

Digital Data Embodiment

HOW DATA EMBODIMENT CONTRIBUTES TO COGNITIVE AGENCY OVER DATA BODIES

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The prevalence of IoT embedded products has made data capture near impossible to escape. With the omnipresence of data mining, the question of how we design data collection becomes increasingly important and difficult to address. Previous research in embodied interaction design suggests the body is vital in creating conscious meaning. The Embodied Data project presented in this paper explores embodiment and data currency as possibilities for reclaiming ownership of our data bodies. The paper proposes that engaging the soma can support conscious awareness during data collection practices, creating an increased sense of agency.

Keywords: Embodied interaction design, Data bodies, Data agency, More-than-human, Entanglement

1. INTRODUCTION

“The extent to which society is being shaped by technology, in good and bad ways, has hardly ever been so large and visible for all to see. Social media, big data, internet of things and artificial intelligence are unlike the first computers, confined to offices, they pervade our whole existence. Consequently, they have very real consequences in our everyday lives, be it getting health insurance to autonomous mobility, and the question of who is responsible for what and ‘is this still what we want?’ has become more prominent in the field [e.g., Light et al. 2017]” (Frauenberger, 2019, p. 16).

With the rise in AI and the smart home product market forecasted to reach 116.4 billion by 2029 (Markets and Markets, 2024), designing for data collection will increasingly pose challenges. Consumers are concerned about their data, with 68% *somewhat* or *very concerned* about data privacy (Fazlioglu, 2023). Despite this concern, 47% *often* or *always* accept cookies (Mitchell-Wolf, 2024). While data collection is typically disclosed, it is done in a way few consumers comprehend, with research revealing 56% of Americans do not understand what a “privacy policy” is (Turow et al., 2023). Additionally, the design ethos surrounding smart products has largely been one that aims to make technology discreet and unassuming, assuaging concerns of the consumer by disappearing seamlessly into the environment. With personal data seemingly a prerequisite for participation in society and consumer concerns on the rise, we stand to question current data collection norms and practices.

An emerging focus in Human Computer Interaction (HCI) is the move from design for ‘users’ to design for bodies to design for more-than-human bodies (Homewood et al., 2021). As technology continues to become more pervasive and more *invasive*, “theories that address human and non-human entanglements are increasingly relevant” (Homewood et al., 2021, p. 6). This entanglement between humans and more-than-humans leads to an “uncertainty in terms of how agency is distributed between human and non-human actors” (Frauenberger, 2019, p. 5). Building on the concept of more-than-human actors in HCI, this paper considers design dilemmas surrounding data bodies.

2. LITERATURE & THEORY

2.1 DATA BODIES

What is a data body and where does it come from? When hearing the word ‘data’ what comes to mind? Maybe you imagine opening a web browser and the inevitable pop-up window that appears asking for consent to track cookies. Or maybe you envision the lengthy terms and conditions page that must be agreed to when downloading a new app or software update. Though valid, this perspective fails to recognize that IoT technology is far more prevalent and increasingly embedded in everyday items. From self-driving cars in San Francisco with always-on cameras inside the vehicles (Bhuiyan, 2023), to electronic toothbrushes becoming oral health data generators (De Saulles, 2017), data collection is near impossible to escape.

A data body can be described as a collection of data an individual creates through their actions online or with IoT (Lutkevich, 2023). Kitchin’s *The Data Revolution*, attests that “capta” rather than “data”, is a more appropriate term to describe what is happening: “Etymologically the word data is derived from the Latin dare, meaning ‘to give’...However, in general use, data refer to those elements that are taken; extracted through observations, computations, experiments, and record keeping (Borgman 2007). Technically, then, what we understand as data are actually capta (derived from the Latin capere, meaning ‘to take’)” (Kitchin, 2014, p. 2). What Kitchin describes is exactly the dilemma with “data”; that information is *taken from us*, rather than *given by us*. This point begets the question of data agency.

2.2 DATA AGENCY

Who should control our digital data? To answer this question, we must define our relationship to our data body. Is a data body equivalent to our shadow? Or perhaps, our offspring? After all, our data body cannot exist without our existence and once birthed by us, it must be continually fed with more data. Whether thought of as our shadow or offspring, there is no denying that our data body is an extension of us. Yet, our data body lives its own life, one we cannot see and have virtually no rights to. Instead, the custody of our data body belongs to that of large corporations. This should come as no surprise, but it does as “many social media users continue to separate the social applications they live with on a daily basis from the corporate ownership of these apps” (Kozel, 2017, p. 119). The ownership of digital

services alongside the IoT industry's ability to operate in secret, leads to a power imbalance between those mining the data and those from whom the data is mined (Carlsson, 2018).

