

Towards Advancing Body Maps as Research Tool in Interaction Design

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ABSTRACT

Body maps are a popular tool in body-centric design, facilitating a sensitization and expression of felt sensations and emotions. Yet, they also bring forth assumptions about the body and our somatic experience. Based on an open and exploratory design ideation inquiry, we have started to explore how body maps could be advanced so as to cater to a plurality of bodies and aspects that shape somatic experiences. We present an annotated portfolio featuring six design themes (temporality, sociality, representativeness, granularity, context, focus). These themes help us examine implicit assumptions of current body maps, and offer possible alternatives for what future body maps could become. We contribute our themes, inspirational design ideas and practical design techniques to help craft novel body maps. Our contributions can serve as inspiration to others, towards advancing body maps as a research tool for body-centric interaction design.

CCS CONCEPTS

- Human-centered computing → Interaction design process and methods.

KEYWORDS

Body maps, body-centric design, soma design, documentation methods, design research methods

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1 INTRODUCTION

With the appearance and development of bodily and movement sensing technologies, HCI has experienced a ‘somatic turn’, characterized by a heightened focus on the bodily experience of people interacting with technologies [19]. This has prompted the development of body-centric design methodologies [19], as well as methods and tools that foreground and leverage the users’ and designers’ body in design (e.g. [19, 31, 35, 50]). Engaging with the body in design brings inherent challenges in terms of articulating, capturing and sharing somatic experiences, due to their subjective, elusive and ephemeral nature [19, 48]. Despite such challenges, the body-centric interaction design community in HCI has adopted and developed tools to document somatic experiences in design processes, and this work focuses on one of such tools: body maps.

Body maps are a documentation tool that help people articulate and represent their somatic sensations and emotions [1]. The classic body map features a graphical representation of the human body, often as a blank silhouette of its frontal plane (Figure 1). Commonly, people report on their felt sensations and emotions by filling in the body map: representing them with drawings, scribbles and symbols, mapping them to the body area where they are felt [1]. Through these drawings, users and designers can articulate and document aspects of their somatic experience that are often elusive and ephemeral [48], and can share and discuss them with others - long after they have been experienced. Thus, body maps have become a popular research tool in the TEI community (e.g. [1, 36] and within the broader body-centric interaction design community in HCI (e.g. [6, 31, 47, 51]). The use of body maps ranges from sensitizing people to attend to and articulate their somatic experience [36, 47], to idea generation [1], sparking conversations [1, 26] and as interviewing tool [28]. Yet, despite their popularity and usefulness, body maps have not been the explicit object of research themselves - besides notable exceptions on how to use them [1].

In this paper, we present the results of an open and exploratory design inquiry towards examining and advancing the classic body map design. Our interest in examining body maps was motivated by the notion that the research methods employed for capturing and representing somatic experiences also participate in the production of that very phenomenon we end up researching [13, 23, 48]. As such, body maps are non-neutral artefacts: our understanding of

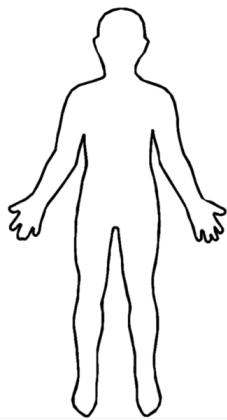


Figure 1: Classic body map silhouette.

bodies, their representations, and how we design for them stem from cultural and social norms [42], and there is a need to articulate the limits and possibilities afforded by our research tools.

To do so, we engaged in two design ideation workshops with eleven body-centric designers and researchers, who explored what future body maps could address. These craft-based [46] ideation workshops resulted in a plethora of inspirational ideas for novel body maps designs, upon which we articulate six design themes for examining and developing body maps: *temporality, sociality, representativeness, granularity, context* and *focus*. These themes build on the shift in HCI from approaching the body as universal and generalizable [42] towards addressing a plurality of bodies and experiences [18–20]. We present the resulting design themes in an annotated portfolio [15] manner. We present each design theme in our portfolio, anchor it in relevant body-centric literature, and illustrate it with specific design ideas resulting from our workshops.

The contributions of our work are twofold. First, our design themes and illustrative design ideas, which can offer design inspiration on how body maps could be advanced so as to address a wider variety of bodies and aspects that shape the somatic experience. Second, we contribute a set of design techniques that capture the practical ways through which we crafted the inspirational ideas for novel body maps designs in the workshops.

Our contributions address current calls for considering more plural bodies and experiences in our design research [18, 20, 42] and for developing documentation forms that can adequately capture and represent the complexity of our somatic experiences [48]. With this paper we do not attempt to supplant the classic body map. Rather, we posit that the classic body map is but one, if ever so useful, way of representing the body, and that it presents often implicit assumptions on what a body is, and what aspects affect and shape somatic experiences. With our themes and techniques we aim at providing inspiration for others to advance body maps in their own research: to examine the assumptions on the body that we (implicitly or explicitly) adopt in our research tools, and to inspire the design of future alternatives. Our work adds to, and extends, the state of the art of body maps as a research tool in body-centric interaction design (e.g. [1, 19, 26, 36, 47]).

2 RELATED WORK

Body-centric design has been gaining traction in the last two decades in interaction design research [19]. Several design approaches have emerged that place the body and somatic experiences at the center of the design process, e.g. soma design [19]; embodied interaction design [9, 43], kinesthetic interaction design [7, 11, 12], and feminist design [18, 42], to cite a few. These and other design approaches build on different perspectives on the body.

Two works from a feminist design perspective [18, 42] have investigated the perspectives and assumptions on the body that underlie body-centric work in HCI. Homewood et al. [18] survey and trace different theoretical conceptions of the body in HCI: from user to body, addressing the centrality of our fleshy, sentient body; from body to bodies, addressing a plurality of bodies; and from bodies to more-than-human bodies, addressing the human and non-human, organic and inorganic, components that form the entanglement of our bodies. Their work calls for designers to understand the perspectives that they take when approaching bodies.

Similarly, Spiel [42] argues that despite varied design approaches, methods and goals, body-centric design research has often maintained a view on the body as universal, normative and generalizable. They argue that the body in design is often that of an adult, white, abled, non-fat, male body, and call for designing with and for a plurality of bodies.

Our work takes on, and extends, both these calls by focusing on a concrete aspect of body-centric interaction design research: the tools we employed for capturing and representing somatic experiences. We build on the notion that research methods and tools are not neutral artefacts, but participate in the production of that very phenomenon we research [13, 23]. Hence, it is important to probe and understand the underlying assumptions behind the tools we employ - so we can critically adopt, adapt, or challenge them in (and for) our research.

Next we review the challenges and importance of documenting somatic experiences in design. We also present existing methods of documentation, focusing on prior work on body maps.

2.1 Documenting Somatic Experiences

Documenting somatic experiences is challenging due to the highly elusive, bodily, physical, and social phenomena that characterize them [48]. Bodily sensations and emotions are often difficult to articulate (*ibid.*): they are often tacitly experienced [50] and spoken language often fails to appropriately address and convey them [19], especially for those users or designers with little or no somatic training [21]. Capturing and documenting such sensations and emotions is equally challenging, due to their elusive and ephemeral nature [48]. Yet, despite such challenges, capturing somatic experiences is of utmost importance in design, both for generative and evaluative purposes, as well as to share and communicate with others the processes and impact of our designs [19, 48].

