The Designer's Body as Resource in Design: Exploring Combinations of Point-of-view and Tense

Dag Svanæs[1,2] and Louise Barkhuus[2]
[1]Norwegian University of Science and Technology, Trondheim, Norway
dag.svanes@ntnu.no
[2]The IT University of Copenhagen, Denmark
{barkhuus; dasv}@itu.dk

ABSTRACT
The design of wearable, tangible and embedded interactive products requires a focus on bodily/kinesthetic aspects of the user experience, that is, how the product "feels" in use. Although best practice in user-centered design (such as iterative design, prototyping, user testing) also applies for this new type of product, the designer's skill set needs to be supplemented with design methods and practices that utilize bodily intelligence and empathy with the user. We present a framework for categorizing such body-centered design practices based on two dimensions: point-of-view (1st, 2nd, 3rd person) and tense (past, present, future). Inspired by Merleau-Ponty's phenomenology of the body, Shusterman's work on somaesthetics, and Buber's theories on intersubjectivity, the framework provides a language for talking about different ways designers and co-designers can utilize their body as a design resource. The intention is not to be prescriptive on method, but to provide guidance during planning, execution and analysis.

Author Keywords
Body-centered design; phenomenology; somaesthetics; user experience; designer training; design process.

CCS Concepts
•Human-centered computing–Interaction design; Interaction design theory, concepts and paradigms.

INTRODUCTION
Designing digital technology for the body, that being wrist-worn emergency alarms for elderly, augmented reality headsets for gamers, or interactive costumes for actors, is a complex task, requiring the designer to pay careful attention to the interplay between the product, its users, and the intended use context.

Through decades, HCI research has addressed many such design issues, using the terms *embodied*, *tangible*, *wearable*, and *embedded* for these products and *body-centered design* to refer to the practice of designing such products. Other terms for these design practices include *soma-based design* [18, 19], *movement-based design* [28], *embodied design* [6], or "*designing with and for the body*" [47].

Several body-centered design methods have been developed to supplement existing interaction design methods (e.g. [9, 16, 20, 28, 29, 36, 38]). Common to most of these methods is that their successful application to a large degree depends on the skills and sensitivities of the individual designer. Some of the proposed methods originate in performance arts and rely on previous training in dance or drama (e.g. [28, 38]). Others rely on training in bodily self-reflection (e.g. [20]), special interviewing techniques (e.g. [34]) or soma-based design [49]. Our aim is not to devise ways to train body-centered skills and sensitivities, but to provide a language for talking about these in the context of design.

Compared to screen-based interaction design, body-centered design is new, and comparably little has been written on what it takes to make such design projects successful. How do we design for the body? What design methods exist? What skills do these methods require from the designers? How do we combine these and other methods in specific design projects?

To help answer these questions, we provide an analytical framework for talking about different ways designers and co-designers can utilize their bodily skills and sensitivities as a resource in design. Our intention is not to provide a prescriptive method, but to provide a language for reflecting on design practice during the planning, execution and analysis of design projects that require a body-centered approach. We have found the two dimensions of *point-of-view* (1st, 2nd and 3rd person) and *tense* (past, present and future) fruitful as an analytical lens for this purpose. In this paper, we will use two design cases to illustrate the framework.

During the planning phase of a project, the framework can help identify what combination of design methods and activities best fit the project in its different phases. During the execution of each method, the framework can help the designers reflect on the personal skills and sensitivities involved, thus raising their consciousness about the "tacit" aspects of their design practice. During the evaluation and analysis of a finished design project, the framework can aid

in identifying areas of improvement for future similar projects, including needs for skill development among the designers.

In user-centered and participatory design projects, users and other stakeholders are often included in the design process as co-designers. Recognizing the importance of the co-designers for the success for many design projects, we thus include their bodily skills and sensitivities in our analysis.

One motivation for making the framework, is to provide a simple matrix that can be used in design without the need to read in-depth the basic theory behind it.