When addressing data agency, recent studies call for more visibility in data capture processes. The work of researchers at Penn State demonstrated a general concern regarding object agency replacing human agency, suggesting that "object agency needs to be congruent with human agency by making the invisible and unconscious user input more visible to the users and more relevant to the interactions" (Jia et al., 2012, p. 1188). Another study found people would "prefer to receive less personalized content, if it meant less data sharing" (Kleanthous & Siklaidis, 2023, p. 3). The study concluded with a clear participant request for more transparency and awareness approaches (Kleanthous & Siklaidis, 2023). Even when data collection becomes more visible, do we comprehend it? While well intentioned, data visibility alone dismisses the role of the body in cognitive awareness.

2.3 DATA EMBODIMENT

Philosopher and dancer, Maxine Sheets-Johnstone set the tone for embodied interaction design with her phenomenology that movement rather than language is the basis of human cognition. She referred to this phenomenon as the "primacy of movement" (Sheets-Johnstone, 2011). Sheets-Johnstone's revelation later informed Kristina Höök who argued that embodied design needs to address "the whole self, body and mind as one" (Höök, 2018, p. 12), further explaining that it is through the body as a whole that "we create meaning in our everyday lives" (Höök, 2018, p. 30).

What the previous studies (Jia et al., 2012) (Kleanthous & Siklaidis, 2023) lacked was a more embodied perspective of data. While they recognized a need for increased awareness of data capture, data embodiment is arguably more valuable than transparency or visibility. If the "body is the basis for the construction of conscious experience" (Levisohn & Schiphorst, 2011, p. 99) then we must look for more opportunities to engage the body, thus creating conscious awareness. Klemmer et al. (2006, p. 141) elaborates on the lack of embodiment in HCI stating "systems that constrain gestural abilities (e.g., having your hands stuck on a keyboard) are likely to hinder the user's thinking and communication". Based on this sentiment, we can conclude that current data collection lacks not only visibility, but bodily awareness. This lack of visibility and embodiment contributes to a lack of conscious awareness leading to a desensitization toward our data body.

3. METHODS & PROCESSES

To investigate the notion of data agency and embodiment, a collaborative design team was assembled. Building upon Höök's definition of the soma as a coupling of mind and body, the *Embodied Data* design concept aimed to materialize data transactions and exchanges into felt bodily experiences. The project examines how an affective mapping of digital data on the body contributes to cognitive awareness of data exchange and possible data transactions. The project draws on aspects of critical design while looking to disrupt seamful design. Seamful design has been considered by the field of ubiquitous

computing to be the “highest ideal...to make a computer so embedded, so fitting, so natural, that we use it without even thinking about it” (Weiser, 1994, p. 1). While long hailed in design as optimal, when data collection starts to become imperceptible, we must question when seamlessness is no longer a positive design attribute.

3.1 DESIGN PROBE

Based on indications that humans lack awareness of their data body, an intra-team design probe was deployed [Figure 1]. The probe lasted over the course of three days and consisted of a diary with prompts. Participants were asked to select three types of digital data they produce and materialize them in physical form using found materials. After materializing their data, participants responded to the following three prompts: how they would feel if they shared their data, if their data was stolen from them, and if they could sell their data. Participants reflected on their emotional response to the scenarios and recorded their bodily responses using body mapping. Results of the probe revealed participants had not previously considered their bodily reaction to data collection. Creating a physical manifestation of their data helped participants envision their data as something tangible and better comprehend their feelings in relationship to how their data is currently harvested and used.

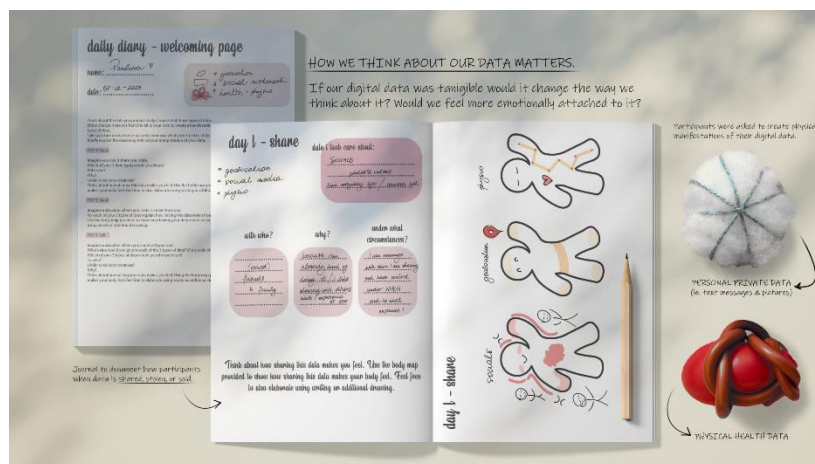


Figure 1. Design probe diary and data representation.