The body-centric interaction design community in HCI has long worked with ways and tools to capture the designers' and users' somatic experiences in and for design. Several works have drawn on interviewing methods and transcriptions of recordings of people's accounts, to report on e.g. the designers' felt experience after

engaging in a sensitizing somatic practice [22], or the users' somatic experience after engaging with the designed technologies [25, 37]). Other works have employed questionnaires to make participants reflect on their somatic experience and document it for future analysis, e.g. [28, 29]. Beyond solely verbal/textual medium, other researchers have explored an aggregation of evocative images and text to capture and represent particular somatic experiences to help in future design activities, e.g.: the *somaesthetic moodboards* [48], or the *inspirational resource kits* [30]. Both these latter examples are inspiring, but focus on capturing singular temporal points of the somatic experience. Other researchers have focused on capturing somatic experiences beyond such a singular point. For example, Tennent et al. [45] approach somatic experience as a journey rather than a static condition: an experience that changes over time. The authors propose *soma trajectories* to address how somatic experience change in relation to how interactive events unfold, which helped in re-feeling or recalling the experience. Further, they suggest that future work could explore using soma trajectories together with body maps, to capture the temporal unfolding of an experience.

2.2 Body Maps as Research Tool

Body maps are one of the most popular tools to elicit and capture somatic experiences [4], both in the TEI community and the wider body-centric interaction design community in HCI. Their abstracted, and empty silhouette offers a simple representation of the body that becomes a canvas on which people can represent their felt sensations and emotions [1, 5, 8, 24].

In HCI, body maps have been widely adopted by the body-centric interaction design community to elicit and capture somatic experiences of diverse participants of the design process [4]. Several works have used the classic body map in their own body-centric design processes in this fashion, for example: Núñez-Pacheco et al. [37] use it to sensitize participants to, and capture their somatic explorations of, focusing attention on the body. Similarly, Jansson et al. [25] use it to capture their somatic explorations of using heat to guide attention. Windlin et al. [51] use them to capture the designers' experience of interacting with an actuation toolkit in ideation processes. Loke et al. [30, 31] use them with dancers in movement-centric design processes. Tajadura-Jiménez et al. [44] and Ley-Flores et al. [28] make participants fill up body maps multiple times during a physical activity: the former, to document somatic sensations of physically inactive people before, during and after engaging in physical activity; the latter, to capture sensations at the different stages of a physical exercise, such as squats.

Other researchers have used them not only to capture somatic experiences, but as a tool to spark discussions, for example among participants (i.e. Khut [26], among participants of interactive art installations), or as discussion tool between researchers and users (i.e. Ley-Flores et al. [28] in evaluative interviews of a movement sonification wearable).

Others have used them as a pedagogic tool, e.g.: Tsaknaki et al. [47] use them in soma design oriented courses to help students to think about and articulate their own somatic experience; Cochrane et al. [4] organized a workshop to collectively explore and teach

researchers how body maps can be used in design to generate new ideas.

While prior work has used the classic body map extensively, it has not focused on body maps as object of research itself. A notwithstanding exception is the aforementioned work of Cochrane et al. [4], who based on their workshops' exploration, created a pictorial that teaches how to use the classic body map. They do so by provide four cases showing the potential of body maps in capturing somatic experiences and experiential qualities, increasing somatic awareness, and identify patterns among participants. Yet, there is an ongoing interest in the body-centric interaction design community in exploring and developing body maps as a tool [36], and in developing documentation forms that can adequately capture and represent the complexity of our somatic experiences [48].

Most of the works above use or focus on the classic body map, and there is a limited number of works that, to date, have explored alternative designs to the classic body maps. One such example is the work of Correia et al. [6], who besides the classic body map silhouette also explore the use of "free-form" body maps, in which participants draw their somatic experience in any shape they want. A related example is that of Gastaldo et al. [14], who use an unconstrained body map form as part of one of the elements of their body-map storytelling method that includes a narrated first-person perspective, a life sized body map and visual elements - that put together offer a deep and contextualized reading of the experience. Another example is found in Núñez-Pacheco et al.'s call for participation [36] to a TEI studio that aimed to explore tangible body maps. A final example is found in Ley-Flores et al.'s work [28], who propose to depict the silhouette engaged in particular actions to help users think about particular movements. Our work is aligned with these in that we also explore future alternative body maps for design. In the discussion section, we discuss how our contributions relate to, and extend, prior work on body maps.

3 METHODOLOGY AND METHODS

Our work followed a Research through Design [16] approach. Research through Design is a method of inquiry based on design practice that considers the construction of artefacts as central to the production of knowledge, as they constitute a unique way of probing into situations and enable particular observations and insights [27]. The work presented in this paper is based on the results from two design ideation workshops with body-centric technology designers and researchers, and subsequent analytical and theoretical discussions among co-authors. In the workshops, we adopted a participatory and craft-based approach to ideation [46], in which participants engaged with and used different crafting materials and objects to build and illustrate their ideas for future body maps. In the later discussions, we engaged in an analytical approach influenced by thematic analysis [2] that was shaped by the authors' theoretical underpinnings.

3.1 Design Ideation Workshops

Participants: We organized two design workshops (W1, W2). The first author sent a call for participation through Uppsala University's communication channels, reaching out to different groups of designers and researchers working with body-centric technologies

Table 1: Overview of Participants in the workshops.

Participants	Career Stage	Research Focus	Workshop	Country
P1	Post-doc	Reproductive Health	W1	Germany
P2	Associate Professor	AI for Physiotherapy	W1, W2	Spain
P3	Post-doc	AI for Physiotherapy	W1, W2	Spain
P4	PhD student	Sports HCI	W1	China
P5	Research Assistant	AI for Physiotherapy	W1, W2	China
P6	PhD student	Reproductive Health	W1, W2	Sweden
P7	Associate Professor	Reproductive Health	W2	Sweden
P8	PhD student	Somatic Play	W2	Sweden
P9	PhD student	Biometric AI	W2	Sweden
P10	Research Assistant	Biometric AI	W2	Greece
P11	Post-doc	Biometric AI	W2	Sweden

and application domains. Ten designers and researchers responded to the call (see Table 1). We consider necessary to situate the positionality of our participants, as it strongly impacted the results of the workshops. All of our participants were women and were at different research career stages. All were from the global north, coming from five different countries (China, Spain, Greece, Sweden, Germany). Further, some of their backgrounds and intimate experiences came into light during the ideation workshops, and shaped the type of bodymaps prototypes they built. For example, one participant (P1) was pregnant at the time of the workshops, which made her consider strongly what was going on *inside* her body. Another participant (P2) is a trained physiotherapist, which made her consider strongly pain as a somatic sensation that she wanted to capture with great nuance. One participant (P4) works part-time as physical trainer, and her ideas often built on sporting and physical training experiences and scenarios. Two participants (P1, P8) had ample experience working with children, which often made them consider children's perspectives. In Section 4.2, we will refer to the participant's background when explaining the body maps that they prototyped - as it strongly shaped their creations. All participants had experience using qualitative methods to elicit and capture somatic experiences (e.g. embodied design workshops, autoethnography, diary studies) and were familiar with body maps as research tool. In addition, five of had used the classic body maps in their own previous research projects. All participants were interested in exploring how body maps could be used and developed further to suit their own research focus.