We start the paper with a brief overview of related work on body-centered design. This is followed by an introduction to the phenomenology of Merleau-Ponty [31] and his concept of the lived body, i.e. the body from a 1st person perspective. To provide a context for self-reflection, Shusterman´s *somaesthetics* [40] and his concept of bodily self-reflection is then presented to highlight our ability to not only act through our bodies, but also reflect on ourselves during the process. Next, we introduce the 2nd person perspective on the body, *kinesthetic empathy*, and its neurological basis in mirror neurons. Martin Buber´s philosophy of I-Thou [2] is used to further explain the 2nd person perspective. We then present the point-of-view/tense analytical framework, and show how it applies to two design project cases that we analyze in retrospect to reflect on our prior body-centered design practice. The paper concludes with a reflection on the value and limitations of the framework and its broader impact.

THEORETICAL FOUNDATIONS FOR BODY-CENTERED DESIGN

Most design methods and approaches have emerged within a specific school of thought and it is therefore useful to start with an overview of the theoretical traditions that have been made relevant for body-centered design.

Gibson's ecological theory of perception [14] was brought into HCI by Norman [33] and Gaver [12], through the concept of *affordance*. It has been made relevant for body-centered design due to its primacy on action [16].

Relatedly, in 2001, Dourish [6] used the *phenomenology* of Husserl, Heidegger, Schütz, and Merleau-Ponty to reflect on what he termed *embodied interaction*. Dourish's focus was not primarily on the body as such, but on the contextual and situated nature of interaction. Svanæs used Merleau-Ponty more explicitly to discuss the role of the body in human-computer interaction, relevant to our framework [46; 47]. Merleau-Ponty [31] makes a distinction between the first-person perspective ("I") of being a body and the third-person perspective ("he/she/it") of seeing the body as an object in the world. In German there are two terms for the body, *Leib* and *Körper*, corresponding to the first- and the third-person perspective respectively [32].

Relatedly, Dewey's aesthetics [4] has been widely used as a philosophical basis for talking about *user experiences* (e.g. [26]). His approach differs from Merleau-Ponty's phenomenology of the body in that its unit of analysis is "*an experience*" with a beginning and an end, such as the viewing of a dance performance in an opera hall, while Merleau-Ponty's unit of analysis is "*the lived body*" in everyday life.

More recently, the contemporary philosopher Richard Shusterman has developed theories about the body: *somaesthetics*, from a synthesis of Dewey's aesthetics, Merleau-Ponty phenomenology, eastern martial art practices and various other sources [40]. His work has inspired research on *soma-based design*, with a strong focus on the bodily user experience [19; 20].

Another theoretical approach to body centered design originates from studies of dance and choreography, often referred to as *somatics*. Schiphorst [38], for example, draws on a wide set of sources for discussing her design methods and techniques and *somatic connoisseurship*, including the works of Depraz et al. [3], Boal [1] and various martial arts techniques. The somatic tradition is however not primarily based in theory, but is to a large extent based on a living corporeal practice taught through dance and choreography classes from master to apprentice.

Finally, methods on introspection, based on the psycho-phenomenology and Elicitation Interview Technique of Petitmengin [35] and the focusing techniques of Gendlin [13] have inspired work on bodily self-reflection in body-centered design (e.g. [34]).

Common to the above theoretical foundations is a first-person perspective on both the user and the designer. This is summarized in a recent paper on "soma-based design", reporting from two CHI workshops on designing for the body [19]: "*.. a first-person perspective places the user's lived experience at the core of the design process—the lived experience of moving and being moved become the main unifying activity during the design process. ... If one wants to design for the lived experience of moving and being moved, designers have to be engaged in their own somatics by doing and experiencing while designing" (ibid., p. 3)*.

BODY-CENTERED DESIGN METHODS

Hummels et al. [16] describe the design method *Move to get moved* inspired by Gibson´s ecological theory of perception and choreography (*somatics*). They describe how they changed their design practice from designing interaction on paper to design interaction while interacting.

Schiphorst [38] describes two first-person design methods used in the design workshops of the Whisper project. First, *Attentional redirection* is a method inspired by practices such as mindfulness and contemporary dance with the aim of redirecting attention from the external world to the inner felt qualities of an experience. She refers explicitly to Depraz et al. [3], who draw on the phenomenology of Husserl [17] and describe this as the three-step bracketing process

(*epoché*/reduction) of Suspension, Redirection and Letting-Go. As a design method, its aim is for the designer to become mindful of the here-and-now and how it affects him/her.

