



Making New Worlds – Transformative Becomings with Soma Design

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ABSTRACT

Soma design is intended to increase our ability to appreciate through all our senses and lead to more meaningful interactions with the world. We contribute a longer-term study of soma design that shows evidence of this promise. Using storytelling approaches we draw on qualitative data from a three-month study of the soma mat and breathing light in four households. We tell stories of people's becomings in the world as they learn of new possibilities for their somas; and as their somas transform. We show how people drew on their somaesthetic experiences with the prototypes to find their way through troubled times; and how through continued engagement some felt compelled to make transformations in how they live their lives. We discuss the implications for the overarching soma design program, focusing on what is required to design for ways of leading a better life.

CCS CONCEPTS

• **Computer systems organization** → **Embedded systems**; *Redundancy*; Robotics; • **Networks** → Network reliability.

KEYWORDS

soma design, entanglement theories, somaesthetic experiences, breathing light, soma mat, longer term study, new materialism

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1 INTRODUCTION

Soma design as an approach to the design of interactive technologies is beginning to establish itself within interaction design practice. The field has seen the development of theoretical perspectives [32], design methodologies [36] and a range of interactive artefacts [30, 46, 50, 64] all of which contribute to the development of a design program¹ rooted in the importance of attending to human's full soma (body, mind, emotions) throughout a design process. One of the most remarkable promises made by soma design is that by following a soma design process an interactive artifact can be created which can increase our ability to appreciate through all our senses and lead to more pleasurable and meaningful interactions with the world around us [32]. Such a promise is intriguing – the notion that through interaction design we can shape the movements of those who use our designs, and through so doing potentially further shape not only their interactions with the world around them, but their being in the world.

As reported by [36], the Soma Mat and Breathing Light (see Figure 1) were designed according to soma design practice. Taken together these two pieces of furniture are intended – very broadly – to give an experience of 'relaxation' and increased body awareness to those who use it. More specifically, according to the authors they have been designed to create a space for winding down, turning one's attention inwards and becoming more aware of the soma, through the careful use and orchestration of travelling heat and softly pulsating ambient light. These prototypes were first presented in [36, 64] and described a one-off encounter that showed how the quality of experiencing a 'soma design product' were markedly different to most people's experiences of other digital, interactive systems. A lingering question remained as to whether the Soma Mat and Breathing Light could deliver on the long-term promise of somaesthetics [62] and soma design theory [32]. Could continued somaesthetic engagement with the Soma Mat and Breathing Light lead to meaningful experiences for those who used it? And more radically, did these continued somaesthetic engagements with the Soma Mat and Breathing Light transform people's somas, their

¹Design program here defined as a coherent set of axioms and prototypical design exemplars as discussed by Redström [59]

movements, and their 'being' in the world over the longer term? Could the Soma Mat and Breathing Light help people to lead better lives? It is to these questions that we attempt to respond, at least in part, in this paper.

In what follows we report on our findings and analysis from a longer-term deployment of Stahl and colleagues' Soma Mat and Breathing Light [64], where the prototype were deployed in four households for three months. We believe this to be one of first longer-term studies of soma design deployed in situ which allows us to offer new insights into the kinds of somaesthetic experiences people have with soma designs when used over the longer term, and the effect these aesthetic experiences have on people's lives. Using data collected throughout these deployments, including interviews and observational data, we tell stories from four households, altogether six people, that attempt to evocatively illustrate the ways in which people engaged with these prototypes, and the impact this engagement had on their somas, and their lives. We turn to new materialism [6] and entanglement theories [37] in our analysis, and in particular Ingold's metaphors of knots, lines and meshwork, to help us explain how it may be that somaesthetic experiences with the Soma Mat and Breathing Light enabled the prototypes to impact people's lives beyond the ephemeral effects in the moment of use.

In sum our contribution is threefold: (1) We report on the first longer-term study of soma design prototypes deployed in people's homes. (2) The outcome of this study gives evidence for the transformative potential of soma design; and (3) through (1) and (2) we argue for a perspective on long-term and somaesthetic engagement as *world-making*. We conclude by discussing how soma design can be seen as world-making, the ethics of transformative mattering, and reflect on storytelling as a method for reporting on soma design studies.

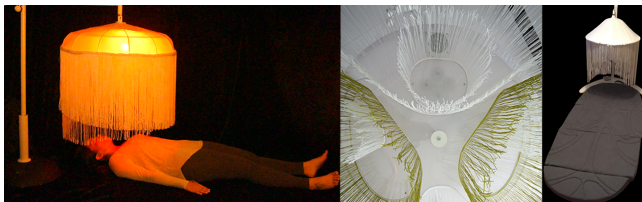


Figure 1: The Soma Mat and Breathing Light. The light dims in and out mirroring the breathing movements of your chest. The mat heats up underneath different body parts to heighten your awareness followed by a guiding audio instruction. In the middle, the breathing light seen from underneath.

2 SOMA DESIGN AS A TRANSFORMATIONAL DESIGN PRACTICE

Soma design [32] is one approach to designing with new digital materials that shape interactions engaging with users' movements, sensoric engagements, and ways of being in the world. Building on the sensory-kinetic epistemology of Maxine Sheets-Johnstone [61] and the pragmatic philosophy of somaesthetics [62], soma theory points to the importance of attending to the aesthetics of

our experiences through our movements and our ways of being and thinking. Sheets-Johnstone [61] argues that movement and thinking are united, and that we must create meaning through the movements we make with the world and as the world dynamically changes. Soma design encompasses, in this way, the body as a whole including the fleshy body, mind, emotions, subjective understandings and values – the so-called 'soma'.

The soma design approach suggests some design tactics: to engage with body practices to improve your somaesthetic appreciation, to engage with the socio-digital material and to engage in first person [32]. The somaesthetic appreciation practices we can engage in are many and varied, for example, contact improvisation dance, Feldenkrais, Tai Chi, Qigong, yoga, meditation, and Alexander-technique. With the starting point to extend body awareness through body practices, it becomes evident that you, as a designer, have to engage with your own body. The materials being shaped in a soma design process are not only the digital and physical materials used to build an interactive artifact, but also your own and your end users' somas, as their interactions with the system will affect their experiences of sensual appreciation and movement in the world. In this relation between world and soma, our soma is also mouldable – we can extend on our experiences and create for alternative and better ways of being in the world by engaging with movements with our senses [62].

It is here that the transformational potential in soma design lies, where designed experiences with interactive dynamics can create for alternative and richer ways of being in the world. Therefore a soma design process builds on the aesthetic potential of the sociodigital materials [32]. This includes the human side of the interaction through our somas and the shape various combinations of computational and physical materials can have. To design for new experiences together with technology it is not enough to study others engaging with their somas or just read others' accounts of it [34, 61]. Instead in soma design, designers have to be engaged in their own somas, they need to feel, touch, interact with and experience the affordances of the 'materials' used to compose the dynamic gestalt of the interaction [65, 69, 73] through a first-person perspective.

Soma design has lately caught the interest of researchers in the HCI community. It ranges from reports of workshops bringing different design approaches together [71], discussing strategies for bridging the body-mind divide [33], creating soma trajectories to map out the experienced temporality [70], somatic explorations in artefacts related to guitar playing [50], tactics to design expressive musical interfaces for improvisers [9] to functioning prototypes for posture awareness [3, 52], drones interaction [24, 46], for reflecting on singing through topographical change to the torso [17] and pelvic floor awareness [65]. Across these studies, we see how soma designers themselves transform through the process of learning new forms of moving and engaging with the world and the design materials. And a growing number of soma designs [30, 46, 50, 64] have started to engage with potential users outside the design team, providing one-time or shorter term encounters that provide the seed of evidence for the transformative potential of soma design. For example, in a once-off encounter the Drone Chi [46] sets its user in a meditative state when they are moving together in Tai Chi inspired patterns. One of few studies that goes beyond the

one-time usage are Eriksson et al.'s [23, 24] studies of bringing five drones onto an opera stage to perform alongside a human performer, where they report deepened sensory appreciation skills after learning to dance with the drones. This backdrop of theory, methods, and artifacts suggest that soma design has now reached a level of maturity, which makes it possible to examine evidence for its claims. It is here the longer-term qualitative study described in this paper can contribute, by evidencing that soma design can lead to somatic transformational experiences, and postulating how experiences with soma prototypes can over time transform how a person chooses to become in the world they are live in.

3 ENTANGLEMENT AS A DEPARTURE POINT

The desire to understand the transformational potential and effect of soma design, brings with it challenges in how we construct knowledge on people, objects, and the relations between them. How can the transformational effect of engaging with a soma design, aiming to mold something as dynamic and complex as our soma's being in the world, be described without running the risk of becoming a mere representation of a detached, simplified and discrete event? One way of trying to understand this increased complexity is to turn to entanglement theories that have started to make their way into HCI [27].

While relational perspectives have a longer and foundational history in HCI [44, 67, 68] a renewed interest in entanglement theories reflects a turn towards the ontological in the sociology of new materialism. Fittingly for design, this ontological turn brings attention to the ways and means through which we create meaning or mattering in our worlds [5], and in the dual meaning of 'mattering' how objects, including interactive objects, come to be part of our world [8, 14, 29]. In new materialism, matter is a 'doing' not a thing that exists and, as such, 'mattering' is inherently dynamic. This dynamic infers an agency on matter, and therefore objects, in the constitution of our lived worlds. Recent work within HCI and digital sociology has shown how such mattering happens within the digital sphere. For example, Lupton [48] uses Barad's diffractive analysis [6] to show how personal data comes to matter in people's lives and relationships. Gardner and Jenkins [28] study experiences of data from biometric devices and describe how people entangle and fill in intervals in the data captured by drawing on affective experiences, including memories and powerful embodied 'intra-actions' with the machines. Homewood et al. [31] examine how removal of technologies as a method can produce knowledge about particular entanglements. Sanches et al. [60] illustrate how diffractively engaging with biodata as it is lived can help surface how data production both affects and depends on the world that is entangled with, and therefore foster more careful and rigorous engagements with data.

Here, we have explicitly turned to the posthumanistic theory of new materialism by Barad [6] and the concepts and metaphors social anthropologist Ingold [37] uses to create an entangled worldview. With agential realism, Barad [6] discusses agency in the terms of how materials, bodies, objects, artefacts, and matter all have agency and thereby play an active role in construction of culture, meaning, and knowledge. This is in opposition to social constructivist views of the world, where matter (artefacts, objects, things) are

only made to matter through discourse and culture. Social constructivists argue that matter only matters when culture and language are applied to them. Barad's account captures how one process influences another in what she refers to as 'agential intra-action'. In intra-action the components are ontologically inseparable [6] – that is, the boundaries between them are not pre-existing conditions but constructed through our observations of them. In Barad's [5] performative view there are no defined borders between which there can be inter-actions. Barad's ontological continuity is thus at odds with notions familiar in our field of discrete 'human', 'computer', and 'interaction'. Instead the boundary of something only becomes known through its intra-actions with other things, constraining but not determining. She concludes 'Boundaries do not sit still' [6, p.171].