Workshops' structure: Due to conflicting schedules, two participants participated only in W1, and five only in W2. Four participants participated in both. Each workshop lasted 2.5h, and were facilitated by the first author. After securing consent from the participants as per Uppsala University's ethical guidelines, both workshops followed a similar structure: a sensitizing phase, an ideation phase, and a discussion phase. The main difference between the two workshops was that in W2 we also presented and discussed resulting designs from W1. Both workshops were video-recorded with two cameras for later analysis.

In the *sensitizing phase*, participants engaged with the classic body map as point of departure for the upcoming ideation, and to

start discussing its potential strengths and limitations. Participants were given two classic body maps. The first author facilitated a short (10') body scanning exercise inspired by Feldenkrais techniques [41]. While participants were sitting in their chairs and with their eyes closed, the facilitator verbally guided participants' through different parts of their body. The facilitator prompted instructions that encouraged participants them to turn their attention to particular aspects of the somatic experience (e.g. "pay attention to your arms and hands", "focus on your breathing cadence"), as well as questions (e.g. "what sensation are you feeling more intensely right now?") as a way to help them focus on their felt sensations and shift their attention through different body parts and sensations. After the body scanning, participants filled up the first body map with colored pencils and pens that were available. Next, participants were encouraged to engage in a somatic activity of their choice (e.g., stretching, walking, breathing...) for another 10' while they focused on their felt sensations. After this activity, they filled up the second body map. The sensitizing phase concluded with a short joint debrief. The participants who wanted shared with others their body maps and their experience of filling them in. Participants started to elicit and discuss perceived benefits and limitations of the current tool for capturing their experience and/or for their own research. Some participants would take on these discussions as the starting point in the ideation phase that ensued.

In the *ideation phase*, participants were invited to generate ideas for how future body maps could better capture aspects of their somatic experience that were important for them, and/or that could address better their own design and research work. In line with the open and exploratory nature of the workshops, the facilitator prompted participants to use a broad basis for inspiration. The facilitator verbally communicated prompts that the participants could focus on when thinking of their somatic experience, e.g.: to focus on their own current somatic experience, focus on prior somatic experiences that they recalled or that had been very intense, to think of particular design projects in which they were involved and in which documentation of somatic experiences was key, or to think about limitations they had started to perceive in the classic body map. Ideation occurred mostly individually, but some participants



Figure 2: a) A classic body map, completed by a participant of our workshops. The orange color represents a warm, fulfilling sensation; the blue, cold and discomfort. The yellow captures feelings of somnolence and difficulty concentrating. b) Craft materials and objects brought to the workshops for participants to build prototypes that illustrated their ideas for future body maps.

paired up to give each other feedback and suggestions on their ideas.

Participants were instructed to capture their ideas in a tangible format to be able to substantiate, document and share their results. Inspired by prior craft-based ideation works [46], participants were given a variety of tangible objects and crafting materials (see Figure 2) to help them explore and express different possibilities with prototypes. Common crafting materials were brought in, such as cloth, clay, thread, needles, paper, colored pens, sticky notes, and so forth. These materials were chosen for their capacity to be used to quickly prototype and express ideas for novel body maps (e.g. mannequins depicting a body from all the angles, classic body maps that could serve as the base upon which to construct alternatives).

Finally, in the *discussion phase*, participants presented their prototypes to the whole group. Participants explained the rationale behind their creation: they explained the body map design and the experience that it was capturing, often also reflecting on how it changed from the classic body map. Each resulting prototype was jointly discussed in the group: others asked questions about the design and often provided reflections on how they envisioned the design to be used and/or adapted for their own work. Discussing the new designs also served as catalizer for participants to discuss their own underlying assumptions and perspectives on the body and somatic experiences.

3.2 Analysis

After the workshops, all participants were invited to participate in the analysis of the work and the writing of the findings. This was done due to the organizer researchers' belief in inclusive research, in particular when the knowledge contributions of the workshops were so intimately tied to the individual participants' lived experience. It was also done to consider participants' perspectives during analysis (and hence, to be as accurate as possible to the experiences that gave raise to particular prototypes) and to offer participants the chance to get their knowledge contribution acknowledged through authorship. Four participants accepted and are hence co-authors of

this paper. To start the analysis, the first author analyzed the video data and identified all the resulting prototypes that illustrated ideas for future body maps design. She noted them down on a document, adding for each idea a provisional ID and identifying name, a picture from the video recordings, and a short description of the body map and the somatic experience that it captured as participants presented it. This document was shared with the other authors and became the data upon which subsequent analysis and discussions were held.

We collectively analyzed the ideas in the document through an approach based on the phases of Thematic Analysis described by [2]. With our analysis, we aimed at finding relevant design patterns that spoke to how body maps as tool could be advanced, and to identify design techniques that could help designers do so. First, each co-author individually familiarized themselves with the data, and enriched each body map idea by adding to it comments and reflections, e.g.: particularly interesting features of the design, interesting aspects of the somatic experience captured, perceived strengths and limitations of the design.

After each of us read all the comments and reflections, we made an initial coding of the text to capture interesting features of the data. In particular, our analytical approach at this stage aligned with what Braun and Clarke call *reflexive thematic analysis* [3]: a type of analysis that acknowledges the impartiality of the researchers in analysis (i.e. it is shaped by the researchers' theoretical backdrop) and that allows for flexible analyses (i.e. in our case, a combination of inductive analysis on the data guided by the researchers' theoretical perspectives). This coding was hence strongly shaped by the authors' different, but aligned, theoretical perspectives - which are mainly anchored on somaesthetics [33, 34, 41], soma design (e.g. [19]), emerging fourth-wave HCI entanglement perspectives [13] and feminist design perspectives (e.g. [18, 42]). In the next section, we will use concepts from these perspectives so as to ground our results. In the next stage of analysis, we collectively discussed the codes to polish and unify the coding labels. Finally, we collectively

started to collate the codes into potential themes, which were discussed and reviewed over three discussion sessions in relation to the data set. These sessions helped to define and name the themes, and discuss and refine the specifics of each theme and the theoretical perspectives underpinning them.

3.3 Documenting the Resulting Prototypes

Alongside the analysis phase, the first author also took on documenting each resulting prototype from the workshops, which illustrated the participants' ideas for what future body maps could become. The first author took pictures of all the constructed prototypes. Some prototypes were slightly damaged after the workshops, or had been roughly sketched with drawings that were difficult to understand without the verbal explanations that accompanied our discussions (e.g. some drawings for alternative silhouettes). The first author recreated some of these prototypes for this paper, to improve their understandability. She did so by reviewing the video data, so as to obtain a view of the original version and recreate the prototype as close as possible to the original idea envisioned by the participant. In the next section, we present the results of our work and we explicitly specify when a prototype is a recreation made for this paper. If unspecified, the image depicts an original creation by one of the participants.