Schiphorst further describes *Somatic facilitated phenomenological inquiry through movement.* This design method is similar to *Attentional redirection* in that attention is turned inwards, but in this case the redirection of attention is used to reflect on the experience of interacting with various design alternatives in an evaluation session where future use situations are enacted.

Loke and Robertson [28] describe the design method *Moving and Making Strange*, inspired by the phenomenology of Merleau-Ponty. An important aspect of this technique is "*making the familiar strange*".

Segura et al. [30] propose *Embodied Sketching* as a way of designing for bodily experiences early in the design process. Their approach to ideation of embodied interaction is activity-centered. They contrast this with "*other embodied approaches to stimulate creativity [that] are artefact-/technology- /service- centred, so that the design activity revolves around designing, prototyping and even testing something concrete*" (ibid., p. 6022).

Inspired by art therapy, Núñez-Pacheco and Loke [34] used Body Maps as a method for externalizing emotional states through graphical representation of the human body, created by the designer or user. They note that "*body maps communicate thoughts, emotions and ideas, including those that are not easily articulated through words. Very importantly, these allow the participant to pay attention to their physical body*" (ibid, p. 2).

In addition to body maps, they also report on the use of *Focusing-oriented Bodystorming*, inspired by the Focusing therapy practice.

Finally, Hillerup Fogtmann [10] developed *Kinesthetic Empathy Interaction* as a 2nd person approach to design.

Common to all above body-centered methods is that the authors say very little about the skills and sensitivities required to successfully practice their method.

RATIONALE FOR A FRAMEWORK

As supervisors and project managers for body-centred research and design projects, we must always take the skills of the designers/researchers into consideration when we plan a project. How do we categorize these required bodily skills? The 1st vs. 2nd vs. 3rd person perspectives were already established as one dimension in the literature [9]. Analyzing previous projects, tense emerged as one important other dimension: Past, Present and Future. Past and Present fit Schön´s distinction between reflection-on-action and reflecting-in-action [39].

DESIGNING FROM DIFFERENT POINTS OF VIEW

Our framework has similarities with previous work by others [9, 15, 24, 41, 42, 48, 50, 51, 54], of which none have combined point-of-view and tense. We start out with Fdili Alaoui et al. [9] in the distinction between 1st, 2nd and 3rd person perspectives (points-of-view) on the body in design:

1. *First-person perspectives are focused on self-observation and exploration of one's own experience in developing and testing technologies.*
2. *Second-person perspectives include participant observation through kinesthetic empathy.*
3. *Third-person perspectives posit observation as objectively gathering data from the world that removes the bias of the self* (ibid, p. 2).

We do not however share Fdili Alaoui et al.'s (ibid) view that 3rd person data are objective and "*removes the bias of the self*". All data need to be interpreted, and although one should always aim to reduce the effects of biases, reaching truly objective interpretations is not achievable.

3rd person: The body as object

Implicit in all 3rd person theories of the user is the assumption that users can be described and understood with the same tools and theories that we use to study other objects in the world. This is the paradigm of western medicine, cognitive science, ergonomics, and movement science. Deeply rooted in most of these theories is the Cartesian assumption that people is the sum of body and mind, — a body having a mind, or a mind having a body.

3rd person design methods

The 3rd person approach has given us insights about cognition and perception that have been important for the design of today´s easy-to-use user interfaces. Examples include the gestalt theories of vision (screen layout), and recognition vs. recall (GUI vs. text interfaces).

The aim of most user-centered design methods, such as observation, interviews, usability testing, and co-design workshops, is to gain a better understanding of the users. Despite this, the designer-user relation is still one of observer-observed, and the ideal is for the designer to minimize his/her personal biases.

1st person: The lived body

The French philosopher Merleau-Ponty's concept of *the lived body* has been an important inspiration for much research in body-centered design. *The lived body* is our experienced body, the body through which we live our lives, which is different from seeing the body as an object in the world. As a resource for body-centered design, this makes us aware of the difference between using our own bodies and bodily experience as a resource in the design process (1st person perspective), versus perceiving our own and our potential users´ bodies "from the outside" as objects in the world (3rd person perspective).

The body extends itself through technology

The body has an ability to adapt and extend itself through external devices. Merleau-Ponty used the example of a blind person's stick to illustrate this. When I have learned the skill of perceiving the world through the stick, the stick has ceased

to exist for me as a stick and has become part of "me". It has become part of my body and at the same time changed it.

