomaterial performativity, affirmative biopolitics

Sociomaterial performativity: material, embodied, and sociculturaly situated qualities of data; balancing ambiguity with interpretability; supporting situated social performances

Affirmative biopolitics: who/what has authority to produce knowledge about health and life; resisting othering categories, supporting many different ways of knowing with data

'Data science, meet emotional knowing'

So in a way, what I'm working on here is combining data science and emotion.
"Data science, meet emotional knowing."

Finally, many many thanks are due. Design doesn't happen in a vacuum, the idea of designing for affirmation was inspired by the many people around me providing support and affirmation.

Thank you all for listening! Happy to take questions

Design futuring approaches, such as speculative design, design fiction and others, seek to (re)envision futures and explore alternatives. As design futuring becomes established in HCI design research, there is an opportunity to expand and develop these approaches. To that end, by reflecting on our own research and examining related work, we contribute five modes of reflection. These modes concern formgiving, temporality, researcher positionality, real-world engagement, and knowledge production. We illustrate the value of each mode through careful analysis of selected design exemplars and provide questions to interrogate the practice of design futuring. Each reflective mode offers productive resources for design practitioners and researchers to articulate

their work, generate new directions for their work, and analyze their own and others' work.

In this pictorial, we explore how emergent menstrual biosensing technologies compound existing concerns for the everyday ethics of extracting and analyzing intimate data. Specifically, we review the data practices of a set of existing menstrual tracking applications and use that analysis to inform the design of speculative near future technologies. We present these technologies here in the form of a product catalog for a fictional company called Vivewell. Through
this work, we contribute both a set of speculative design proposals and a case study of a design project that begins with the analysis of existing data policies.

These designs exist only in the form of this fictional product catalog. The designs extrapolate current trends in menstrual biosensing to the extreme, to the point of seeming creepy or problematic, to prompt critical reflection.

For example, in the center is Lithe Power underwear, which embeds biosensors to monitor flow, exercise, and emotions. This design plays on stereotypes of the female body as ‘natural’ and ‘unruly’, something that can be made more manageable and controllable via technology.

Privvy is a smart toilet that monitors pregnancy status, STI status, drug usage, and time spent in the bathroom as a proxy for productivity. It explores issues of workplace surveillance.

Vivid on the left is a smart menstrual cup design for teens, that enables parents to monitor their child's flow. It explores issues of parent-child surveillance.

After Trump's election Islamophobia spiked, resulting in increased harassment, mosque attacks, and discriminatory border control. I felt afraid, this reminded me of post-9/11 and personal and family experiences of Islamophobia. Responding to this, I created the Salaam Sculpture in collaboration with Stan Clark and Sahil Mohan. The sculpture's form is based on the Arabic writing for salaam, meaning peace, used as an everyday greeting. One aspect of Arab culture is the importance of respectfully greeting everyone—everyone merits this basic recognition and goodwill. To me it feels like these seemingly trivial everyday interactions can

accumulate and circulate, becoming part of the fabric of our daily sensibility.

I invited passerby to spray paint their own greetings and responses on the sculpture, collecting and circulating these mundane yet foundational affects of shared social life. In a political climate of othering, fear, and violence, the sculpture rises tall and unafraid, extending a greeting of peace and respect. I showed the sculpture at the Islamophobia Conference, at the center of Berkeley's campus, at Oakland Figment art festival, and at a Muslim literary magazine gala.

This is a new collaboration with Noopur Raval and Morgan Ames. We just pulled in a grant together from the Center for Technology, Society, and Policy.

We aim to map the ethical and social landscape of current AI research and its limits by conducting a critical and comparative content analysis of how social and ethical concerns have been represented over time at the NeurIPS conferences, as a premier venue for AI scholarship. Based on the dominant themes, concerns, and limits of what constitutes the "matters of concern" and interest in current AI scholarship that emerge from this study, we will ask what it might look like to shift and expand the grounds of AI discourse by convening a one-day workshop of researchers, activists, journalists and others at UC Berkeley to develop an alternate lexicon of AI vocabulary that is informed by and responsive to situated experiences of AI in different parts of the world as well as historical feminist, decolonial and queer concerns around technologies of identification and enumeration.

I propose enrolling biosensing to support more poetic, unscripted ways of experiencing daily life. FEELER / CRAWLER / OCTOPOETS wander the environment and invite others to wander too. Their senses/sensors comprise their own quirky perspective, not the all-seeing authority of data surveillance. Some have skin with sensing pigments that change color in response to temperature, pH, carbon monoxide, UV, and ozone. Some sense touch with conductive fabric and piezo discs, and respond with electrical signals transduced into sound. With protruding feelers, some crawl around accumulating (recording, sensing) material traces of dust, dirt, leaves, and DNA.

As alien visitors, FEELER / CRAWLER / OCTOPOETS sometimes ask earthlings to show them around,

positioning people as authoritative local hosts. The role of host is one who belongs and can choose to welcome outsiders, and who has the authority to help make sense of data. Through participatory workshops with artists, I will explore the potential of these absurd robots to foster defamiliarization, or creative alternative ways of perceiving the everyday. FEELER / CRAWLER / OCTOPOETS blur divisions between sensors, senses, feelers, feelings, and knowledge. They crawl in the com-post (Haraway 2016) of post-human poetics of relation (Glissant 1997). These absurd creatures suggest being more humble about the kinds of knowledge claims we make with biosensing. They invite us to be curious, open, playful, and joyful with new ways of sensing, feeling, and experiencing urban space and daily life