From this perspective we can see soma designs as being 'performative intra-actions'. Experiences are designed with a bounded openness for other somas to become with their own meaning, producing new knowledge and in turn making new worlds for the somas experiencing it [65]. This complex and dynamic intra-action resists encoding and requires that we act to delineate objects in intra-action. Barad refers to the act of observation and separation of the intra-action as an 'agential cut', which operates through apparatus and technologies of observation. We argue that an agential cut could be used to transcribe the transformational potential of soma design. This cut is itself a specific intra-action which results in a division of subject and object as a local resolution among components within the holistic phenomenon. That is, the agential cut allows us to see what each part of an intra-action is 'doing' to define the relations among them. Seeing the world and its matter as a doing (not a thing), the matter becomes a dynamic stabilizing and destabilizing process of iterative intra-activity, in which matter is becoming an active agent [6].

The proposition and implications of Barad's agential realism and intra-action for HCI are substantial, yet challenging. For us, and in this paper, in making sense of this position, we find the resonant metaphors of Ingold helpful. They both avoid a representationalist worldview, while provide a vocabulary – a mattering – for thinking with. The entangled ontology discussed in the metaphors of lines, knots and meshwork [37, 40] describes the world as lines that have an ongoing direction of travel. These lines entangle and create knots with one another and become a mesh. Entanglement of things is, as with Barad's perspective, a dynamic – a mesh of interwoven lines of growth and movement [38]. It is not the knots as such that make them interesting, it is the lack of exteriority and interiority – it is their interstices. Just as Barad rejects boundaries as pre-defined, Ingold suggests that it is not the line that is of interest in the knots, it is the surfaces that lie in between. Ingold compares his meshwork, where the lines join with each other, with voices of choral music that find harmony in altering their tension and resolution. The lines of the meshwork have an 'inner feeling' for each other, which Ingold refers to as sympathy – a feeling of *togetherness together*. Ingold refers to this inner feeling or sympathy as *correspondence* as opposed to interaction. The difference lies in the characteristics, interaction goes back and forth as agents, while correspondence does not take sides but joins longitudinally in-between [40]. If we would see all matter in these metaphors – a soma design that we enter into people's lives could become something that people

would live with, create an inner feeling for, a sympathy, rather than looking at – then we might capture more of the entanglements that are happening. According to Ingold [37], Barad’s account on intra-activity aims for a similar perspective of the world. In the report of our study our attempt is to describe our participants’ complex transformational becomings with these prototypes. Here we make use of Barad’s agential cut, and within this cut we zoom in on certain entanglements using the metaphors from Ingold. Although we describe this as a cut, we still acknowledge that in their absence these prototypes might still today be becoming in the lives of our participants.

4 THE SOMA MAT AND BREATHING LIGHT

Let us start by describing the two furniture pieces used in the study in more detail and the experience sought in designing them.

4.1 How they work – the Soma Mat and Breathing Light

The Soma Mat (see Figure 1) has integrated heat pads and uses these to subtly guide your attention to different body parts together with synchronized audio instructions: for example, “How does your body contact the floor right now—your shoulders, your right shoulder? Left shoulder? Is there any difference between them?” the mat slowly heats up underneath your right shoulder and leaves slowly and then continues to your left shoulder [43]. The design of the prototypes is grounded in body scanning and Feldenkrais lessons [25, 36] which aim at making us more aware of our bodies and all the alternative ways we can move and act. This is achieved through engaging participants in very slow movements, while simultaneously directing attention to the different parts of their bodies and how they interact. The Breathing Light prototype consists of an enclosure made of fabric and string curtains (see Figure 1) that you lie under, creating a room within a room. Inside this enclosure there is a sensor that measures the breathing movements of your chest. The sensor controls the lamp, creating an ambient light that will dim in and out mirroring your breathing. The lamp shuts out the outer world and creates a space for inwards turning and winding down. In their analysis of a one-off study with the prototypes [36] the authors articulate experiential qualities that define and enable the experience: *subtlety; making space; and intimate correspondence*. They frame these key defining features as characterising ‘somaesthetic appreciation design’. When you lie down on the Soma Mat with the Breathing Light module above you, you feel enclosed and taken care of. The Soma Mat and the Breathing Light are designed to be used in combination and this is how they have been used in this study.

4.2 Designing the Soma Mat and Breathing Light

How can we design something for people to engage with, that allows them to bring in their lives, including their somas with its changing and developing backgrounds, contexts, situations and relations? And that at the same time aims to be transforming, moulding the soma and creating alternative ways of being the world. In the words of Barad, design to become world-making [6]. Stähl and colleagues [64] describe this compound experience in their design

as wanting to evoke somatic awareness as a route into the mouldable soma. The soma prototypes are a designed experience, where you are both active and passive, where you act and undergo. You lie there seemingly passive, but you breathe, you listen, you sense, you direct your attention etc. In this moment, acting and undergoing do not have to be separate. Dewey refers to this combination as habit [21], while Ingold, with his own take, refers to it as volition [40]. To enact an experience is to *do* undergoing. The acting is inside the undergoing and it brings about transformation from within (*ibid*). The soma prototypes can be experienced over and over again, and the person using them will not be quite the same entering again.

From this we understand that we need to design not just what the user is doing – the act – but the whole enactment. So rather than trying to explicitly solve a problem for the potential users by letting them ‘act on’, the designers put the focus on designing an open space for them to ‘become in’. This is an open but yet bounded compound enacted experience – a *bounded openness* of sort. This is in line of the Japanese Philosophy of *Ma* (間), which is about attuning to the in-betweens [55]. *Ma* has been widely used within Japanese artistic culture [41, 42] and is starting to enter the area of design [1, 2, 45]. *Ma* is indeed an ambiguous concept, operating experientially at the interstices of being [55]. But the potency of attuning to and being sensitive to *Ma* lies exactly in turning our focus around and appreciating the potential and value that lies in not separating (*ibid*). Akama concludes that the between-ness might be the ground for being and ‘becoming with’ [2]. Others have also paid attention to the importance of interstices in experience – Manning refers to intervals [49], Derrida’s notion of *espacement*, which is a becoming space [19]. In design practice we are used to thinking about the actual interaction, the subject and the object and the aim of the interaction. Even though we may have the view of exploring a design space, we seldom shift our perspective. And it might be in this shift, in being sensitive to the in-between by not separating, that part of the space for becoming lies. But designing this space for becoming is not totally open, it has a direction. This is closely connected to the experiential quality of evocative balance [66]. It draws on the dual meaning of the word ‘to evoke’, evocative balance is experienced when the design evokes the past and evokes the new in a dynamic interplay. At the same time this is balanced with suggestive openness. In the case of the soma prototypes, we see this in how the prototypes evoke body awareness experiences through its design, which can open up for a new dynamic interplay of becoming for the users. But this openness is balanced by carefully guiding the users’ soma attention through heat, light and audio. It is with this understanding in mind, that the soma prototypes were designed with the aim of transforming, moulding the soma to become world-making. In sum, this is not just any technology, it is designed to create a space to evokes body awareness balanced with an openness.

5 METHODOLOGY

We draw from the holistic posthumanistic performative perspective of the world [6] described in the background, as opposed to analysing interview data from our users into themes that cut across their experiences. This in an attempt to keep a holistic and dynamic approach to our participants’ experiences of becoming. We do so

by telling stories of each person’s experiences of the soma prototypes based on our analysis of the interview and observational data. These stories are in fact our agential cuts [6] showing how the participants transform with the prototypes. We then turn to Ingold’s metaphors using lines, knots, meshworks and in-betweens [37] as an analytical lens to zoom in and make sense of some specific events in the stories.

5.1 Study Design

The prototypes were lent to the participants for three months. The length of the study was appropriate for the participants to get used to the prototypes and for them to be domesticated and adopted into their everyday practices. We regularly met up with the participants in their homes. The first time to solicit informed consent to participate in the study. They were informed that could end the study at any time without stating a reason, but we could report on that they ended. The participants were introduced to the soma prototypes and were asked to choose themselves where to place the prototypes in their homes. They also received usage instructions along with a user manual. For the study we had prepared one audio recording to accompany use of the soma prototypes lasting 11 minutes. Participants were told to aim for using the prototypes 3-5 times a week. In the subsequent meetings, we conducted three semi-structured interviews with each participant across the study. We allowed each participant to make room for the connections that were specific to how they lived their lives, where they could reflect and delve in their particular experiences in detail, rather than trying to tease out differences between different participants. The interviews lasted about an hour each, and were conducted at one-month intervals. All interviews were transcribed verbatim to include additional utterances like *hmm* and *ugh*. Below, we will use pseudonyms rather than the participants’ real names to preserve their anonymity. The participants were recruited through a call on a range of mailing lists, our research institutes’ web pages and postings on social media. In the end we chose households to participate in the study at random through a lottery.

The households participating were:

The Larsson Family: The family consists of a mother, a father and a daughter. The mother is 43 years old and works as a freelance in video photography and as a personal assistant for children in school. She walks the dog and practices Qigong on a daily basis. She also takes Kum Nye yoga lessons from a live online instructor once a week. She meditates on a regular basis and has tried out mindfulness apps for children in connection to her work in school. The father is 50 years old and works as a photographer and as a service engineer. He does some kind of physical activity three times a week. The daughter is aged 13 and is a student. She has gym class in school twice a week. Her interests are within music, playing the drums, saxophone and the piano.

Maggie: This household consists of a single woman who is 37 years old, she rents a one room flat. During the time of the study she lived in the center of a big city and then moved to a close suburb. She works as a service designer at a company developing apps. She works out in classes at a gym 2-3 times a week and one of these is a yoga class. She practices something called Three Principles: universal mind, universal consciousness and universal thought [15].

Christina: The woman in this household is 53 years old and lives in the center of a big city in an apartment together with her husband. She works as a general practitioner in primary care. The couple has two children who don’t live at home any longer. She does orienteering or running in the forest 3-4 times a week. There she uses a GPS-watch to keep track of her running course. The husband was originally part in the study, but dropped out after the first interview and is therefore not included in the short stories.

Sarah: The woman in this household is 30 years old and lives alone in an apartment in the center of a big city, she has a boyfriend. She works as a project leader at a heating plant. For physical activity, she dances, and attends two different weight training classes to strengthen her body core every week.

5.2 Data Analysis through Storytelling

In the following sections we will make an argument as to why we consider storytelling an appropriate interpretative method to utilise in this paper; second we will describe the approach used to immerse ourselves in the data and create the stories shared here, which we consider to represent a rigorous and authentic way of treating the data; third we present the stories which illustrate the participants’ experiences with the Soma Mat and Breathing Light; and lastly we present reflections on the stories through the lens of Ingold’s metaphors as a vocabulary that helps us to make sense of what we see happening in the data – in short, a somaesthetic experience with the Soma Mat and Breathing Light that can be transforming to ones being.