The self-reflecting body: Somaesthetic reflection

In his book *Body Consciousness: A philisophy of Mindfulness and Somaethetics* from 2008 [40], the contemporary American philosopher Richard Shusterman builds on Merleau-Ponty, but goes deeper into the body´s ability to reflect on itself in action. Shusterman uses a person walking through an open door as an example:

"Just as we can observe the door opening as a distinct object of perception, so we can consciously perceive (both visually and proprioceptively) whether our stance is wide or narrow and whether our arms are extended or close to our torso. We can likewise explicitly recognize that our breath is short or that our fists are clenched; we can even be mindfully aware of the distinct feelings of such breathing or clenching. At this level, which Merleau-Ponty regards as the level of mental representations, we can already speak of explicitly conscious somatic perception or Somaesthetic observation" (ibid. p. 55).

Somaesthetic reflection can be trained

We all observe our bodily reactions in everyday life; tense shoulders on our way to a job interview, excitement before meeting a person we like, tiredness after a long day. But *somaesthetic reflection* is also a skill that can be improved through training in drama and dance classes, eastern mind-body practices such as Tai Chi, yoga, meditation and martial arts. Somaesthetics has lately been made relevant to body-centered design by bringing Shusterman into design centers, teaching researchers and designers *somaesthetic reflection* through hands-on workshops [7, 27].

1st person design methods

Most of the current body-centered design methods are 1st person, e.g [16, 18-21, 28-30, 38, 50]. They utilize the designers´ bodily skills as a resource in design and thus make possible design solutions that would often not emerge through a "cognitive" approach to design.

2nd person: The body of the other

When observing a user *in situ*, say a teenager texting on a mobile phone, we utilize our own experience with that technology as a background for analyzing the use situation. There is however a more direct approach available, making conscious use of our inborn ability to "directly" feel other people´s movements and experiences through *kinesthetic empathy [37]*.

Mirror neurons

In the late 1990s, researchers studying the brain function of monkeys with fMRI made some interesting observations [11]. When recording the brain functions of a monkey that observed another money eating, they observed the same brain activity as when the monkey itself was eating, only weaker. Investigating this further lead them to the discovery of a new set of neurons in the motor centers of the brains of all primates, including us, that they called mirror neurons. These neurons are not in the frontal cortex where cognition resides, but reside deep in the brain where they trigger when we observe someone else doing an action. They "mirror" actions of others in our action centers. This means that when you observe someone doing something, like performing in a ballet, you not only aesthetically observe a body in motion, but you feel an instinctual drive to repeat the same movements. You feel their movements, as if they were yours. This is the 2nd person perspective, our species-specific innate potential for bodily empathy. Some researchers take this a step further and argue that this shows we are "programmed from nature" to feel other people's pain and joy in this direct fashion (the link between mirror neurons and empathy is complex, with many open questions. See [8] for a discussion).

2nd person design methods

Empathy with the user has been explicitly stated as a goal in design within HCI since the early 2000s (e.g. Fulton Suri [43]), but has often been seen as something that would emerge automatically from observing or interviewing users.

As Wright and MacCarthy [51] put it: "*By their tight focus on a functional use of empathy, for example to design attractive systems, early attempts to introduce empathy into HCI often seem somewhat paradoxically to have maintained a third-person perspective on users*" (ibid., p. 644).

Hillerup Fogtmann´s *Kinesthetic Empathy Interaction* [10] and Kouprie et al.´s *Empathizing Process* [24] are examples of design method that put empathy center stage.

2nd person vs. 3rd person: Buber

We find the work of the Austrian philosopher Martin Buber relevant for a discussion about the 2nd person perspective in body-centered design, even though his focus was not primarily on the "tacit" bodily aspects of intersubjectivity. In his seminal work *I and Thou* from 1923 [2], Buber argues that there are two distinctly different ways of relating to another person, either as a "you" (I-You / 2nd person) or as an "it" (I-It / 3rd person). In real life we mostly have instrumental I-It relations to other people, and pure I-You encounters are fairly rare. I-You relationships are characterized by being mutual, holistic, and without objectification of one another, different from I-It relationships where the other person is a means to an end.