4 AN ANNOTATED PORTFOLIO: RESULTING DESIGN TECHNIQUES AND THEMES

Through our analysis, we identified a corpus of 25 resulting prototypes that illustrate ideas for future and alternative body map designs. We also generated six *design themes*: *temporality*, *sociality*, *representativeness*, *granularity*, *context* and *focus*. We also identified five *design techniques* that our participants used to expand the classic format of body maps: *layering*, *quantifying*, *connecting*, *coding* and *abstracting*.

In this section, we present the results of our work as an annotated portfolio [15, 32]. Annotated portfolios present a selection of designs that share resemblances, often using a visual medium combined with brief textual annotations [15]. We first present the identified design techniques, to create a shared vocabulary that we

will use to annotate our body maps designs. Second, we present our design themes. In our design themes, we capture recurrent underlying aesthetics and design focuses that we identified throughout our corpus. We ground each theme on works that reflect the theoretical perspectives of the authors - which shaped the generation of the themes. We illustrate each theme with a selection of our participants' body maps prototypes (13 in total). These prototypes were selected for their capacity to not only illustrate family resemblances among design ideas within a same theme, but also to illustrate differences within it.

4.1 Design Techniques Used in Our Corpus

We identified five recurring design techniques in our corpus that our participants used to craft their prototypes (Figure 3). We list them and briefly explain what they were used for with a twofold goal: first, to establish a vocabulary that we will use in the next pages to annotate the prototypes that illustrate each theme. Second, to provide practical and inspirational techniques through which future body maps designs could be developed.

Connecting. Connecting focuses on portraying relations between e.g. causes and effects on sensations and emotions, relations between body parts, but also connections between the own body and other bodies. Participants portrayed connections through different materials, e.g. using thread or arrows, positioning mannequins in relation to other bodies.

Coding. Coding focuses on portraying and distinguishing sensations and emotions through the use of specific symbols, icons, words and colors. Participants employed different ways of coding, e.g. colours used on the body map linked to words that capture what the colours symbolised, or verbally explaining their scribbles and drawings. Coding allowed other participants to understand the represented somatic experiences, creating a structure that enabled to interpret the body maps.

Layering. Layering focuses on portraying sensations that built on each other, portray the inside and outside of the body, and offer a comparison between somatic experiences. Participants used different materials to create layers, e.g. superposed transparent lamination sheets, or adding clay on top of clay.

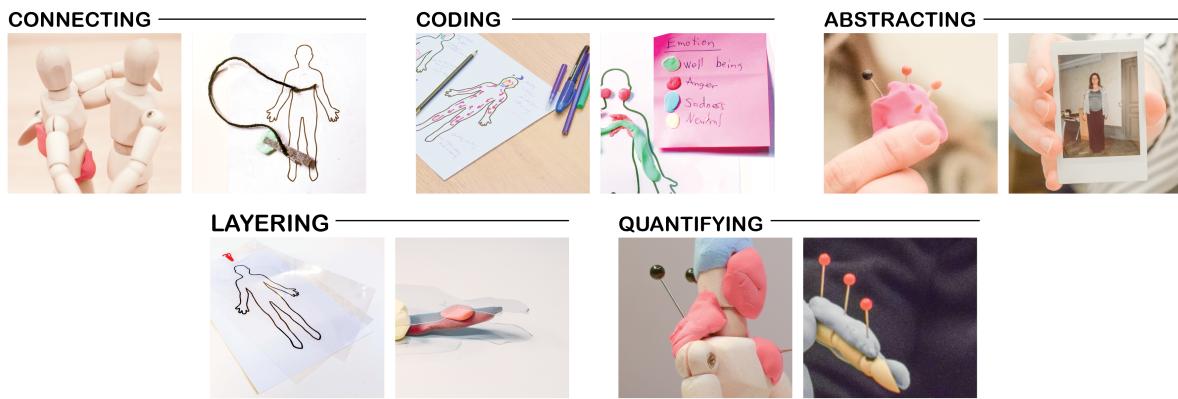


Figure 3: Visual overview of the design techniques participants employed in our workshops to build their prototypes that illustrated their ideas for future body maps.

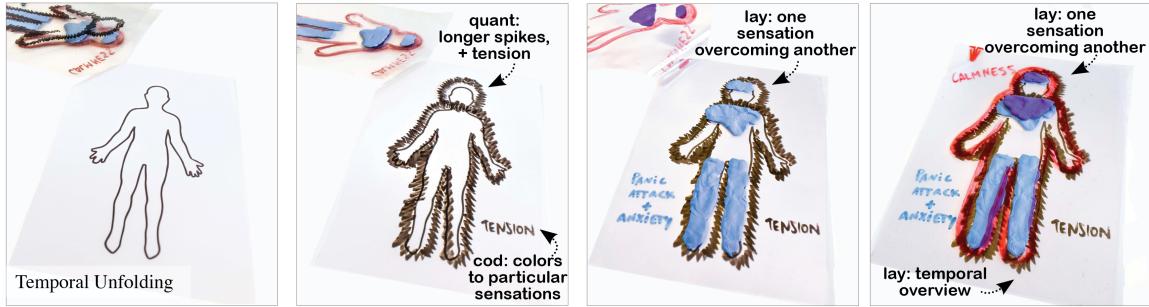


Figure 4: Prototype *Temporal Unfolding*. Captures the progression of a somatic experience: a panic attack.

Quantifying. Quantifying focuses on portraying with more nuance the extent to which sensations and emotions are felt. This technique allowed participants to portray varying degrees of intensity or importance. Participants used different materials to quantify experiences, e.g. using more clay or colors or sticking needles deeper into the body map to represent more intensely felt sensations.

Abstracting. Abstracting focuses on portraying the body and emotions in more or less realistic ways. Participants used different materials, e.g. their own digital tablets and instant cameras to photograph the body; clay and pins to abstractedly represent emotions.

We use these techniques in the next subsection to annotate the body maps' prototypes resulting from the workshops. We annotate them as follows: *con*=connecting; *cod*=coding; *abs*=abstracting; *lay*=layering; *quant*=quantifying.

4.2 Design Themes

We generated six design themes that can serve to probe and inspire future body maps designs: *temporality*, *sociality*, *representativeness*, *granularity*, *context* and *focus*, which we present and illustrate below.

4.2.1 Temporality. Temporality refers to sequences of time, or particular events, and its relation with somatic experiences. It connects with individual and collective awareness of “change” experienced in the world and oneself [38], and with “events” contained in a particular situation and duration [38]. Previous work stressed the

need to understand somatic experiences as a *soma trajectories* that sequentially unfolding through time [45]. Yet, the classic body map prompts a focus on singular points of the somatic experience, often at the moment of filling it in [4, 45]. Several of our designs explored the rich and complex interplay between somatic experiences and temporality in different ways.

Some prototypes captured the temporal unfolding of a somatic experience. For example, Figure 4, created by P10, captures the different stages of a panic attack as she sometimes experiences it herself. P10, who has dealt with anxiety for a long time, wanted to visually represent how different sensations overcome each other, and to obtain an overview of the whole experience at the end. To build the prototype of her idea, P10 used the classic body map as base and stacked three transparent laminated sheets on top of it. In each sheet, P10 represented with colors and clay a sensation she felt during the progression of a panic attack: an initial tension in anticipation, anxiety during the attack, and calmness when the intense anxiety subsidized.