5.2.1 Storytelling as a Rigorous Method for Understanding Transformative Becomings. The transformational, long-term implications of soma design that we identify in earlier sections of this paper raise challenges to the methodological toolbox of HCI. We want to be able to illustrate the entanglements between the soma designs and the soma that is becoming, but several of our ‘go-to’ approaches to data analysis failed to achieve this. Thematic analysis [12, 13] is one technique that has penetrated the field for working with qualitative data. It is a powerful, useful and flexible method that is excellent at identifying patterns across people, culture or society. However thematic analysis did not *work* for this data. We could not find a way to use it which would maintain the wholeness of the individual experience with the artefacts. We searched instead for an alternative technique, one that would keep the chronological, holistic experience together so that we can show and theorise around the knots between the soma and the designs, the in betweens, and the matterings and becomings that are so key to how we theorise and understand our current relations with interactive technology. Such an approach would complement our belief that experiences with a soma design will be a unique intra-action between a person, their soma, and the soma design [6, 65]. As described earlier, when doing soma design we purposefully design for an *bounded openness* which means we do not expect all people to have the same experiences, or even necessarily similar experiences. We want to instead privilege individual experiences to be able to examine how the soma mat and breathing light entangle with the soma over time and the influence that these entanglements have on the soma. To this end, we have been inspired by narrative-led approaches, and in particular storytelling, which allows us to deeply immerse ourselves in our data

while creating a compelling presentation of one single individual's experience [16, 22, 53]. As Connelly and Clandinin [16] suggest: 'People shape their daily lives by stories of who they and others are and as they interpret their past in terms of these stories. Story, in the current idiom, is a portal through which a person enters the world and by which their experience of the world is interpreted and made personally meaningful.' We describe the process by which these stories were created in the following section.

5.2.2 Immersing in Data and Writing the Stories. Initially one researcher immersed themselves in the whole dataset, while the remaining four researchers deeply engaged with the dataset belonging to a particular family or individual. For each researcher, this involved reading the interview transcripts alongside listening to the audio recordings of the interviews in order to hear something of the additional context of the conversation. Each researcher loosely coded the transcripts they had worked with, and brought these to a coding and analysis meeting. In this meeting the researchers discussed their coding, and the dominant themes that each saw in the data. The focus of the meeting was on discussing and finding patterns and themes that captured experiences across each family's interactions with the Soma Mat and Breathing Light. This initial stage gave us an understanding of common themes of experiences over the different participants, but as we discussed the data in relation to the themes we realised we had lost the holistic view, the effect, connections and entanglements that the technology created in an individual user's life. Thus, we decided to make yet another analysis of the data, this time based on the narrative approach of story telling [53]. The intent was participant by participant to holistically capture the dynamic and temporal entanglements that were growing and affecting each participant's life. The stories included below were crafted through several phases. In the first stage, the first author returned to the data and re-immersed herself in the full transcripts, revisiting also photographs and observational notes made throughout the data collection activities. The interview transcripts themselves do not tell a neat story by themselves, they are a 'messy chronicle' [53] of each participant or family's experience. We have added an excerpt from the transcriptions of the interview with one of our participants, Christina, to exemplify what the data that the stories were crafted from looked like (translated from Swedish):

Interviewer: Do you think you have become more aware of your body and breathing?

Participant: Yeah, I think so. Right then, it was actually then, the day before Vasaloppet, since it was so stressful with this operation. I talked to my mother maybe 10 times that evening and it was only at 10 o'clock in the evening that we knew everything had gone well.

Interviewer: Oh, what an awful evening!

Participant: It wasn't so...I kept saying, I cannot do much. But anyway I had a hard time falling a sleep then. That was when we were at my friend's sister's place, you are not used to falling a sleep there. It was partly due to all these calls and that it was finally OK. And then I knew I was skiing tomorrow and had to get up. And then I actually used that relaxation and

the breathing to fall a sleep. I felt that I was very agitated...you get very upset and so on. Then when we all went to bed at the same time at half past ten, then I felt that I really had problems to wind down. But then I breathed and I could easily perceive...because I felt that I was that tense in my muscles that you can sense when you have...when you become...I sensed that my body was tense. Then when I breathed like that, I sensed that I got more relaxed. So then it was useful for me to be able to wind down and focus on the skiing I was supposed to do next morning.

To craft the story based on excerpts as the one above, the first author started to flesh out a character central to the story based on the data from the interview transcripts and observational notes – this included the character's emotions, values, perspectives; alongside how the character sees the events that have happened to them, the sequence of these events and how they connect. The first author then sequenced events from the transcript into a coherent plot, to reveal the major turning points in the story and the significant events around which the story should hang. Drafts of each story were produced. This was a creative writing process where attention was paid by the first author to the voice in the story, the character descriptions, their roles in various events throughout the story, alongside how events from the interview data should be best described. In order to achieve this well, the first author asked herself what role would the character (interviewee) play in this scene, how would the character act and how would this relate to the character's values, emotions and perspectives. The first author used her observational notes to visualise the events happening in-place to be able to richly describe those events referred to in the transcript, and which were part of the overall plot. Drafts of the stories were then shared with the second author for input. This discussion focused on whether the characters captured adequately the values, emotions and perspectives of what was understood through the interview transcripts; whether the events resonated with those depicted in the interview transcripts; and whether the stories seemed authentic to the interview data as a whole. Feedback was integrated into revisions of the stories. We want to emphasise that these stories do contain fictional elements to help bring characters and situations to life. However, there is a clear distinction between the types of information that is based on the interview data and that which is fiction. All details and nuances connected to the entanglement of the participants' somas, in their becoming with the prototypes, originated from quotes in the interview transcripts, as in the interview excerpt above, which can be seen in Christina's story below (6.3). Often participants came back to the same event and developed their reflections gradually. The fictional elements that make the story become alive is built from our knowledge of how different environments generally look and how things happen in Sweden, and also details of our recollections of the atmosphere in our participants' homes and lives. For example, we can imagine what it is like to stop at a gas station in Sweden, and the imagined weather is based on our knowledge of when the designs were deployed with families and passing comments made in interviews. Even so, as a whole they are not a fiction. They are grounded in the realities of what participants told and showed us throughout our interviews with

them. The stories are presented with accompanying illustrations, these were added to make the stories become alive. They are loosely based on photographs from the study, memories of the environment and atmosphere at the time for the study and our general knowledge of how certain environments in Sweden typically look.

6 LIVING WITH THE PROTOTYPES – TRANSFORMATIVE BECOMINGS

Here, we will present the four short stories with accompanying imagery, where the first one that represents a family, consists of four shorter separate sections. The stories are individually focused, because that was predominantly how the participants talked about their experiences with the prototypes.

6.1 The Larsson Family



The darkness surrounding the red wooden cottage house was dense, this far out in the countryside there are no streetlights to guide the way. It was a quiet and peaceful place by the end of the road surrounded by fields and a bit of forest. In November it could be a bit isolated, when the days became shorter. But they had made an active choice to move out from the city to a place where they could grow their own vegetables, and have a dog and some chickens, and to somewhere there were outhouses to serve their interests in carpentry, Qigong, yoga and there was even space for a photo studio. Others might see their home as bohemian with non-matching furniture, pieces of clothes draped over sofas and things lying around here and there, but they liked it this way, it was cosy. It was a 10-minute bike ride to the bus that took the children to school, they hardly complained, they were used to it, it was their reality. On days when their father went by car to work, he could give them a ride.

6.1.1 Caroline, the Mother. Her arms slowly painted a circle in the air, her hands were positioned straight above her head. With the palms touching each other she slowly pushed down the energy to a point in her lower belly, her qi. She slowly breathed in and out and stayed extra long in examining a knee movement, they were curious today. In her Qigong and meditation, she was in control and could deeply examine and put her focus on places within her body that needed attention. She felt grounded and ready to start working.

With a cup of homemade mint tea in her hand, she crossed the wild garden. She still had the experience of the qi gong in her body and mind. She started thinking of the Soma Mat and the light how she liked the warmth and the lamp with its billowing strings, it was soothing. But the ‘instructor’, she thought, he annoys me, he sets the pace, he decides where to focus, and for how long. He is jumping from how far down you should breathe to feeling the temperature of a part of body. She got all irritated by just thinking of him, in my Qigong, she thought, I get to decide when and where and explore in my own way. She opened the door to the old red outhouse with its squeaking hinges and entered her photo studio. She connected the hard drive to the computer and continued editing the photos from the last photo shoot. Not bad, she thought to herself. The day went by, Caroline was absorbed by the editing. The delivery to the customer was the next day, and she would have time to make the last changes tomorrow. Suddenly, she heard the dog barking that usually meant that Tilly was back from school. It was Caroline’s turn to cook dinner, she finished up and saved the edited files to the hard drive – at least that was what she thought she did.

– No, no, no! she screamed in panic.

Cold sweat was pouring down her back. It can’t be true, they can’t be gone! But the hard drive was empty. Everything was gone, even the original photos. I am so stupid, she thought filled with panic. The mat and the light, she thought, the nice warmth that is what I need. She lay down and this time it was different, she simply put herself in the hands of the instructor and let him take care of her. Afterwards she noticed that her mind had a stillness to it. During the exercise her mind had been distracted from wandering off into all the winding thoughts of panic, the guidance had kept her attention here and now in her body and in her breathing. There was no room for thoughts. It was like going from 100 to 0 in 11 minutes. A couple of weeks later, when everything had calmed down Caroline looked back at the stressful time, she had really felt the need of letting go that the mat and light provided. She had come to terms with the instructor, he was all hers now. She thought to herself, when you stop fighting the instructions, the whole concept of heat, light and voice and how it is put together to hold your attention is genius, someone has actually put in a lot of thought in there. She concluded to herself, once you have this sensation and experience in your body, it becomes like a lifeline you carry with you that makes you safe.

6.1.2 Tilly, the Daughter. She heard it coming already when she came pedalling down the hill, as she reached the bus stop, she could see the back of the red bus as it vanished in the road bend between the trees. Oh my god, Tilly thought, I’m going to be late, I hate being late, and what will the teacher say? I have to knock on the door and come up with an excuse, she sighed and felt a lump of anxiety in her chest. Tilly was on her way to school, she was in her 8th year and the demands were getting higher. She did well in school, and she had nice friends, but she worried about her performance and what others would think, as most teenagers, but maybe too much sometimes. The waiting was the worst, she felt the lump in her chest again and her mouth was all dry. She was the next to present. Today they were presenting their individual project work in history class, she knew that she was well prepared, but it didn’t matter, she was still nervous. If only this day would be over and I

could go home, Tilly thought, my safe home, where I can relax. Her mind wandered to the sensation of calmness she had when using the mat and the lamp. She closed her eyes, took a deep breath and the calmness was there with her.

– Tilly, your turn!

She was brought back into the classroom by her teacher. With the recreated calmness in her body she went up to present her work. The lump of anxiety was gone, and just she felt confident and relaxed. Gradually autumn turned into winter, she had been using the Soma Mat and Light for three months now. Tilly stared out of the window into the darkness, but the only thing she saw was the reflection of her own face. She smiled to herself and the other her smiled back. She was happy about the way her life had turned lately. Tilly had liked the taste of calmness inside her from using the mat and the light from the very beginning. But ever since she had started to recall the body sensation in other situations, she had experienced that her self-confidence had grown. When she used to think: can I really do this? in new situations, she now just felt it's cool, what can actually happen? Presentations and tests in school were not connected to that lump of anxiety anymore, of course she still cared, but the uncontrollable nervousness was gone. Overall, she was calmer and did not worry so much beforehand.