Buber's text is almost poetic, but the meaning is clear: *"The primary word I-Thou can only be spoken with the whole being. The primary word I-It can never be spoken with the whole being"* (ibid., p.11). In our context this means that a 2nd person approach to design requires us to step out of the role as analytic observers and enter into an open dialogue with the user with "the whole being".

As an inspiration for user-centered and participatory design, Buber's philosophy reminds us of the importance of treating our users as subjects and not as objects.

TENSE IN BODY-CENTERED DESIGN

The body-centered design methods differ in point-of-view (1st, 2nd, and 3rd), but they also differ in tense, i.e. whether a particular method is intended to answer questions about what has happened in the past, what is happening now, or what might happen in the future.

Present vs. Past

The difference between present and past lies in the current experiences contrasting memories and recollections; Hummel et al.'s *Move to get moved* [16] for example, is a 1st person method that is very much in the present. It is concerned with exploring design alternatives through interaction here and now from a 1st person perspective. Similarly, Schiphorst's *Attentional redirection* [38] is concerned with the present, in an attempt at getting access to the 1st person experience of interacting.

When doing an *Elicitation Interview* [34], as exemplified and described by Petitmengin [35] on the other hand, the interviewer is taking the interviewee back to previous encounters with technology. This technique activates memory, and is looking back at the past, still from a 1st person perspective.

Present vs. Future

Future, in comparison to present bodily experience methods, are focusing on potential and possibilities, such as *Somatic facilitated phenomenological inquiry through movement* [38], which is concerned with enacting future use scenarios. The enactment is happening in the present, but projected on to possible imagined futures.

In this relation, we find Merleau-Ponty's distinction between *abstract* and *concrete* movements relevant for the discussion about tense in design. Merleau-Ponty distinguishes between movements made on purpose "as movements", and movements made naturally as part of a situation. He describes the former as *abstract* (future), the latter as *concrete* (present). If a person is asked to move the left foot in front of the right foot, the resulting movement is *abstract* because it is made outside the normal context of bodily movements. When part of everyday walking, the same kind of movement would be *concrete*. When a dancer rehearses a new dance, trying out different ways to move, her movements are abstract, while when on stage with the resulting performance, her movements are concrete.

Abstract movement is what enables us to step out of habitual behavior and use the body to communicate and explore alternative courses of action. Through these kinds of playful simulations we explore possible futures. For Merleau-Ponty, abstract movement or *"play-acting ... to place oneself for a moment in an imaginary situation, to find satisfaction in changing one's 'setting'"* is at the core of human nature ([31], p. 156).

We therefore include three different tenses in the body-centered design framework: Past, Present and Future. As a property of design activities, tense is orthogonal to point-of-view.

A 3X3 MATRIX OF POINT-OF-VIEW AND TENSE

Placing *point-of-view* and *tense* on two orthogonal axes, we get a 3x3 matrix of body-centered design activities and corresponsing skills. This gives rise to nine combinations of *point-of-view* (1st, 2nd, 3rd person) and *tense* (past, present, future) in body-centered design. Table 1 illustrates this.

Point-of-view/ Tense	Past	Present	Future
1st - Me	**Accessing memories of how it felt for me in the past.**	**Awareness of how it feels for me here and now.**	**Awareness of how it feels for me when I am enacting a possible future.**
2nd - You	**Empathically observing recordings of someone else in the past.**	**Empathically observing someone else here and now.**	**Empathically observing someone else enacting a possible future.**
3rd – He/She	**Analytically observing recordings of one self or someone else in the past.**	**Analytically observing one self or someone else here and now.**	**Analytically observing one self or someone else enacting a possible future.**

Table 1. A 3x3 matrix of Point-of-View and Tense.

COMPARISON WITH EXISTING FRAMEWORKS

Table 2 sums up how some relevant related frameworks compare with the Point-of-view/Tense framework.

Reference	1st	2nd	3rd	Tense
Fdili Alaoui et al. [9]	x	x	x	
Zhang and Wakkary [54]	x	x		
Wright and McCarthy [51]		x		
Kouprie and S Visser [24]		x	x	
Tomico et al. [48]	(x)	(x)	(x)	
Wilde et al. [50]	x			(x)

Table 2. Comparison with existing frameworks.