Other prototypes focused on tracing interconnected causes and effects of temporal events and their impact to particular somatic sensations experienced in the present. For example, P4 wanted to connect sensations she experienced during the workshop to different events. In Figure 5-a, using a rough temporal timeline of events in one paper, the classic body map and clay, P4 connected a headache she was experiencing to poor sleep the prior night; and discomfort in her right wrist due to work-related work activities

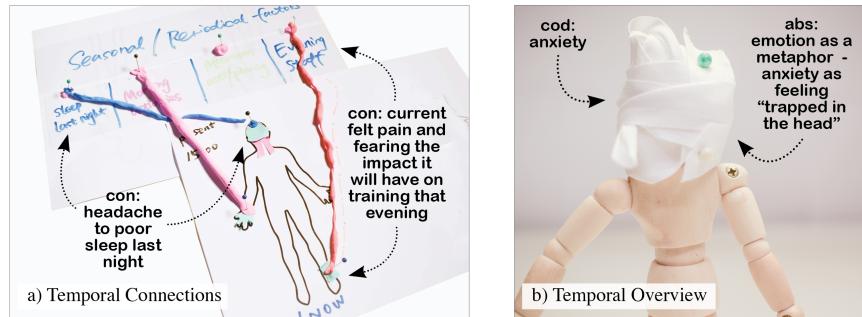


Figure 5: Theme: temporality. Two prototypes: a) *Temporal Connections*. Captures the causality of temporal events and their impact on current somatic sensations. b) *Temporal Overview*. Captures the most salient felt somatic sensation that the person felt over a long period of time: anxiety felt and expressed as “being trapped in my own head”.

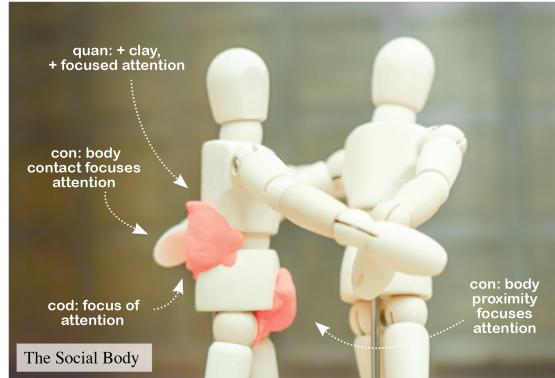


Figure 6: Theme: sociality. Prototype *The Social Body*. Captures the somatic experience of two people interacting physically during partner dance.

during the very morning of the workshop. P4, who is also a personal trainer, also reflected that her ankle pain made her focus on, and fear, a training class she had to deliver on the evening.

Finally, other prototypes focused on capturing an overview of the felt sensations over long periods of time. For example, P3 wanted to capture the most intense emotion she experienced during the previous last year: anxiety due to work. In Figure 5-b, she built a prototype with a cloth stripe fully wrapped around a drawing mannequin's head, which helped her portray anxiety as intrusive thoughts that made her feel like "trapped in [her] own head". P3 mentioned that it was important for her to single out this emotion, as it was so prevalent during such an extended period of time and coloured the rest of her experiences.

4.2.2 Sociality. Sociality refers to how different bodies interact with, relate to, and affect each other [33]. Our social interactions affect how we experience ourselves, what sensations and emotions we feel and how we act in the world [33]. This body sociality also prompts shifts in focus and attention to particular aspects of our experience [33, 34]. The classic body map design focuses on an individual body, prompting an understanding of the body as

isolated from its intersubjective relations and limits the ability to portray how other bodies affect somatic experiences.

Several of the resulting prototypes focused on capturing the social complexity of somatic experience. All these prototypes foregrounded how particular felt sensations and emotions were elicited and shaped by our bodily interaction with, or awareness of, other people. The prototype in Figure 6, created by P1, serves to illustrate this theme. P3, reflecting on her recent experience in learning cuban salsa (a latin partner dance), wanted to capture how her somatic awareness during the lessons was highly influenced by her dancing partner. P3 did not know her dancing partners beforehand, and often found herself overly aware of, and attentive to, body areas that were in close proximity and contact with the other person: the lower back and the groin. She illustrated her experience by building a prototype involving two drawing mannequins staged in a dancing pose. P3 added clay to the body areas of the mannequin that represented herself to indicate where her attention was directed to.

4.2.3 Representativeness. Representativeness refers to inclusion and diversity of (human) bodies in the representations [18, 42] and access to the research tools employed to research them. In HCI, the

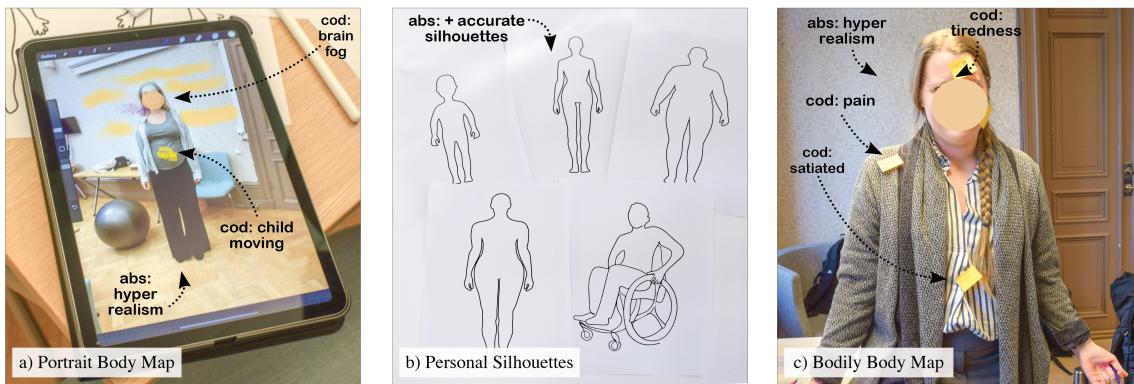


Figure 7: Theme: Representativeness. Three prototypes that propose body representations alternative to the classic silhouette: a) *Portrait Body Map*, using a picture of the person who will fill it in; b) *Personal Silhouettes*, representing different body sizes, ages and needs; c) *Bodily Body Map*, using the own body as canvas to label where particular sensations and feelings are experienced.