6.1.3 Fred, the Father. As he drove down the hill, the lights lit up the road in a regular pattern, coming and then leaving. It was December, the darkness was dense. If there only could be some snow soon to light up the world, he thought. It was dark in the morning when he left home to drive to the university, where he worked as an IT-technician, and just as dark when he drove back home again. A sound from his phone pulled him back into reality. The display revealed a text from his wife. The milk, I have forgotten to buy milk, he thought. Now he had to turn back. All the things that he had in front of him this evening suddenly piled up in front of him. In reality it was just the usual stuff: dinner, washing up, driving Tilly, walking the dog, preparing for tomorrow, fixing the router, but here and now his mind was jumping back and forth in between all the things and the smallest thing became like a mountain to climb. And he was so tired. The mat he thought, I am going to lie down on the mat when I come home. Before he used to just lie down on the floor for 5 min after dinner to rest a bit, but that just became a pause for him where everything just continued afterwards. The mat and light on the other hand was like rebooting, where he could start over from scratch at home. In the background he heard distant clanks and voices from the kitchen as he was slowly coming back from his short session on the mat. He thought to himself: it is just to follow the breathing in your body, it is not more complicated than that. It is simply not possible to let other thoughts come through. It doesn't have to be a fancy and difficult meditation – it can work on another plane as well. On the way to the kitchen he hugged his wife and he felt that he was present in the moment, the constant buzz from the day was gone, things had stopped spinning in his mind. All the things he had to do this evening didn't seem so big anymore, just clearer, one thing at a time he thought.

– Have you noticed that you often hug me after you've been on the mat? It is like you all of a sudden see me? Caroline said

– Hmm, yeah more loving, he said and smiled at her.

6.2 Maggie



Maggie heard the alarm from afar, her body felt heavy and numb. Still half asleep she reached out for the phone ringing next to her on the floor and pressed snooze. Her arm fell back down and she fell asleep again. This pattern was repeated several times until she had actually taken a proper hour-long nap at 6pm. Oh no, not again! she thought, now I will never be able to fall asleep tonight and tomorrow I have to be in the office early to meet a client. It almost became a self-fulfilling prophecy that she would lie awake in bed tonight. She had always fallen asleep easily, in cars, trains, airplanes, on the beach, whenever there was a waiting time and now on the Soma Mat. The light reminded her of a sunny beach where clouds intermittently hid the sun, the warm sand towards her back. She really liked it, she felt safe in there. I have to change this, she thought, while hiding a yawn behind her coffee cup the next morning. It was not a big problem, but napping during the day made her night sleep too short. Maybe, if I use the mat and light only when it doesn't matter if I'm up late and can sleep in the next day? Weekend-use is the solution, she contently concluded to herself.

– Is Michael sick too?

She felt the stinging sensation around her kidneys again, as she was to get a urine infection again, it always coincided with stress. They had a project delivery for an important client this week, and two of her co-workers had called in sick, leaving her to manage this on her own. This was her third month at work, and it was her first real job as an app developer. She liked it, although it had of course been demanding to start a new position, but they had let her ease in and slowly handed over more responsibility. It is strange how fragile life is, she thought, just the other week her life was quite balanced, going to the gym, sleeping well, not feeling stressed at all. But all of a sudden she had lost it. It had started with a dislocated shoulder, which had hindered her from all sorts of physical exercise. On top of this her two colleagues had called in sick one after the other. She felt the tingling sensation in her stomach again. She was really stressed but at the same time very tired. From having settled in with the mat and light as a weekend routine, she was now longing to go home to use it right after work. To let the breathing slow down

and to get rid of that stinging in the kidney area. She was lying wide awake in bed again, but this time it was different. It was not stressful, just unusual for her to have someone breathing beside her in bed and someone she really liked. Her one-room flat only had space for a single bed and the sofa was so small it could barely be called a sofa. She had tried a breathing technique, chakra cleansing, that she had learnt in yoga classes to slow her breathing down to relax and fall asleep, but without success. She looked down at the Soma Mat and thought: that is like a sleeping pill for me, what if I would grab a blanket and start a session? Next morning, she woke up to the smell of coffee, still lying on the floor.

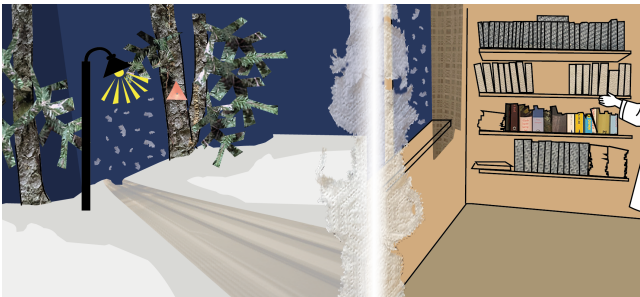
– Slept well? he asked.

– Yes, strangely enough this was very comfortable, she replied and stretched out.

– You're going to return those things to the researchers soon right? Nice to get the floor space back, eh?

– Well, I kind of like them, I think I am going to miss them!

6.3 Christina



It is still daytime, even so it is dark. Stockholm is awake outside the hospital building, a young mother is bustling across the square with Christmas presents sticking out under the buggy that she is pushing through the snow. Christina looks back at computer screen and calls in her next patient:

– Sigurd Andersson!

A man in his 70s enters the room. He has been a patient of Christina's for several years now and they are well acquainted.

– And then I have a lot of pain in my back and it radiates out into my arm, which makes me worried and sometimes I think I have problems breathing.

Christina knows from his history that this is most likely related to muscle tensions.

– So, the yoga classes you had signed up for, how is that going?

– Honestly, I don't really think it is for me. I don't understand the breathing they are going on about. I have also tried meditation classes, but I simply don't get it.

Christina tells him that she is part of study on a prototype that uses a sensor connected to light to mirror the breathing.

– So, in here is the sensor that measures the distance to your body.

– Interesting!

– Let's try to breathe together and reflect on the movement it produces in the body.

Christina starts breathing into the chest and then deep into the stomach and guides Sigurd into doing the same. They inhale and

exhale together.

– How is that for you?

– I actually think I understand better now, it was kind of nice. Sigurd replies.

Christina's mind starts to wander: What do you actually need in life, and how do you prioritize? How do I actually spend my time? Someone calls and all of a sudden, I postpone myself, my needs. She thinks about several of the patients she meets as a doctor, especially young mothers and the norm in society of what you should do: Is it more relaxing to go to Thailand with another family than to be at home? Do your children have to go to every single party they are invited to? Start dancing when they're two? This is hard to see when you are in the midst of it – you need to pause and reflect. When everything is spinning around these patients, the advice she usually gives is to slow down and relax more. But how can they? When they don't know how to or even what it is to relax? It is almost 6 o'clock and time to finish work. She sorts some papers and logs out from her computer.

Finally, the crisp, cool wind hits her face. The ski tracks are newly made, and she has found a good pace where she just can keep on skiing. This exercise routine makes the stress from the workday go away and gives her new energy. She has always been exercising: orienteering, skiing and running, there is a calmness to it. She ponders, the breathing and body awareness from the mat and light also creates calmness, but in another way. Lately, she has found herself making use of the breathing when it is stressful at work. I would never give up the physical exercise though, she thinks, but does it have to be one or the other? They could compliment each other.

Coffee and cinnamon bun 25 kr, the colourful sign said. They had stopped for petrol. It was Christina and two of her friends in the car. They were heading north to Mora to participate in the big ski race, Vasaloppet. They arrive at Stina's sister's home in Mora, where they are going to stay. So convenient not having to get up super early and drive to the start. She sinks down on the sofa with a cup of tea together with the others. She is relaxed but still excited about tomorrow. The sharp signal from Christina's phone suddenly interrupts them.

– Oh, it is my mother, I will have to answer. She said and went up to her room.

Later in bed, she turned. Turned side again. Stared up at the ceiling. Even though she had a room of her own, it was hard to fall asleep tonight, she was all wound up and upset. Usually she was sleeping well. Now she missed her own bed, next to her husband, in their flat at home. It was now past midnight and at 10 o'clock she had had the last call out of 10 from her mother and finally she got to know that everything was OK. It was her father, he had suddenly collapsed and needed an immediate heart operation. Her mother had almost had a nervous breakdown, which was understandable. But at the same time, she had to handle her mother's frustration and questions and she thought: I cannot be made responsible for the Swedish health care system just because I am a doctor! It was frustrating for her not to be close and at the same time she also knew that she had to sleep prior to the race tomorrow, which made it even more stressful. But then she started to use her breathing. She could easily discern that her body was tense, her muscles. While lying there she started to imagine what happens on the Soma Mat,

she could sense her muscles gradually start to relax and she made use of the breathing to be able to fall asleep. Back in her office Christina once again turned around and looked out on the square through the window and thought: Others' reactions are interesting: 'oh so you are into such things?' Such things? As though I was staring into a crystal ball! I do believe in the effect of breathing and the warmth. In general, I think the use of the mat and light have had a positive effect for me.

6.4 Sarah



If only this headache could go away! Sarah thought where she stood looking out through the unwashed window at the ground floor, where her one room apartment was situated. It was the middle of March and the sounds from the city were louder than ever, windy and no green leaves yet to dampen the noise from the traffic. She sighed and turned around just as the bus arrived outside her window, so close that she made eye contact with an old lady, but Sarah looked away and turned around and went back to the kitchen to start preparing dinner. For the past one and a half years Sarah had tension headaches and neck problems, she could sense that she was pressing her teeth at night. Overall, she was healthy, she slept well and didn't have any problems falling asleep, but she was still tired when she woke up. It was not a major problem, she enjoyed her life, she had a good job with nice colleagues, occasionally she met up with friends, she had a boyfriend that she loved and found inner peace from doing physical exercise. This was the way Sarah had grown up, she followed the way of living that she knew and as a social being, the way other people around her lived their lives. At work, sitting a lot in front of the computer, she could feel the tensions building up in her neck and shoulders. She had visited several professional physiotherapists, naprapaths and massage therapists to sort out the problem. The massage therapists had talked about slowness and the physiotherapist had told her to try to relax her shoulders, and she really tried to. She tried to relax in the evenings on the sofa just watching TV or reading a book. The only things that felt truly relaxing to her was intense physical exercise, going to gym classes, dancing or spending time in the hot sauna. Just up until three months ago she had not understood the value in