As described above, Fdili Alaoui et al. [9] make a distinction between 1st, 2nd and 3rd person perspectives (points-of-view) in design very similar to ours.

Zhang and Wakkary [54] discuss the role of designers' personal experiences in interaction design practice; not specifically related to the body, but still of relevance here. Based on multiple case studies, they argue for legitimizing and valuing the use of personal experience in design. Personal experience corresponds to the 1st person perspective in our framework. They also discuss the value of

combining personal experience with empathic design (2nd person).

Several authors have discussed the role of empathy in design, but often as a property of the design process (e.g. [23, 43]). Wright and McCarthy [51] recognize this shortcoming, and propose empathy understood as "communicative performance built on responsivity to others" (ibid., p. 644).

Kouprie and Sleeswijk Visser [24] also go beyond describing empathy as a property of the design process, and see it as an ability people have. They further explicitly compare the 2nd person empathic approach to the 3rd person detached approach to design.

Tomico et al. [48] describe a design case where a European designer went from designing for an abstract user group in India (3rd person), to a specific user group that he interacted with (2nd person), to designing for himself as embedded in the Indian context (1st person). Although not explicitly related to embodied design, the paper is relevant in showing the pros and cons of the different approaches to design.

Wilde et al. [50] present a theoretical framework for analyzing the inner working of *Embodied Design Ideation (EDI) Methods.* The framework sees the design methods as examples of estrangements (Shklovsky). Eight EDI methods from two conference workshops are analyzed. The framework does not discuss neither Point-of-View nor Tense, but is relevant because EDIs are examples of methods that will occupy the *1st person – Present* and *1st person – Future* cells in our framework.

TWO DESIGN CASES

We have selected two design cases to illustrate the practical application of the presented framework. The aim is not to make a rigid analysis of the design cases themselves, but to provide examples for grounding the discussion and illustrate ways in which the framework can be used. In this instance we use it as a tool for post-hoc analysis, where in other instances it might be useful for design activity planning. The design cases here are independent of one another, but the authors were involved in each of them.

The way we use design cases to illustrate transitions between cells in the matrix has strong similarities with how Smeenk et al. [42] used Tomico et al.´s framework [48] for analyzing a specific design process.

Case 1: Mechanical elephant ears for the stage

As part of the collaboration with a student theater company, we were approached by the producer and asked to make large artificial movable ears for a red elephant character in a children's play (Figure 1, right) [45].

In the resulting body enhancement, the actor controlled the flapping of the ears with flex sensors on a glove. The ears were used on stage every day over a period of three weeks.

Figure 1. Mechanical ears on designer (left) and actor (right).

The design team consisted of one master student and one of the authors. The project went through 5 phases, in which different perspectives were dominant (Table 3):

Point-of View/ Tense	Past	Present	Future
1st - Me	5. Interview with actor after performance (actor)	2. Design of mapping between input and output (actor and designers)	3. Enacting future use (actor)
2nd - You	5. Interview with actor after performance (designers)	4. Empathically observing actor using ears in performance (designers-actor)	3. Empathically observing actor enacting future use (designers)
3rd – He/She		1. Design of form factor, mechanics and electronics (designers)	

Table 3. The design process of case 1.

Phase 1. Design of form factor, mechanics and electronics

The project started out by designing and building the form factor, mechanics and electronics. The frame was taken from an off-the-shelf helmet, and the mechanics was built around it. We tried it on ourselves with a focus mainly on size and fit, not on how it felt in use. We made numerous modifications to make sure it was not too heavy or fell off. In this process, we mainly had a mechanistic 3rd person perspective on our own bodies (*3rd person - present*). When we brought in the actor, it was also all about fitting it to his physiology (head size and head shape). We further had to cooperate with the costume designers to make sure the red cloth hood they designed could fit our mechanical ear skeleton.

The physical design of the control glove was also all about physiology, fitting it to the hand of the user (the actor) and making sure the bend sensors followed the movement of the two fingers. In addition, a small 3D printed box was made for the electronics, which was fastened to the wrist of the actor with a Velcro band.