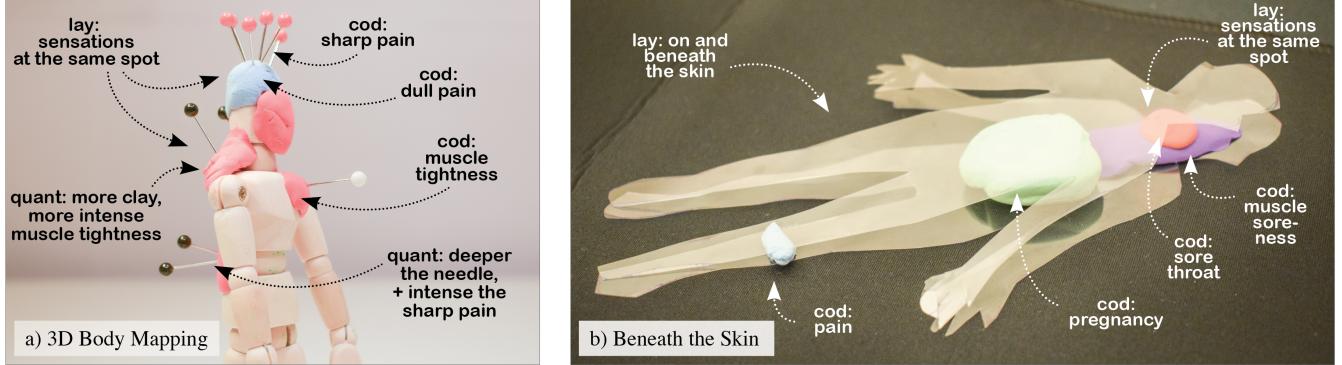


Figure 8: Theme: Granularity. Two prototypes: a) 3D Body Mapping and b) Beneath the Skin. Both leverage a 3D format to capture different sensations exactly where and how they are felt in the body. These maps also capture superimposed sensations at the same body area, as well as different intensities of felt sensation.

conceptual move from viewing the body as universal [18] - often an adult, male, white, able body [42] - calls for representations that address a plurality of bodies, catering also to those not centered in mainstream discourses: disabled, old, fat, racialized bodies [42]. The classic body map risks perpetuating a universalizing and generalized view of the body.

Several of the resulting prototypes represented the body in a more inclusive and diverse manner. Several participants were interested in inclusivity in research, and they discussed that it was important to enable people to identify with the representations. Some prototypes explored not using an abstraction (i.e. a silhouette) of the body as canvas, but rather pursued hyper realistic forms. For example, P1 and P3 explored in Figure 7-a taking a photograph of the person who would fill in the map, using that photo as canvas. P3's took a picture of P1 using a digital tablet she had brought in for work, and P1 filled it in capturing her felt sensations at that moment: a brain fog because she had just eaten and was tired, and her child moving in her uterus. P1 mentioned that while she appreciated the canvas capturing exactly how she looked, it could also risk disengagement with the body map if the picture was deemed not flattering.

Another prototype also used hyper realistic forms in a different way: using the own body as canvas, to help populations that might struggle with articulating and mapping sensations and emotions in a drawn silhouette. P8, reflecting on her own work on somatic play with children, mentioned that it is often difficult for children to articulate their felt sensations. She considered that the classic body map might not be the best suited tool to help children reflect on and portray their somatic experience, as it requires translating elusive felt sensations to an abstract silhouette on a piece paper. In Figure 7-c, she proposed to work with the own body as canvas, and mapping directly felt sensations and emotions to the actual body area where they were felt, via e.g. post-its with words. Finally, she suggested to documenting the resulting "map" through photographs - to allow for later reflection.

Finally, some prototypes suggested expanding the classic blank silhouette to represent other bodies; or letting people draw their own silhouette. A joint discussion in W2 around issues of how

bodies get represented in research (and in particular in body maps) prompted us to envision using body maps depicting different ages, abilities and body shapes. In Figure 7-b, using professional drawing software, we have ad-hoc recreated some of the silhouettes that we discussed could better capture a plurality of bodies.

4.2.4 Granularity. Granularity refers to eliciting and capturing somatic experiences with nuance, richness and detail [48]. Our bodies, felt sensations and emotions are complex, multifaceted and multidimensional [41, 48], and can be experienced with varying degrees of intensity or awareness [41]. The classic body map provides an abstraction of the body that prompts a two-dimensional focus on the frontal plane of the body, but the nuances and richness of somatic experiences require different kinds of granularity to be portrayed.

Several of the resulting prototypes focused on representing somatic experiences with greater detail. In particular, prototypes focused on 1) mapping felt sensations to particular body areas with more precision; and 2) portraying felt sensations with greater accuracy: quantifying and qualifying sensations to capture their varying intensity, and occurrences when several sensations superimposed in the same body area.

Figure 8 illustrates examples of both. P2, drawing on her experience as trained physiotherapist, wanted to capture with accuracy different types of pain (a central somatic sensation in physiotherapy) and pin them to the exact muscles and body areas where they might be felt. In Fig.8-a, she built a prototype that allowed her to do so: she portrayed the varying intensity of the felt sensations by using needles and amount of clay: the deeper the needle and the bigger the amount of clay, the more intense the sensation. Further, she used the drawing mannequins as a three dimensional representations of the body, because she felt it allowed her to pinpoint more accurately where exactly in the body each type of pain was felt.

Similarly, in Fig.8-b, P1 prompted by her own pregnancy, wanted to build a prototype that allowed her to focus on, and capture, what she felt "beneath the skin". With the classic body map as model, she cut-off two body map silhouettes using the transparent sheets. Creating a sort of a "sandwich" between the transparent sheets, she

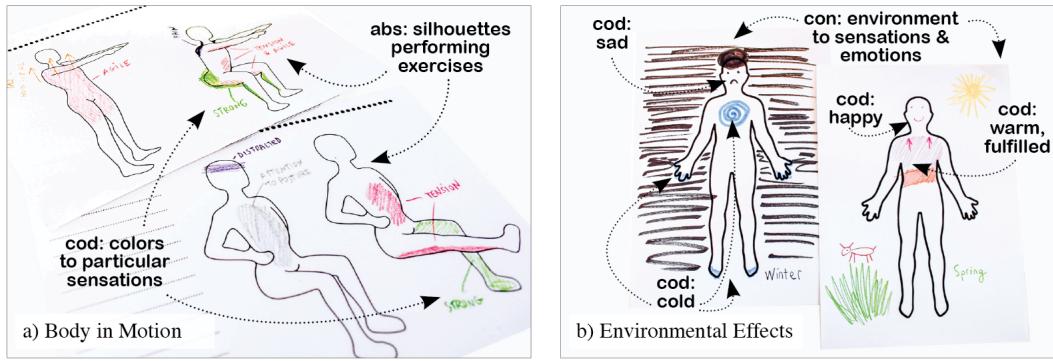


Figure 9: Theme: Context. Two prototypes placing the body in the context that prompts specific sensations and feelings : a) *Body in Motion*, representing the body engaged in particular movements; and b) *Environmental Effects*, situating the body in relation to the environment.

used clay to map sensations to particular organs, muscles and body areas that are not visible to the naked eye, such as her baby moving.

4.2.5 Context. Context refers to the particular situation in which somatic experiences unfold, in particular its material and cultural environment, practices and situated actions [9]. While there are potential overlaps with sociality as extended to non-human elements, we include context as a way to address the assemblage of norms, materials and environments beyond intersubjective relations that shape somatic experiences [13, 40]. The classic body map abstracts the body, prompting a portrayal of felt sensations and emotions as isolated from the context that shapes them.