slow practices, such as yoga, Qigong or any sort of meditation. She had tried it, but it was too slow for her, not physically challenging enough. It made her restless. She couldn't understand what it was that made people spend so much of their time meditating, going to silent retreats or becoming yogis. Surely relaxation was nice, but she couldn't grasp the obsession. Now it was part of her. In a short time, it had become entangled in her whole life. Sometimes it just happened by itself without her even actively thinking about being slow. Several times now her friends had complained about her walking too slowly. She had even started questioning her choice of living in the city center, where she had lived her entire life. The tempo was so high in the city and people were stressed, they were running to the underground, the bus, everywhere. When she met someone moving at the same slow pace as her, she thought: You and me stranger! Lately, she had noticed that she was less tired, not pressing her teeth as much, the headache was also better. Sarah poured up the pasta on a plate and sat down by the tiny kitchen table with room for two persons. While eating she reflected back on the first time, she had tried the mat and lamp and how she instantly had felt I wanted more of this. It was something new to her, that she hadn't experienced before, a deeper kind of relaxation experience. Previously, she had thought she was relaxed while lying on the sofa, but this was a completely different level of relaxation. And it was so quick for her to get there, 30 seconds on the mat and she was already relaxed. She especially remembered some sessions on the mat early on where she, for the first time, could let go of all thoughts – and if a thought appeared, it was so easy to let go of it. It reminded Sara of the sensation after physical exercise, to just let go of everything in her life. Keep the focus here and now. Her worries became smaller, they were not as important anymore. She wondered: Could it be something with the heat? She had tried guided relaxation exercises before, but she had never managed to keep the focus on the different body parts. With the heat she experienced that she could direct and sustain her attention and with that came an awareness of the specific body part. Sarah had become very aware of her breathing as well. She could find herself sitting on her office chair, at the bus or in the sauna focusing on her breathing, how and where in her body she was breathing and had tensions. She could all of a sudden combine this with exercises from the physiotherapist that she hadn't understood the value of a year ago. She realized that these experiences had made her reappraise meditation and overall slow practices. Three month ago it wouldn't be on her world map to start doing Qigong, but now she was even practicing it at home by herself. The experiences with these prototypes had worked as a catalyst, it was the piece that was missing to tie all loose ends together. But at the same time, she realized that this reevaluation of her life might have happened sooner or later anyway and that there were many other pieces involved, but it surely had a great part in it happening at this point and so fast. Sarah was pulled back into reality by a text message on her phone. It was from a charity organization she had been involved in. She reflected on how easy it was for her to say 'no' to things now, to continue to keep her focus on relaxing, doing physical exercise and her friends. Not make so many plans, take the day more as it comes. She had changed her attitude to what she should do in life, and once this change was made it was OK to say no. And when she sometimes had to explain her decision, she found that she had the confidence to simply say,

this is what I need to do right now. And it felt good!
The rain was pouring outside, leaves whirling in the wind. Autumn was here. Sarah thought back on the past six months after she had left the study with the mat and lamp. She had really changed her way of living. I should send an email and thank the researchers for letting me be part of their study:

'I just want to thank you for letting me be part of your study in using the soma mat and breathing light. It has totally changed my life and I feel good!'

Best Regards,
Sarah

7 A REFLECTIVE ANALYSIS OF TRANSFORMATIVE BECOMINGS

In the short stories above, we have tried to mirror a holistic picture of the transformative becomings of our participants' lives beyond a particular use situation. In line with Ingold [37] we have made an attempt with our stories to describe the holistic mesh work of lines, where the knots with their inter-stitches or in-betweens show the becoming with these prototypes. We will now spend some time to look at the lines, knots and the meshwork and how they make up in the stories. Not to untangle them, but rather reflect on the areas in between and the mesh they belong to. We seek to demonstrate how we come to understand these prototypes as a 'with-ness' that are brought along as a fellow-traveller, rather than an 'of-ness' that becomes an object that our participants have to attend to (*ibid*). Important to remember here is that the lines, knots and meshwork are just metaphors, and our work with them is interpretative, we do not intend to sort out or depict their exact relations to each other. Simplifying the entanglements would be contradictory to the worldview Ingold presents:

Thus when I speak of the entanglement of things I mean this literally and precisely: not a network of connections but a meshwork of interwoven lines of growth and movement. [38] pp3.

We have chosen to highlight four entangled becoming with from the stories (not representing one from each participant) – the threading a line – tying knots, the creating sympathy, the looping of a thread, and the molding of the in-between-ness.

7.1 Sarah – Threading a Line – Tying Knots

As we can see in Sarah's story she has recurrently sought treatment for headache, pain in her neck and tiredness. She has tried various things, such as physiotherapy, massage, visiting naprapaths, yoga, meditation, qi gong and has gotten advice from different quarters pointing at slowness, relaxation and awareness of certain body parts. If we would see Sarah's attempts in the metaphors of Ingold, she has all these lines of experiences around body awareness practices in her life that can be described as 'and ... and ... and', but they are not entangling and becoming 'with ... with ... with' [40]. They can be seen as loose ends spreading in different directions and not entangling with the mesh work of her existing lines, knots and in-betweens, she is not tying up these loose lines (*ibid*). Before she used the soma prototypes she was missing an experience (a line) that would tie or entangle these loose ends. She describes how she, through engaging with the soma prototypes, gets hold

of an experience that is new to her, a deep kind of relaxation she never experienced before. The line made by this new experience entangles and 'becomes with' the loose ends, and creates meaning in the in-betweens in her newly woven meshwork – it gives a shape to the direction of the many lines of body awareness she has accumulated. All of a sudden the earlier experiences make sense to her, and she is, in the words of Ingold, becoming with and the lines are contrapuntal, harmonic [40]. In this reflection, we position the experience with the prototypes as not only an experience or interaction in and of itself, nor only between Sarah and the technologies, but entangling with the multiple lines that have run alongside her experiences of stress and physical discomfort. We will return to Sarah further down and see how she indeed becomes with her evolving meshwork.

7.2 Caroline – Creating Sympathy

If we turn to the story of Caroline (the mother), she has vast knowledge and practises techniques that aim at increased body awareness and/or being in the moment, such as Qigong, and meditation. In the words of Shusterman, she is increasing her somaesthetic appreciation by extending on her experiences and thereby she can become more perceptive and aware in the physical world in which she lives and acts [62]. But as in most areas you can always learn more, understand things differently. The soma prototypes are not the same as her Qigong or meditation practices, but has the same purpose of increasing the sensory appreciation. Thinking of the world in Ingold's metaphors, her mesh work already contains lines walked and knots knotted around body awareness, with inter-stitches touching upon how she lives her life and the choices she makes. She has found a way which she is continuously developing. The soma prototypes are similar to her practice, but uses a different route to body awareness and stillness of the mind than she is used to. We can see this in how she is struggling with the instructor voice of the prototypes, she is used to deciding the pace, the direction of attention herself. Her new experiences with the prototypes cannot easily find their way into her existing meshwork, she has to add new lines tying knots in the mesh and alter her understanding of the in-betweens. When something is so similar, but still different it can, as we see, become a struggle to figure out how the new experiences may become together with the world. Her expertise within her own body comes from closely knotted lines, that resist new entanglements. It is like the lines of the experiences are joined 'up', but not 'with' – when lines are joined 'up' they become fixed and cannot alter their tension or resolution [37]. For Caroline it becomes confusing, she does not understand how to make sense of the experience with the prototypes. Her stressful experience with losing photographs is a prompt to loosen the knots, and in particular to acknowledge the flux in her own control which has been carefully knotted in her bodily practices. The knot of control is loosened and the 'instructor' and prototypes are given space. In the end the entwined lines of her meshwork join 'with' one another and possess an inner feeling for each other, they create a harmonic feeling for one another – a sympathy [37]. She has started to live with the prototypes rather than to look at them [40], both experiences can travel now alongside.

7.3 Christina – Looping a Thread

In Christina's story her father becomes ill, her mother is worried and turns to Christina both as a daughter and a doctor with insights into the health care system. Christina is at the same time preparing for a ski race and needs to be well rested. She has a hard time winding down when she is away from home, far from her parents, and she should be focusing on her race. She thinks of the experience she has when she uses the soma prototypes and if she can make use of it where she is now. Through using Ingold's view of knowledge as being carried on, we attempt to sort out how she can use that experience at another time and place. By bringing together the activities of remembering and imagining to the present, that is remembering presences the past; imagining presences the future [40]. Ingold discusses knowledge to be open-ended rather than closed off, and thereby merges into life in an active process of remembering (*ibid*). He refers to this as wayfaring where knowledge is carried on not to be seen as a discrete closed off transmission [39]. The remembering here is becoming, it is not making an object of a memory that we are over and done with, then past cannot be part of the present. The past is not finished but active in the present. In Christina's case she lets the somatic knowledge of experiencing the prototypes that is entangled in her meshwork, continue their joining in an active process of remembering rather than being set aside as a passive object of memory. She is able to utilise the entanglement of the prototypes with her bodily experience even in their (physical) absence – the knowledge is with her, carried with her body, and not in the object or objectified outside her. This knowledge – a new means to make sense and ways of being – is entangled in how she incorporates new lines into her meshwork as a loop, a space through which other lines can be moved. Christina manages to do both remembering and imagining – to join the past with the future, and she can use her somatic knowledge of breathing and focusing on body parts to finally fall asleep.

7.4 Sarah – Molding of the In-Betweens

As we reflected on above, Sarah has through her new experience with the soma prototypes a line that entangles in knots with all her previous loose ends of body awareness practices. But how do these new entanglements affect other parts of the meshwork that make up her life? Ingold refers to a meshwork rather than a network, a meshwork is not made up from interconnected points but of interwoven lines [37]. The difference lies in between how these are built up, a network is fixed connections between points, while a meshwork is along lines, where the lines are elastic and the knots can be tightened, loosened and even untied. If you entangle with one part of the meshwork, it affects the other lines, become with, and possess an inner feeling for each other [40]. Deleuze and Guattari [18], refer to this as lines of becoming, where the line is not defined by its connection but how it creates in-betweens with other lines. In a network, it is what is going on between the points that matter, while in a meshwork it is the in-between that matter and these are moldable [37, 38]. If we turn to back to Sarah, we see that after using the prototypes for a while, the entire meshwork she is part of gets affected. Dynamically it affects different parts of her life, like in the choices of engaging in Qigong or mediation. Practices that before were too slow for her have now been made available

through the in-betweens formed by the soma prototype experiences. Other parts of her life are also affected, like how she starts to walk slower, do things more slowly, she also finds the confidence to say no to things. We can see how parts of the meshwork that are not so closely connected to the experience as such co-respond too. The moldable in-betweens are affecting her whole way of being in the world. This goes in line with Shusterman's perspective on the soma (that is, part of the meshwork), according to Shusterman [62], it is not only through our living body and movements that we understand the world, but our soma is also mouldable. By engaging with movements with our senses, like in the soma prototypes, we can extend on our experiences and create for better ways of being in the world. The entanglements created in Sarah's meshwork through her becoming with the soma prototypes has created new possible ways for her to be in the world.