Having fitted the ear skeleton to the head and built the mechanics and electronics to make the ears flap, we had to design the mapping between finger movements and ear flapping. Seen as a mathematical problem, a number of possible mappings exist from two bend sensors to the left and right servos, of which we ended up with a "natural" mapping

of one finger for each ear. This mapping was inspired by Norman´s concept of "natural mapping" from [33].

In explaining why some mappings are more "natural" than others, Norman uses information theory: *"Readers conversant with information theory might consider how the various mappings reduce the information load on the user"* ([17], p.223). Referring to information load in this context is a good example of how cognitive science is applied to explaining the mind of the user in HCI.

In the making of the first version of the ears, we used a 3rd person perspective on the human body that was a combination of a mechanistic view of the physical body (physiology) and an information processing perspective on the user´s mind (cognitive science). Taken together this can be called the intelligent robot view of the user: A mechanical body being controlled by an information processing brain. This is the implicit model of the user in most engineering-driven design projects.

In the case of the mechanical ear project, the 3rd person perspective was necessary to get the ear mechanics, electronics, and input-output mapping right. There is clearly a place for the 3rd person perspective in body-centered design, but we will argue that this perspective should be supplemented with other perspectives.

Phase 2. Getting the mapping between input and output right

When trying out the first version of the ears, we did a lot of tweaking of the parameters in the mapping between finger movement and ear flapping to get the right natural "feel" we were after. Initially, our Bluetooth protocol introduced a short delay that made the mapping very "unnatural". We also had problems with a low sampling rate in the first version, leading to "staccato" movement of the ear. Through these trial and error sessions with ourselves as users, we learned the importance of giving attention to detail in the mapping between finger movements and ear flapping. Referring to the framework, trying out different input-output mappings to get the "feel" right is an example of *1st person – present*. Our attention was on our own here-and-now bodily experience of using the technology. Figure 1, left shows one of the designers testing out the ears to get the mapping right.

Phase 3. Enacting future use

Having tweaked and experimented with what we felt was the right mapping between input and output, we brought in the actor and observed him enacting the mechanical ears as if on stage. Only minor changes were necessary before he accepted the ears. In this process, we empathically observed the user to make sure it felt right for him. This can be characterized as *2nd person – future* for the designer, mentally and emotionally stepping into the user´s shoes by empathically observing the user enacting a future use scenario.

For the actor as co-designer, he made use of his ability to imagine and act out a future scenario, while reflecting on his own experiences. This involved skills in *1st person- future*. This illustrates how one design activity can span two cells in the matrix, and how the perspectives are not always mutually exclusive.

Our aim as observers in this phase was on understanding how it felt for the actor to use the ears, and not on measuring his movements. Understanding the user through empathy is a 2nd person skill. An example of a 3rd person approach for this case could have been to record the sensor data from the control glove to enable statistical analysis of how he moved his fingers. Analyzing such data can be done "rationally" from a detached 3rd person point-of-view, without the need to empathize with the user.

What made the design activity happening in a possible future and not in the present was the fact that the user enacted a future use scenario while trying out the artefact. The enactment was of course happening in the present, but the actor imagined being on stage (future). If he had tried out the mechanical ears with only a here-and-now focus in our lab without imagining future use, the design activity would have been *1st person - present*.

Phase 4. Observing actor using ears in performance

When we later observed the actor using the ears in the children´s play, we saw how his familiarity with the ears increased. After a week of acting, he used the ears actively in his dialogue with the children in the audience. The children enjoyed it very much, which further motivated the actor to include improvised ear flapping as part of his performance. He had become the cyborg actor that we had aimed for. Empathically observing the actor on stage is an example of *2nd person - present*, where we used ourselves as instrument for interpreting his experience of using the ears.

Phase 5. Interviewing actor after performance

We interviewed the actor after the last performance. He confirmed that the ears had become natural for him on stage, and that he really enjoyed having them on as part of his costume. Referring to the 3x3 matrix, we are now in the *1st person - past* cell, remembering what it was like using an artifact, but in this case from the user and not from the designer´s perspective. From the designer´s perspective we are in the *2nd person - past* cell, empathizing with a user remembering a past use of technology.