Several of the resulting prototypes explored how to contextualize the somatic experience in particular environments and situated actions. Some prototypes focused on addressing the ways people adjust their movements to fit different contexts and practices [19]. For example, inspired by [28]’s work, P3 brought up in W1 the possibility of depicting the body map silhouette engaged in particular movements of a physiotherapy practice (P3’s domain of interest). Using professional drawing software, we recreated the silhouettes that we had discussed could better ground and contextualize the felt experience in the very movements that shape them.

Other designs focused on making causal links to context, connecting situational elements to the effects they had on felt sensations and emotions. Figure 9-b, originally created by P2 and recreated for this paper, illustrates it. At the time of the workshops, P2 was a visiting professor at Uppsala University during winter time. Coming from Spain, a country with less extreme winter weather conditions, P2’s emotions during her stay abroad were being strongly shaped by the weather and the activities it allowed. She wanted to capture and emphasize how these environmental factors shaped her somatic experience, and hence, P2’s scribbles on the body map focused equally on her somatic experience and on the contextual factors that shaped them. For example, whereas dark and cold days made her sad, introspective and wanting to stay indoors, she appreciated all the more the sunny days with good weather in which she could go out for walks in the park, which made her happy.

4.2.6 Focus. Focus center on the notion that complex and rich somatic experiences can be subdivided, so as to direct attention to specific body areas, sensations and emotions [19, 41]. Further, such focus can be grounded and sustained over a period of time, to allow people to attend to it and explore it in depth [19, 41]. The classic body map itself does not promote a focus on particular felt

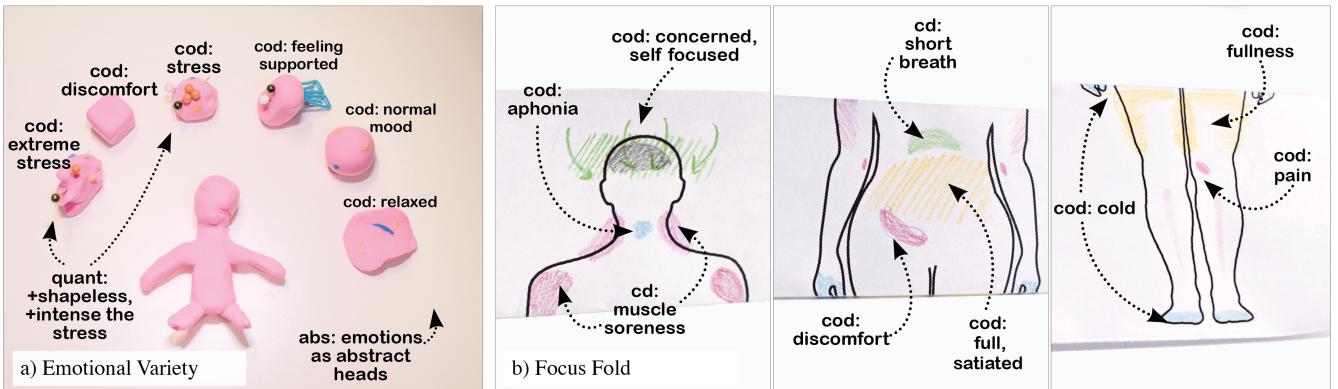


Figure 10: Theme: Focus. Two prototypes: a) *Emotional Variety* and b) *Focus Fold*.

sensations, emotions or body areas - it is rather up to the researcher, facilitator or person filling in the body map to direct the attentional focus.

Several of the resulting prototypes centered on directing or sustaining the attention to particular subdivision of the somatic experience. Some prototypes centered on eliciting a focus on the felt emotions, which mostly resulted in abstract representations, often mapped to the head. For example, P5, as a junior researcher in training, wanted to focus and capture the variety of emotions she would often experience during her studies. In Figure 10-a, she used clay to shape abstract heads that she felt enabled her to portray the variety and differences among her felt emotions.

Other prototypes centered on fostering a sustained focus to a particular body area. For example, P7 suggested to focus the attention to one body area at a time, to allow the person filling it to explore in depth sensations felt there, before focusing on other body areas. To illustrate her idea, P7 built the prototype in Figure 10-b, in which she folded a classic body map in three and proposed to present to the user only one of the folds at a time.

5 DISCUSSION

In this section, we discuss our work from theoretical and methodological perspectives, pointing at limitations and future work. We also discuss the contributions of our work in light of prior work.

5.1 Reflections on Our Themes

Our work yielded an annotated portfolio encompassing six themes: *temporality*, *sociality*, *representativeness*, *granularity*, *context* and *focus*. We have presented each of these themes, grounding them in empirical material and theoretical underpinnings. Our portfolio presents these themes individually, and we acknowledge that there is a risk of instrumentalizing the body when presenting aspects of somatic experiences as singled out and carved out from the complex phenomena to which they belong [18, 20]. There is also a risk of incorrectly suggesting that these aspects exist in isolation, or even opposition, to each other. All the aspects we have captured in our design themes are part of our somatic experience, and some of our prototypes can already be seen as addressing a variety of those themes. For example, the Social Body body map (in Fig. 6) illustrates not only the theme *sociality*, but it could also be considered to address *context*, as the creator captured a particular somatic experience elicited in the very concrete context of cuban salsa, an intimate and sensual somatic practice, with a stranger. Our themes can act as lenses to focus attention to particular aspects of somatic experiences that may be obfuscated, or not explicitly foregrounded, in the classic body map tool. We believe that these aspects are worth considering in the design and use of future body maps.

The prototypes that our participants created allowed us to interrogate implicit assumptions in the classic body map on what is a body, what bodies get represented, and what aspects affect our somatic experiences. Yet, in doing so, we inevitably arrived at other ways of assuming what a body is, which was shaped by the authors' theoretical perspectives. We can recognize such assumptions in our themes. For example, our thematization of temporality (particularly in the body map *Temporal Connections*, in Fig. 5-a) is indebted to a perspective on conscious bodily sensations as abstractions from

experience, inheriting from past events and anticipating a future [38]. Our thematization of *sociality* is indebted to an intercorporeal perspective on somaesthetics, and the notion that interacting bodies influence and affect each other [33, 34]. Finally, several of our thematizations and examples consider the body in relation to things, spaces, other people and materials. While this is indebted to entanglement and *more-than-human* theoretical perspectives in an emerging fourth wave HCI [13], our themes still strongly center the human in design and primarily consider the body as a human subject (cf [18]).

We argue that there is no escaping theoretical assumptions and perspectives when designing and using body maps (or any other research tool for that matter [23]), but we would do well to think carefully about how they figure into our research. Particular choices in the design of our research tools (and in this case, body maps) also have ethical ramifications, as they set the parameters for how participants can understand their own body experience and relate to a body representation. As body maps could both potentially reinforce or defamiliarize conceptions of the body, our agency as designers also point to a need for accountability [13] in how we design and use them.