8 DISCUSSION

Earlier in the paper we argued that soma design has now reached a level of maturity where there is confidence in the theory and the expertise in soma design methods [3, 9, 23, 46, 50, 52, 70, 71], that it is possible to begin examining the promise of soma design, and its wider implications for the field. In this paper we have reported on the first longer-term study of soma prototypes deployed and lived with over three months. This has allowed us to examine and analyse how people experienced these prototypes not just in one-off evaluations, but when returned to over and over again in their everyday lives. We started this paper with a bold claim, namely that soma design when done with rigour [65], can result in 'world making' designs. Through our agential cuts described as short stories and our reflections using Ingold's metaphors we unpack the participants' transformative becomings with the soma mat and breathing light. We believe that these are indications of 'world making' in action. We see in this material that continued somaesthetic engagement with the soma mat and breathing light did indeed create meaningful experiences for our participants. It is also evident that the prototypes influenced their 'being' in the world over the longer term. And the engagements also created alternative ways of being in the world for our participants – transformative becomings. For some of them we could even draw the conclusion that these alternatives led to better ways (for them) of being in the world and richer lives. But this is a very tricky conclusion and hard to show evidence for. In our discussion, we will unpack what we mean by 'world making', and what such a design program means for interaction design practice. This is followed by a discussion on ethics, partly reflecting on the value-laden claim of *better* ways of being in the world. We end this section with a reflection on using storytelling as a method to capture and describe transformative becoming in soma design.

8.1 Making New Worlds

We have used Ingold's metaphors of lines, knots and meshworks [37] in the analysis to try and illustrate how people with these prototypes has transformed in their becoming which affect their knowledge actions, perspectives and ultimately the worlds they intra-act with. The stories we provide, along with the analysis, show this 'world making' happen in different ways for different

participants: from Sarah, who through engaging with the soma mat and breathing light over time starts to walk slower and begins to say no to things that she does not want to do, through to Christina, who through her becomings with the soma prototypes is able to calm her soma in troubled times, even when she is no longer directly using the prototypes.

Entanglements with the soma mat and breathing light seem for some to lead to transformational becomings that gives new meanings, new practices, new knowledge, with the potential to make new worlds. Although learning to say no, or learning to speak up are in some sense small changes, the self knowledge engendered at the same time can be transformational of the participants' worlds, providing greater freedom to choose how they want to be in the world [23]. Drawing from Barad's new materialism we could characterise intra-actions with the soma prototypes as creating the possibilities for change which in turn leads to changing ways of being in the world:

Agency is about changing possibilities of change entailed in reconfiguring material-discursive apparatuses of bodily production, including the boundary articulations and exclusions that are marked by those practices in the enactment of casual structure. [6] pp325.

We see these transformational becomings as something else than a small or simple straight-forward, logical or linear change in behaviour. It is not about understanding that you need to change your behaviour and e.g. relax more, from collecting various complex bio data, where you can see patterns in your life. It is also not about implementing this change in your life (which in itself is very challenging). It is about taking another route to the understanding of the change, to understand through our senses, our somas, what such a change of experience feels like – where our participants transformationally become. Through using the prototypes they now know a new experience, which gives them an alternative way of being in the world. This opens up for other possibilities to meet a situation they end up in and in turn can make new worlds. The doctor in our stories, Christina, pinpoints this when she refers to her stressed patients: How can they relax, when they don't know how to?

It is possible that on reading this claim – that soma design makes new worlds – that the reader considers that we as designers are returning ourselves to a god-like position, deciding for participants and for society at-large what is best, or what is a better life for us and for them. In many ways, ideas of 'world making' might resonate with Simon's [63] stance that characterised design (or the science of the artificial) as normative and concerned with 'how things ought to be'. Thus, the tasks of humans is to 'invent' the world that they want based on what they think / know to be best. But, as Bardzell notes [7], such a position leaves us still with the question of how we can know which future is preferred over others? In many ways, yes, soma design is about *re-inventing* the worlds we want. This could be understood as worlds where our full selves are taking into account in the design of technology and not just our fingers, eyes, and brains. Or worlds where we are able to interact with technology in ways which do not cause pain, or continued cognitive distraction. In this context, soma design is intended to

provide an alternative somatically experienced perspective of what interactions with digital materials and technologies might be like. But, nevertheless, we find ourselves needing to push back against the possible characterisation that we – as soma designers – are deciding what a better life might be, or what a better way of being might be. We are merely opening possible options of how to become in the world. Much like the feminist utopias described by Bardzell [7], we find that the world-making happening in relation to the soma prototypes is not one where one world is presumed best for all, but instead there are multiple possible futures in progress [51].

In section 3.2. we described doing soma design as about both searching for an 'evocative balance' [66] and creating a 'bounded openness' [65]. Both of these design concepts are oppositional to the idea of the worlds being made as fixed, or the idea that there is a linear or logical progression from a design to an outcome (it is not predictive; x does not lead to y). This is not about behaviour change. Instead these approaches to design suggest an openness to what is experienced and what might be gained by engaging. Building on perspectives from New Materialism [6] we understand that an intra-action with the soma prototypes is ongoing with the soma that intra-acts with it. We cannot and would not try to fix this, nor imagine it as a set of interacting parts controlled by an external logic [6]. Different somas will intra-act with the artefacts in different ways, leading to different material configurations, different knowledge, and different outcomes. Every person who experienced living with the Soma Mat and Breathing Light experienced it differently. There was no fixed transformation that resulted from a greater body awareness, or sense of relaxation, one participant chose to slow down and in some sense disconnect, another chose to use these experiences to find confidence in their voice and speak up. As such, it is not the soma designer who chooses in what direction a transformation may go, or what a 'better life' is, but rather a result of the intra-action between the soma and the soma design that open up for how a soma can become in the world.

8.2 Ethics of Transformative Mattering

Barad writes about how the possibilities for change and transformation oblige us to intra-act with responsibility in the world's becoming [6]. And, we find that the work presented here forces us to ask questions of what it means to act responsibly as a soma designer, and as a human intra-acting in the world. To start, we find ourselves asking who gets to live a better life? People come to the soma prototypes from many different places and spaces – and for some people the soma prototypes fall outside of their boundaries. For example, the boundaries of the experience as articulated by the prototypes was enough that one participant withdrew from the study because they could not find the value in the experiences for themselves. And for Caroline it took time, and a particularly stressful experience, for her to be able to overcome the boundaries and give the soma prototypes space in her life. The soma prototypes have physical boundaries too, which must also be considered. Perhaps on viewing the Soma Mat and Breathing Light, you the reader, have noticed the floor space that these would require? Perhaps you have considered how a person using the prototypes would need a stable electrical connection, or even moments of peace and quiet in the home that would make it possible for someone to lie

down and take a few minutes to themselves. And, it is clear that many of those in the world today do not have at least one of these things. In fact, we know of one person who used the Soma Mat and Breathing Light in one of the participant's apartments, but who themselves were unable to have these prototypes in their own home and participate in the study because of their living conditions. In this sense the soma prototypes create another kind of boundary to use, the privilege to be living in a setting where it is possible to house and use these them. We recognise this privilege. We see it. It is codified in the prototypes themselves, it is not codified in how we think about who should get to lead a better life. We do not think that soma design should be a middle class concern. To become aware of the body can be good for everybody – particularly in times of immense stress. The soma approach with its first-person perspective questions and provides alternatives to underlying values, norms and structures in our society. And these soma prototypes are one attempt at embedding soma design processes and practices into interactive materials. But, their form factor and interactional properties are not the only way in which this evocative balance may be made – other furniture or materials may also come to the same bounded openness.

Soma design and ethics have been explored in several recent papers [35]. In 'Ethics in Movement' Eriksson and colleagues [23] examine how an artist's performance is shaped by the technology around them, and the movements afforded by the technology. The authors' close analytical account of how dancers interacted with drones to create a performance shows the ways in which a soma is influenced in the here and now to respond to what is 'understandable' to the drones, what is safe to do around the drones alongside the artistic intentions in the performance. The authors describe the somas of the dancers as being transformed by the drones. In this paper, we build on these perspectives to show how the soma can be transformed over-time by soma designed prototypes to create new becoming practices, even when no longer interacting with the technology. While soma design theory has theorised that designing interactions through a soma design process could lead to 'self-knowledge, support people in making the right choices, happiness, and justice' [23, 62], we believe the data presented in this paper is the first time we have seen such an outcome. This brings to focus a series of questions as to what such a finding might mean for soma designers as a community, and interaction design at large. First, as acknowledged in the previous section, having designed interactions with a bounded openness means that we do not dictate the direction or transformations that might occur from interacting with the technology. Thus, when soma designers put a soma design out into the world (or study it in the world) it is not possible to predict how people will become with it, what kind of knowledge or self knowledge they might construct, and how this might impact upon their actions, and movements in the world. Clearly, there are risks to this, and these should be carefully considered with every soma design and deployment. To a certain degree, the use of first-person methods as a fundamental part of the soma design process helps give some clarity to what the potential experiences with a soma prototype may be, as do one-off studies with potential users. By the time a soma design is deployed it has been in-use by its designers for many months and usually also tried by people outside the design team.

However, as argued in the previous section, we firmly believe that each individual soma completes the becoming with the prototype. This said, one might think that it is then pointless to try to make design, which will be different for everyone using it. But one key is how you approach the design you make. We do not design for *what* a precise experience or what a world should be like, we design for *how* users can become. Once again, we turn to the bounded openness, which is crafted in practise by testing the boundaries of the openness in the socio-digital material [32] iteratively with our somas, both by its designers and potential users [65]. Sensing the boundaries of how the design feels is different from trying to understand what the design does. We do acknowledge that this is not enough to know all the possible implications of our design's deployment. Perhaps also it is clear to the reader that people need to be open to engaging with these prototypes, you cannot force such an experience upon someone. Eriksson et al. [23] spoke of this already, the idea that a person's orientation to the world around them, their attitude will influence the extent to which they are willing or able to engage with some designs. And, we found this also in this study. People are not necessarily open to such things. Not everyone wanted to engage with the soma prototypes, and indeed being open to engagement is not a permanent thing, but something that is in-flux.

8.3 Storytelling as Method for Transformative Becomings

The transformational, long-term implications of soma design raised challenges to the analytical techniques that we commonly used to analyse people's experiences with technology. In particular, we found that thematic analysis approaches [13] did not help us illustrate the entanglements between the prototypes and our participants' becoming in the world. For us, the use of an analytical technique that is focused on finding patterns across a dataset did not fit with our desire to show the matterings within a unique individual's intra-actions with the soma prototypes. This desire resonates with the theoretical roots of somaesthetics and soma design. For example, if we turn to Sheets-Johnstone [61], she argues that movement and thinking are united, and that we must create meaning through the movements we make with the world as the world dynamically changes. In line with this is Barad's account on 'agential intra-action', where one process influences another and in which the components are ontologically inseparable [6]. Both perspectives argue for an approach that seriously considers the uniqueness, dynamism and mattering of each intra-action in the world.

We do not argue that there is no place for thematic analysis to understand new configurations of experiences and relations with technology, nor that story telling is the only viable method for capturing and illustrating these becomings. But storytelling gives an alternative approach that we find complements the perspectives in the philosophy of somaesthetics [61]. This need to innovate in methods to help explain, understand, and illustrate experience is not new within the field, and reflects the field's embracing of new theoretical and philosophical perspectives on how we exist with design and technology [27, 31, 72]. For example, micro-phenomenological interview techniques has been increasingly used by the HCI and

interaction design community over the last several decades in order to be able to capture experience beyond surface level descriptions [57]. And this method is seeing some uptake by soma designers as a possible method for more richly and deeply understanding the micro-details of an experience with soma designs [26, 26, 56, 58]. There is a growing tradition within the interaction design community to use narrative-led, and creative approaches to support data analysis and reflexivity. This includes for example stories, autoethnography [4], conversations [47], pictorials [11], design fiction [10] and designed artifacts [20].