The results of the design probe suggested that more bodily awareness of data collection was needed to support cognitive meaning making processes. These findings led to an exploration of sensory materials on the body to create an affective mapping of different types of digital data. Using SomaBits, a technology platform that enables simple one-bit actuation of different sensory behaviors (Windlin et al., 2022), various data mappings on the body were explored through a series of bodystorming using outputs including: inflation, heating and cooling, vibration, light, and sound [Figure 2].

3.2 DESIGN CONCEPT

The design concept was twofold: to create bodily awareness of data collection and to consider an alternative future where people reclaim ownership over their data body. The design consisted of a

wearable vest-like garment that promotes bodily awareness during data transactions using sensory responses [Figure 2]. The vest mapped three zones: the neck, the stomach, and the chest. Each zone correlated to a type of digital data. The neck represented commercial data (recent purchases, buying habits, browsing history, etc.). The stomach represented physical health data (steps-per-day, family medical history, health screenings, etc.). The chest represented deeply personal data. What defines personal data is different for everyone, for some this could be private text conversations, for others it might be pictures or recent streaming history. Each region of the vest featured a different sensory actuation. The neck contained a small vibrator, the stomach a heating pad, and the chest an inflatable. The various actuators elicit bodily responses when data is shared. For instance, if the wearer chooses to share his/her health data with a doctor, the stomach of the vest would automatically warm, calling attention to the data sharing action. The bodily responses elicited were not denoted as being inherently good nor bad, rather they were a means of drawing conscious attention to the felt experience of the body during data transactions based on the type of data extracted.



Figure 2. SomaBit bodily exploration and vest design.

Current methods of data harvest revolve around what we will call *data acquisition*, in which data is taken unknowingly without active consent, and *data exchange*, where data is taken with consent. In an attempt to regain agency over our data bodies, the concept explored an alternative future scenario where data could act as a form of currency. Instead of data being taken, humans would have the choice to actively sell their data in exchange for goods or services. The wearer of the vest assigns the three types of data (commercial, health, and personal) a value ranking. The value assigned determines the financial value of the data set. The vest is charged through digital data actions that occur naturally during the day. For instance, browsing an online store such as Amazon would contribute to commercial data points while tracking daily steps with a wearable would contribute to health data points. After accumulating data points, wearers can pay for goods and services in exchange for their data [Figure 3].

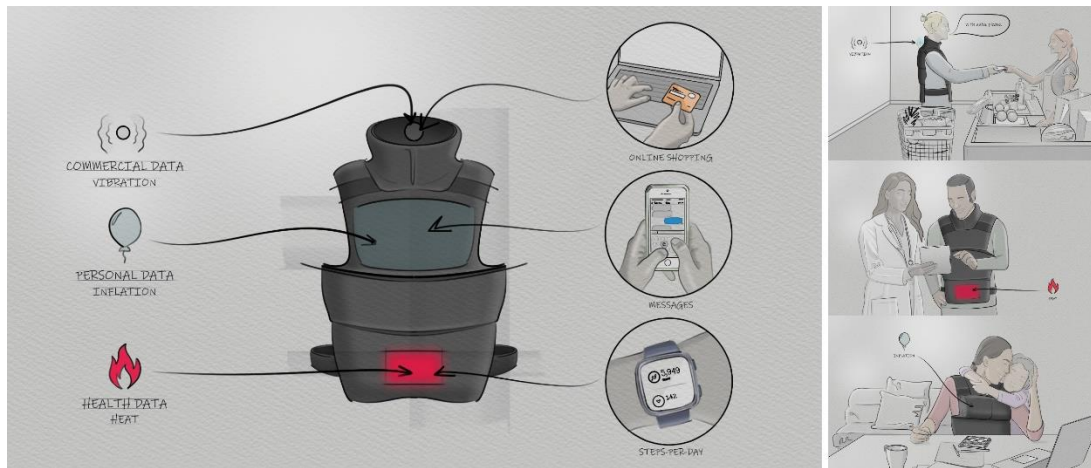


Figure 3. Design concept sketch and speculative scenarios.

3.3 TESTING

The concept was tested on four participants from varying cultural backgrounds between the ages of 20-40. Participants were asked to wear the vest and envision the following speculative scenario: *“imagine it’s 2050 and your digital data is now a form of currency”*. A moderator, aided by visuals, guided participants through the three data scenarios previously described (commercial, health, and personal). In each scenario, participants were asked to sell their data. Upon transaction, the vest reacts with the corresponding sensation. Following each scenario, participants reported their emotional response.