5.2 Methodological Reflections and Limitations

Our work touched on the differences between the prototypes that illustrated ideas for future body maps and the classic body map design, and how the differences matter for what becomes represented. Thinking with alternatives [10], provided a vantage point from which to explore what gets included and what gets excluded in the classic body map to capture somatic experiences. As designers, we are complicit in the designed outcome - together with the other participants and materials that contribute to the design exploration [17, 49]. As in any ideation design method, our choice of what objects to bring to the craft-based ideation session shaped the possibilities for prototyping [46, 49]. We acknowledge that bringing different craft materials could have resulted in ideas for future body maps being prototyped in very different ways, which in its own could potentially have given raise to other analytical insights, discussions and considerations. Similarly, the participants in our workshop also shaped and delimited the outcomes of ideation with their personal experience and interests (within and outside their research) and theoretical perspectives. Our contributions were elicited by participants that were all women, academic, and from the global north. Considering other positionalities would surely enrich and expand our work, bring other perspectives and epistemologies on how we conceptualize and research the body.

Limitations. Our work presents some methodological limitations worth discussing. First, in the workshops, to make participants ideate alternative body maps, we encouraged them to use as inspiration their own personal experience in a very broad sense (e.g. current or past somatic experiences, particular design projects and challenges they experienced, etc). Giving participants such ample room upon which to construct new body maps can be seen as at odds with the traditional body maps' objective of capturing in-the-moment felt somatic experiences [4]. Yet, we favored such approach as a way to generate a multitude of design ideas to probe the current body map design and open up for future alternative body maps'

designs. Second, we are acutely aware of the exploratory, and provisional, nature of our work. As it is common in design ideation processes [35, 49, 50], our aim was generative - rather than evaluative. The prototypes, design themes and the ideas they carry provide a tentative idea of how future body maps could be designed to address different bodies and aspects of the somatic experience. However, we cannot and do not claim that these prototypes are ready available to be implemented and deployed in real projects.

5.3 Future Work

We believe that our work opens up for different lines of research worth exploring in the future. First, future work is needed to explore the *replicability and usefulness* of the prototypes and themes in particular contexts. In terms of replicability, we consider that a substantial factor in replicating our prototypes will reside in the building capacity of the researchers. In our work, we used widely available off-the-shelf crafting material and design techniques, both of which are presented in this paper to offer a repertoire on which others can draw in the preparation of a particular body map. Some prototypes are quite straightforward to replicate and implement in other contexts, given that researchers obtain the crafting material (e.g. Fig. 8-a, or Fig. 6, if a drawing mannequin and clay are obtained). Other prototypes may require of more substantial preparation, such as Fig. 4 or Fig. 8-b, both of which use transparent sheets stacked in different ways, and hence need to be crafted prior to deployment. We encourage researchers interested in replicating particular prototypes to reach out to us for further information on how particular prototypes can be crafted. In terms of usefulness, in the next Section 5.4 we connect our themes and prototypes to previous research on body maps, which speaks of the relevance of our themes to current research - and hence the potential usefulness of the prototypes resulting from our work for others. Further, how successful body maps are in eliciting and capturing somatic experiences will depend largely on how they are used in the design process [1] - as designing is never solely the design of a “thing”, but also the design of its use [39] to make it relevant particular contexts. Future work is needed to evaluate how well future body maps inspired by our contributions can capture the somatic experience of other people.

Finally, we believe that our work opens up for future research on body maps themselves. One such direction could be to challenge or expand on the proposed themes through explorations done with other participants with different backgrounds than ours - who might very well arrive at different conceptualizations and themes. Hence, it is important to take our work here as offering a first step, and not as an exhaustive exploration of all the possibilities of what future body maps could become. Another interesting direction could be to create a typology that maps the design space of body maps - e.g. considering 3D body maps (such as those using dolls, assemblages, sculptures), or 2D variations of the classic body map (e.g. photo-realistic maps, personal silhouettes). While this was outside the scope of our work, we believe that it could lead to useful new body maps paradigms to use in body-centric research.

5.4 Situating Our Contributions

The contributions of our work are twofold. First, we contribute the design themes and the resulting prototypes from our workshops,

that help illustrate the themes. Some of our themes contribute concretely to prior work. Our theme *temporality* aligns with, and extends, prior work that addresses temporal aspects of somatic experiences (e.g. [28, 44, 45]). Prior work using body maps that also touches on temporal has been limited to having participants filling the classic silhouette at different points of the experience and comparing them afterwards (i.e. [28, 44]). Our work extends this with different notions of temporality beyond capturing in-the-moment felt experiences, and with ideas for alternative future body maps that can capture them.

Beyond body maps, the theme *temporality* also enriches prior approaches to document temporality, i.e. soma trajectories [45], also with ideas that address different temporalities. One of the resulting prototypes (i.e. Fig. 4) shows how the concept of soma trajectories can be used together with body maps to capture the sequential unfolding of the somatic experience, explicitly connecting temporal considerations to the somatic experience as represented in the body - which soma trajectories lack. Yet, our theme also considers temporality in broader terms than prior work does [45], i.e.: by capturing how somatic experiences inherit from the past and relate to the future events (Fig. 5-a); and by focusing on capturing an overview of the sensations and emotions felt over long periods of time (Fig. 5-b).

Our theme *context* aligns with prior work [28] that presented silhouettes that depict particular movements, and it extends it by providing a theoretical backdrop that helps argue why such depictions can be interesting to use. It also aligns with the aims of Gastaldo et al.’s work [14], in that both their work and ours aim to contextualize body maps within the situations and narratives that give raise to particular experiences.

Our theme *representativeness* contributes to prior work calling for better documentation methods of somatic experiences [48] that consider a plurality of bodies [18, 42]. It does so by providing examples of how future body maps could be designed to represent other bodies beyond the adult, male, white, able body that often is taken as default in HCI design [18, 42]. Our themes *sociality* and *context* contribute to prior work that suggest approaching the body in design research not as an isolated abstraction, but as entangled in an assemblage of norms, environments, materials other bodies that also shape somatic experiences [13, 18, 40].

Our second contribution are the concrete design techniques through which we have built our prototypes, that others can build upon as inspiration to craft their own body maps. To the best of our knowledge, this is a novel contribution, as prior works have provided pointers on how to *use* body maps [4], yet not on how to craft novel ones.

Our work adds to, and extends, the state of the art of body maps in HCI, and can serve as inspiration for the interaction design community interested in body maps as research tool (e.g. [1, 6, 14, 19, 25, 26, 28–31, 36, 36, 44, 47, 51]). Our contributions can help examine underlying assumptions of the classic body map and provide inspiration on how to design future alternative body maps.

More broadly, our work contributes to prior research calling for better methods to document the richness and nuance of somatic experiences, which is of particular importance in the soma design community [19, 20, 45, 48]; and to critically examine the how we

approach and conceptualize the body in body-centric design in HCI [18, 42].

6 CONCLUSION

In this paper, we have presented an annotated portfolio that captures the results of an ideation design inquiry focused on exploring how body maps could be advanced - so as to better address a plurality of bodies and aspects that shape somatic experiences. It is important to highlight that our work does not strive to supplant the classic body map design. Rather, our themes and illustrative prototypes aim at providing inspiration for others, to critically examine and challenge the tools for knowledge production that we use, and the implicit assumptions that they carry. Thus, we believe that our work can be relevant for researchers wanting to adapt body maps to suit their particular research projects, but also to those researchers working with the classic body map - to be sensitive to the tool's implicit assumptions and limitations. We hope that our contributions will provide a useful and inspiring starting point to advance body maps as a research tool in interaction design.

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