We emphasise stories as a form of mattering that is both deliberate and meaningful. Storytelling helped us maintain the wholeness of the individual experience with the artefacts. This technique allowed us to keep together the dynamic, chronological, holistic experience and avoided separating out the soma, the prototypes or the transforming from its meshwork. By following processes from narrative-led qualitative inquiry [53] we were able to create stories that are deeply engrained in the qualitative data collected throughout the study, while also being able to creatively illustrate the participants' unique experiences of becoming with and through the soma prototypes. The creativity and interpretation of the data seen here is similar to the creativity and interpretation common in many qualitative approaches. The delicate balance between adding fictional elements while staying true to the data is not trivial, but through an iterative approach with many authors revisiting the data we can cater for rigour. We also see much future potential in bringing these stories back to participants as part of the analytical process – as depicted by Nasheeda and colleagues [53].

These stories helped us to really see, show and think with the bounded openness that is articulated by the soma prototypes. And in particular these stories show that the soma prototypes are not designing for *what* people should experience (to have the same experience), rather they are designing for the possibility to 'contest and rework *what* matters and what is excluded from mattering' [6].

9 LIMITATIONS

When we planned and conducted this study, we were not aware of the struggle we would encounter in the analysis of the data or that we would choose to present the result as stories. Had we known prior to the study, we might have chosen different methods, such as micro-phenomenological interview techniques [54], or combinations of methods for the interviews. This could have allowed us to put more emphasise into teasing out certain details and connections in each participants life, which could have made the stories even stronger. Another addition to strengthen the resulting narratives, would be to let the study participants read the stories and alter them based on their opinions, as recommended by [53].

10 CONCLUSION

In this paper we have presented data and analysis of a longer-term study of two soma prototypes, which were deployed in four households over a period of three months. Through story telling we have provided holistic accounts of people's experiences with the soma prototypes that showed that these intra-actions with the prototypes led to new becomings in the world. These new becomings were open and various, and included learning how to say no, learning

a way of slowing down, or learning way of finding confidence to speak. Drawing from new materialism, and entanglement theories we have shown how intra-actions with the soma prototypes create the transformative potential of 'changing possibilities of change' that in turn lead to richer and more meaningful lives for some of those who used them. Based on this study and analysis we contribute evidence that soma design can deliver on its promise to lead to more meaningful experiences of being in the world, transform somas, and people's being in the world over the long term.

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REFERENCES

- [1] Yoko Akama. 2014. Attuning to Ma (between-Ness) in Designing. In *Proceedings of the 13th Participatory Design Conference on Short Papers, Industry Cases, Workshop Descriptions, Doctoral Consortium Papers, and Keynote Abstracts - PDC '14 - Volume 2*. ACM Press, Windhoek, Namibia, 21–24. <https://doi.org/10.1145/2662155.2662179>
- [2] Yoko Akama. 2015. Being Awake to Ma: Designing in between-Ness as a Way of Becoming With. *CoDesign* 11, 3-4 (Oct. 2015), 262–274. <https://doi.org/10.1080/15710882.2015.1081243>
- [3] Simon Asplund and Martin Jonsson. 2018. SWAY - Designing for Balance and Posture Awareness. In *Proceedings of the Twelfth International Conference on Tangible, Embedded, and Embodied Interaction*. ACM, Stockholm Sweden, 470–475. <https://doi.org/10.1145/3173225.3173262>
- [4] Madeline Balaam, Rob Comber, Rachel E. Clarke, Charles Windlin, Anna Ståhl, Kristina Höök, and Geraldine Fitzpatrick. 2019. Emotion Work in Experience-Centered Design. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems (CHI '19)*. ACM, New York, NY, USA, 602:1–602:12. <https://doi.org/10.1145/3290605.3300832>
- [5] Karen Barad. 2003. Posthumanist Performativity: Toward an Understanding of How Matter Comes to Matter. *Signs* 28, 3 (2003), 801–831. <https://doi.org/10.1086/345321>
- [6] Karen Barad. 2007. *Meeting the Universe Halfway: Quantum Physics and the Entanglement of Matter and Meaning*. Duke University Press.
- [7] Shaowen Bardzell. 2018. Utopias of Participation: Feminism, Design, and the Futures. *ACM Transactions on Computer-Human Interaction* 25, 1 (Feb. 2018), 1–24. <https://doi.org/10.1145/3127359>
- [8] Jane Bennett. 2010. *Vibrant Matter: A Political Ecology of Things*. Duke University Press, Durham.
- [9] Francesco Bigoni and Cumhur Erku. 2020. DogDog: Soma-Based Interface Design for an Improvising Musician. In *Proceedings of the 7th International Conference on Movement and Computing*. ACM, Jersey City/Virtual NJ USA, 1–4. <https://doi.org/10.1145/3401956.3404242>
- [10] Julian Bleecker. 2009. Design Fiction: A short essay on design, science, fact and fiction. (2009).
- [11] Eli Blevins, Sabrina Hauser, and William Odom. 2015. Sharing the Hidden Treasure in Pictorials. *Interactions* 22, 3 (April 2015), 32–43. <https://doi.org/10.1145/2755534>
- [12] Virginia Braun and Victoria Clarke. 2006. Using Thematic Analysis in Psychology. *Qualitative Research in Psychology* 3, 2 (2006), 77–101.
- [13] Virginia Braun and Victoria Clarke. 2019. Reflecting on Reflexive Thematic Analysis. *Qualitative Research in Sport, Exercise and Health* 11, 4 (Aug. 2019), 589–597. <https://doi.org/10.1080/2159676X.2019.1628806>
- [14] Levi R. Bryant. 2011. *Democracy of Objects*. Open Humanities Press. <https://doi.org/10.3998/ohp.9750134.0001.001>
- [15] Chip Chipman and Elsie Spittle. 2019. *Genesis of the Three Principles: Reflections on the Life and Discoveries of Sydney Banks*. Independently Published.
- [16] F. Michael Connelly and D. Jean Clandinin. 2006. Narrative Inquiry. In *Handbook of Complementary Methods in Education Research* (3rd ed. ed.). Lawrence Erlbaum., Mahwah, NJ, 477–487.
- [17] Kelsey Cotton, Pedro Sanches, Vasiliki Tsaknaki, and Pavel Karpashevich. 2021. The Body Electric: A NIME Designed through and with the Somatic Experience of Singing. In *NIME 2021*. PubPub, Shanghai, China. <https://doi.org/10.21428/92fbeb44.ec9f8fdd>
- [18] Gilles Deleuze and Félix Guattari. 2013. *A Thousand Plateaus: Capitalism and Schizophrenia*. Bloomsbury Academic, London.