4. RESULTS

The concept garnered an overall positive response. Participants showed mixed reactions to the idea of selling their data, some felt at ease while others showed hesitation. All participants felt the connection between vibration and selling their commercial data describing it as a notification or alert. Participants found the heat to be comforting, noting it assuaged any doubts about selling their data. This response raised questions about the morality of soothing people into selling data. The chest inflation was by far the most radical and disturbing sensation. Many associated the sensation with anxiety and expressed the desire to rip the vest off and abort the sale of their data mid-transaction. Main findings indicate that the type of bodily sensation greatly impacts how users feel about their data. Future iterations of the concept should explore a more modular solution where the sensorial actuators could be moved to areas of the body based on the emotions and preferences of the wearer.

4.1 LIMITATIONS

While findings from the project indicate the importance of somatic experience in human cognition and awareness, limitations of time, test subjects, and sample size contribute to a lack of decisive findings. Further studies would require more exhaustive testing and iterations.

5. DISCUSSION

Recent studies in psychology (Van den Bussche et al., 2020) suggest that increased cognitive effort and control is crucial in establishing a sense of agency. The sensory vest engaged cross modal actuation of the body to support conscious awareness during data collection. By engaging the body and thus, awakening the conscious mind, participants were able to actively reflect on their digital data and consider their emotional response to their data being taken. The design concept provoked questions and debate regarding how people feel during data collection. Age, culture, and other factors influence how people value their data and consequently, their emotions regarding data collection. The intention of the garment was not to assign emotions, rather it was to assign sensations to the body that could be discussed with the participants to determine how it matched their perception. Though considering data currency as a means of reclaiming agency over data bodies is an interesting and relatively unexplored area, the most valuable responses to the concept resulted from engaging the body as a stimulus for creating comprehension of digital data.

5.1 KNOWLEDGE CONTRIBUTION

Though the *Embodied Data* project was an abstract experiment exploring bodily interpretations of data collection, it gives way to bigger questions about the future implications of data in design. Could we imagine more embodied ways of gaining consent for data collection? Could we move away from screen-based design to consider more tangible interfaces that engage both body and mind? The continuous expansion of AI and embedded IoT technologies indicates the *data dilemma* will not disappear. As designers, we will be faced with decisions about whose interests we serve and if technology that reduces mental friction is in fact a good thing. This project contributes to the field by demonstrating the link between the soma and conscious experience, urging for consideration of more embodied solutions.

6. CONCLUSION

Current data collection strategies favor large corporations and government agencies rather than the humans to whom the data belongs (Carlsson, 2018). Kozel (2017, p. 122) stresses, the current “dilemma is how to facilitate a cultural shift away from passive acceptance of dataveillance (data surveillance) in order to reclaim agency over our bodies and digital traces”. Previous studies around data agency emphasize the need for user awareness and transparency (Kleanthous & Siklaidis, 2023). However, these studies call for increased visibility when addressing awareness which prioritizes ocular modes of perception and outdated beliefs separating mind and body in human cognition. GDPR laws in the EU already attempt to address data visibility by requiring consent from data subjects (Wolford, 2023). Cookie consent pop-ups inform subjects about data collection and request their consent for tracking; however, these types of regulations are usually more of a hindrance than helpful. These annoying pop-ups can be referred to as *sludge*: “any aspect of choice architecture consisting of friction that makes it harder for people to obtain an outcome that will make them better off” (Thaler & Sunstein, 2021, p. 153). Not only does sludge induce additional mental strain, but it relies on default options. As Thaler and Sunstein express in their book, *Nudge*: “Many people will take whatever option requires the least effort, the path of least resistance...if, for a given choice, there is a default option—an option that will prevail if

the chooser does nothing—then we can usually expect a large number of people to end up with that option, whether or not it is good for them.” (Thaler & Sunstein, 2021, p. 108). We can infer it is of no coincidence that the default options are often preset to allow cookies and data tracking, requiring conscious effort to opt-out heightened by the lack of bodily awareness of data sharing practices.

As products continue to become seamlessly integrated with IoT technologies, we have to question when unobtrusive and so-called “shy tech” starts to toe the line of ethicality. When should designers challenge the notion of seamless design? Frauenberger (2019, p. 2) asserts that “the extent to which digital technology shapes who we are means that whoever shapes technology, puts the chisel on humanity”. Homewood et al. (2021) further imply that we do not design *for* bodies, we design bodies themselves. These implications place an immense amount of responsibility on designers. It would be naïve to assume there is ever a neutral decision in design (Thaler & Sunstein, 2021). So, when neutrality is not an option, what decisions do we make? To suggest that data should or should not be collected would be to define what is “right” versus “wrong”. Rather, this paper suggests we prioritize bodily engagement during data collection practices, allowing for increased cognitive awareness and consequently, an increased sense of agency. By awaking the soma, we can create a moment of consciousness, providing the cognitive capacity to empathize for our data body and reflect on the future we want for it.

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