- [19] Jacques Derrida. 1993. *Memoirs of the Blind: The Self-Portrait and Other Ruins*. University of Chicago Press, Chicago.
- [20] Laura Devendorf, Kristina Andersen, and Aisling Kelliher. 2020. The Fundamental Uncertainties of Mothering: Finding Ways to Honor Endurance, Struggle, and Contradiction. *ACM Transactions on Computer-Human Interaction* 27, 4 (Sept. 2020), 26:1–26:24. <https://doi.org/10.1145/3397177>
- [21] John Dewey. 2007. *Human Nature and Conduct an Introduction to Social Psychology*. Cosimo, New York, NY.
- [22] Carolyn Ellis. 2004. *The Ethnographic I: A Methodological Novel about Autoethnography*. Number v. 13 in Ethnographic Alternatives Book Series. AltaMira Press, Walnut Creek, CA.
- [23] Sara Eriksson, Kristina Höök, Richard Shusterman, Dag Svanes, Carl Unander-Scharin, and Åsa Unander-Scharin. 2020. Ethics in Movement: Shaping and Being Shaped in Human-Drone Interaction. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1–14.
- [24] Sara Eriksson, Åsa Unander-Scharin, Vincent Trichon, Carl Unander-Scharin, Hedvig Kjellström, and Kristina Höök. 2019. *Dancing With Drones: Crafting Novel Artistic Expressions Through Intercorporeality*. Association for Computing Machinery, New York, NY, USA, 1–12. <https://doi.org/10.1145/3290605.3300847>
- [25] Moshé Feldenkrais. 1990. *Awareness through Movement: Health Exercises for Personal Growth* (1st harpercollins pbk. ed ed.). HarperSanFrancisco, San Francisco.
- [26] Jules François, Yves Candau, Sarah Fdili Alaoui, and Thecla Schiphorst. 2017. *Designing for Kinesthetic Awareness: Revealing User Experiences through Second-Person Inquiry*. Association for Computing Machinery, New York, NY, USA, 5171–5183. <https://doi.org/10.1145/3025453.3025714>
- [27] Christopher Frauenberger. 2019. Entanglement HCI The Next Wave? *ACM Transactions on Computer-Human Interaction (TOCHI)* 27, 1 (Nov. 2019), 2:1–2:27. <https://doi.org/10.1145/3364998>
- [28] Paula Gardner and Barbara Jenkins. 2016. Bodily Intra-Actions with Biometric Devices. *Body & Society* 22, 1 (March 2016), 3–30. <https://doi.org/10.1177/1357034X15604030>
- [29] Graham Harman. 2011. *The Quadruple Object*. Zero Books, Winchester.
- [30] Sjoerd Hendriks, Simon Mare, Mafalda Gamboa, and Mehmet Aydın Baytaş. 2021. Azalea: Co-Experience in Remote Dialog through Diminished Reality and Somaesthetic Interaction Design. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems (CHI '21)*. Association for Computing Machinery, New York, NY, USA, 1–11. <https://doi.org/10.1145/3411764.3445052>
- [31] Sarah Homewood, Amanda Karlsson, and Anna Vallgård. 2020. Removal as a Method: A Fourth Wave HCI Approach to Understanding the Experience of Self-Tracking. In *Proceedings of the 2020 ACM Designing Interactive Systems Conference*. ACM, Eindhoven Netherlands, 1779–1791. <https://doi.org/10.1145/3357236.3395425>
- [32] Kristina Höök. 2018. *Designing with the Body: Somaesthetic Interaction Design*. The MIT Press, Cambridge, Massachusetts.
- [33] Kristina Höök, Steve Benford, Paul Tennent, Vasiliki Tsaknaki, Miquel Alfaras, Juan Pablo Martinez Avila, Christine Li, Joseph Marshall, Claudia Dauden Roquet, Pedro Sanches, Anna Ståhl, Muhammad Umair, Charles Windlin, and Feng Zhou. 2021. Unpacking Non-Dualistic Design: The Soma Design Case. *ACM Transactions on Computer-Human Interaction* 28, 6 (2021).
- [34] Kristina Höök, Baptiste Caramiaux, Cunchur Erkut, Jodi Forlizzi, Nassrin Hajinejad, Michael Haller, Caroline Hummels, Katherine Isbister, Martin Jonsson, George Khut, Lian Loke, Danielle Lottridge, Patrizia Marti, Edward Melcer, Florian Müller, Marianne Petersen, Thecla Schiphorst, Elena Segura, Anna Ståhl, Dag Svanæs, Jakob Tholander, and Helena Tobiasson. 2018. Embracing First-Person Perspectives in Soma-Based Design. *Informatics* 5, 1 (Feb. 2018), 8. <https://doi.org/10.3390/informatics5010008>
- [35] Kristina Höök, Sara Eriksson, Marie Louise Juul Søndergaard, Marianela Ciolfi Felice, Nadia Campo Woytuk, Ozgun Kilic Afsar, Vasiliki Tsaknaki, and Anna Ståhl. 2019. Soma Design and Politics of the Body. In *Proceedings of the Halfway to the Future Symposium 2019 (HTTF 2019)*. Association for Computing Machinery, New York, NY, USA, 1–8. <https://doi.org/10.1145/3363384.3363385>
- [36] Kristina Höök, Martin P. Jonsson, Anna Ståhl, and Johanna Mercurio. 2016. Somaesthetic Appreciation Design. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 3131–3142.
- [37] Tim Ingold. 2007. *Lines*. Routledge. <https://doi.org/10.4324/9780203961155>
- [38] Tim Ingold. 2010. *Bringing Things Back to Life: Creative Entanglements in a World of Materials*. Technical Report. University of Manchester., University of Manchester.
- [39] Tim Ingold. 2011. *Being Alive*. Routledge. <https://doi.org/10.4324/9780203818336>
- [40] Tim Ingold. 2017. On Human Correspondence: On Human Correspondence. *Journal of the Royal Anthropological Institute* 23, 1 (March 2017), 9–27. <https://doi.org/10.1111/1467-9655.12541>
- [41] Arata Isozaki. 2000. *Ma – Ni Ju Nen Ato No Kikanten, (MA – Twenty Years On), Exhibition Catalogue*. Tokyo Geijutsu Daigaku, Tokyo.
- [42] Arata Isozaki. 2006. *Japan-Ness in Architecture*. MIT Press, Cambridge, MA, USA.
- [43] Martin Jonsson, Anna Ståhl, Johanna Mercurio, Anna Karlsson, Naveen Ramani, and Kristina Höök. 2016. The Aesthetics of Heat: Guiding Awareness with Thermal Stimuli. In *Proceedings of the TEI '16: Tenth International Conference on Tangible, Embedded, and Embodied Interaction*. ACM, Eindhoven Netherlands, 109–117. <https://doi.org/10.1145/2839462.2839487>
- [44] Kari Kuutti and Liam J. Bannon. 2014. The Turn to Practice in HCI: Towards a Research Agenda. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, Toronto Ontario Canada, 3543–3552. <https://doi.org/10.1145/2556288.2557111>
- [45] Pui-Ying Lorelei Kwan. 2012. Exploring Japanese Art and Aesthetic as Inspiration for Emotionally Durable Design. In *Designed Asia*. Hong Kong.
- [46] Joseph La Delfa, Mehmet Aydin Baytas, Rakesh Patibanda, Hazel Ngari, Rohit Ashok Khot, and Florian 'Floyd' Mueller. 2020. Drone Chi: Somaesthetic Human-Drone Interaction. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. ACM, Honolulu HI USA, 1–13. <https://doi.org/10.1145/3313831.3376786>
- [47] Debora de Castro Leal, Angelika Strohmayer, and Max Krüger. 2021. On Activism and Academia: Reflecting Together and Sharing Experiences Among Critical Friends. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. Association for Computing Machinery, New York, NY, USA, 1–18.
- [48] Deborah Lupton. 2018. How Do Data Come to Matter? Living and Becoming with Personal Data. *Big Data & Society* 5, 2 (July 2018), 205395171878631. <https://doi.org/10.1177/2053951718786314>
- [49] Erin Manning. 2016. *The Minor Gesture*. Duke University Press, Durham.
- [50] Juan P Martinez Avila, Vasiliki Tsaknaki, Pavel Karpashevich, Charles Windlin, Niklas Valenti, Kristina Höök, Andrew McPherson, and Steve Benford. 2020. Soma Design for NIME. In *Proceedings of the International Conference on New Interfaces for Musical Expression*. Zenodo, Birmingham, UK. <https://doi.org/10.5281/ZENODO.4813491>
- [51] Erin McKenna. 2001. *The Task of Utopia: A Pragmatist and Feminist Perspective*. Rowman & Littlefield Publishers, Lanham, Md.
- [52] Svetlana Mironcika, Annika Hupfeld, Joep Frens, Jessica Asjes, and Stephan Wensveen. 2020. Snap-Snap T-Shirt: Posture Awareness Through Playful and Somaesthetic Experience. In *Proceedings of the Fourteenth International Conference on Tangible, Embedded, and Embodied Interaction*. ACM, Sydney NSW Australia, 799–809. <https://doi.org/10.1145/3374920.3375013>
- [53] Aishath Nasheeda, Haslinda Binti Abdullah, Steven Eric Krauss, and Nobaya Binti Ahmed. 2019. Transforming Transcripts Into Stories: A Multimethod Approach to Narrative Analysis. *International Journal of Qualitative Methods* 18 (Jan. 2019), 1609406919856797. <https://doi.org/10.1177/1609406919856797>
- [54] Claire Petitmengin. 2006. Describing one's subjective experience in the second person: An interview method for the science of consciousness. *Phenomenology and the Cognitive Sciences* 5 (12 2006), 229–269. <https://doi.org/10.1007/s11097-006-9022-2>
- [55] Richard B. Pilgrim. 1986. Intervals ("Ma") in Space and Time: Foundations for a Religio-Aesthetic Paradigm in Japan. *History of Religions* 25, 3 (Feb. 1986), 255–277. <https://doi.org/10.1086/463043>
- [56] Kristina Popova, Rachael Garrett, Claudia Núñez Pacheco, Airi Lampinen, and Kristina Höök. 2022. Vulnerability as an Ethical Stance in Soma Design Processes. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. <https://doi.org/10.1145/3491102.3501994>
- [57] Mirjana Prpa, Sarah Fdili-Alaoui, Thecla Schiphorst, and Philippe Pasquier. 2020. *Articulating Experience: Reflections from Experts Applying Micro-Phenomenology to Design Research in HCI*. Association for Computing Machinery, New York, NY, USA, 1–14. doi.org/10.1145/3313831.3376664
- [58] Mirjana Prpa, Kivanç Tatar, Jules François, Bernhard Riecke, Thecla Schiphorst, and Philippe Pasquier. 2018. Attending to Breath: Exploring How the Cues in a Virtual Environment Guide the Attention to Breath and Shape the Quality of Experience to Support Mindfulness. In *Proceedings of the 2018 Designing Interactive Systems Conference (Hong Kong, China) (DIS'18)*. Association for Computing Machinery, New York, NY, USA, 71–84. <https://doi.org/10.1145/3196709.3196765>
- [59] Johan Redström. 2017. *Making Design Theory*. The MIT Press. <https://doi.org/10.7551/mitpress/11160.001.0001>
- [60] Pedro Sanches, Noura Howell, Vasiliki Tsaknaki, Tom Jenkins, and Karey Helms. 2022. Diffraction-in-action: Designerly Explorations of Agential Factors Through Lived Data. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. <https://doi.org/10.1145/3491102.3502029>
- [61] Maxine Sheets-Johnstone. 2011. *The Primacy of Movement: Expanded Second Edition* (second ed.). Advances in Consciousness Research, Vol. 82. John Benjamins Publishing Company, Amsterdam. <https://doi.org/10.1075/aicr.82>
- [62] Richard Shusterman. 2008. *Body Consciousness: A Philosophy of Mindfulness and Somaesthetics*. Cambridge University Press, Cambridge. <https://doi.org/10.1017/CBO9780511802829>
- [63] Herbert A. Simon. 1969. *The Sciences of the Artificial* (third ed.). MIT Press, Cambridge, MA, USA.
- [64] Anna Ståhl, Martin Jonsson, Johanna Mercurio, Anna Karlsson, Kristina Höök, and Eva-Carin Banka Johnson. 2016. The Soma Mat and Breathing Light. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in*

- Computing Systems (CHI EA '16)*. Association for Computing Machinery, New York, NY, USA, 305–308. <https://doi.org/10.1145/2851581.2889464>
- [65] Anna Ståhl, Vasiliki Tsaknaki, and Madeline Balaam. 2021. Validity and Rigour in Soma Design - Sketching with the Soma. *ACM Transactions on Computer-Human Interaction* 28, 6 (2021). <https://doi.org/10.1145/3470132>
- [66] Anna Ståhl, Jonas Löwgren, and Kristina Höök. 2014. Evocative Balance : Designing for Interactional Empowerment. *International Journal of Design* 8, 1 (2014), 43–57.
- [67] Lucy Suchman. 1987. *Plans and Situated Actions*. Cambridge University Press.
- [68] Lucy Suchman. 2006. *Human-Machine Reconfigurations: Plans and Situated Actions*. Cambridge University Press.
- [69] Petra Sundström, Alex Taylor, Katja Grufberg, Niklas Wirstrom, Jordi Solsona Belenguer, and Marcus Lundén. 2011. Inspirational Bits: Towards a Shared Understanding of the Digital Material. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. ACM, Vancouver BC Canada, 1561–1570. <https://doi.org/10.1145/1978942.1979170>
- [70] Paul Tennent, Kristina Höök, Steve Benford, Vasiliki Tsaknaki, Anna Ståhl, Claudia Dauden Roquet, Charles Windlin, Pedro Sanches, Joe Marshall, Christine Li, Juan Pablo Martinez Avila, Miquel Alfaras, Muhammad Umair, and Feng Zhou. 2021. Articulating Soma Experiences Using Trajectories. In *Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems*. ACM, Yokohama Japan, 1–16. <https://doi.org/10.1145/3411764.3445482>
- [71] Paul Tennent, Joe Marshall, Vasiliki Tsaknaki, Charles Windlin, Kristina Höök, and Miquel Alfaras. 2020. Soma Design and Sensory Misalignment. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. ACM, Honolulu HI USA, 1–12. <https://doi.org/10.1145/3313831.3376812>
- [72] Ron Wakkary, Doenja Oogjes, Henry W. J. Lin, and Sabrina Hauser. 2018. *Philosophers Living with the Tilting Bowl*. Association for Computing Machinery, New York, NY, USA, 1–12. doi.org/10.1145/3173574.3173668
- [73] Charles Windlin, Anna Ståhl, Pedro Sanches, Vasiliki Tsaknaki, Pavel Karpashevich, Madeline Balaam, and Kristina Höök. 2019. Soma Bits: Mediating Technology to Orchestrate Bodily Experiences. In *RTD Conference*. Delft. <https://doi.org/10.6084/M9.FIGSHARE.7855799.V2>