1st, 2nd and 3rd person

When going from phase 1 where we engineered the ears, to phase 2 where we tried them out, we changed perspective from 3rd person to 1st person. The ears were no longer only servo driven costumes on the actor´s head controlled from his hand, but had become bodily extensions. The aim of the design went from designing a costume that should fit the actor´s head with a "natural" control, to making an artifact that through learning could become a natural extension of his body. Like the blind person and the stick in Merleau-Ponty´s example, the ideal was now for the ears to become an instrument that the actor could express himself through on

stage without having to focus on the mechanics of the artifact. The ears and the glove should become "transparent in use", the same way the stick is for the blind person. The aim became to make a man-machine cyborg that could devote all his creative energy on stage on acting, without being burdened by the control of his large flapping ears.

To be able to verify that the ears actually became bodily extensions, we made use of our ability to step into the user´s shoes (ears) through empathic observation. The 2nd person perspective enables us to get closer to the user´s 1st person experience. This illustrates the co-existence of points-of-view in the design activities, where different people (e.g. designers and users) have different foci.

Past, present, future

When the actor enacted future use of the mechanical ears (phase 3), he was in the present, but his attention was on the future. This is different from when we observed the actor on stage (phase 4), where our attention was on the here and now (present). When later asked to remember his experience of using the ears (phase 5), he was in the present, but his attention was on his memories of the past.

All three tenses were at work in this project, in different phases: imagining future use during design (future), observing actual use during the performance (present), and remembering it as a past experience after the last performance (past).

Filling in the blanks

From the designer´s perspective there are four unutilized cells in the matrix. Could any of these combinations of point-of-view and tense have been used as inspiration for alternative courses of action in the project?

1st person - past: Before starting the design process, we could have reflected on how to utlize our past bodily experiences of technology use as a resource.

1st person - future: In the first phase of the design we only worked in the lab to fit the ears and gloves to our bodies. We had not done our homework on studying the actual context of use, which would have allowed us to do a more realistic enactment of future use from a 1st person perspective by testing out the ears with the stage in mind.

3nd person - past: Observing videos of past performances could not only have allowed us to imagine how it would feel for the actor, but could also have given us hard data like how much an actor typically moves on stage in plays for children and how often they address the audience.

3rd person - future: We never made a usability test of the ears. Enacting future use in a controlled laboratory setting could have given us data on movement patterns and technology use.

In addition, we could have done more from a *2nd person – past* perspective. We started our design process trusting the initial requirement given to us by the producer. We could have observed video recordings of earlier similar performances for kids, trying to imagine what it would be like to wear large flapping ears on stage.

Value of point-of-view/tense analysis

The mechanical ears project was successful in that it resulted in a product that was used on stage as intended, and that was well received both by actor and audience. The above analysis has made us aware that we had more design activities at our disposal than we considered at the time. The analysis also made us aware of the extent to which we used our sense for "the feel dimension" [25, 44] (*1st person - present*), even when we were doing what we at that time considered software development, struggling with tweaking the mapping between finger movements and ear flapping.

In hindsight, we see that targeted training in *somaesthetic reflection* and *kinesthetic empathy* could have prepared us better for these aspects of the design process.

Case 2: An Interactive Audio Drama

The interactive audio drama *This must be the place* was conceptualized by the professional actress Rebecka Pershagen, as a location-specific interactive self-biographic audio drama. The piece was developed as an independent art project released in 2014. It was developed to run on a customized mobile app. The app was further developed to host a number of audio dramas with guest writers and actors. The overall concept *Tempus Fugit* received a prize for most innovative new technology in the tourist category for Stockholm in 2015.

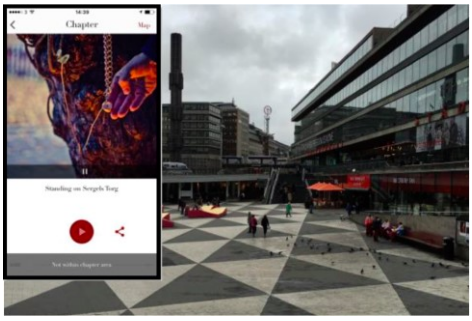

Figure 2. Site and app for the audio drama.

The audio drama is experienced by going to specific places (defined through the phone's GPS API) to listen to each chapter in the story (Figure 2). The story is self-biographic and the places where each chapter takes place are places where the original scene took place. The experience therefore becomes more grounded in the real life of the performer and the audience member can relate and understand the surroundings of the scene better than a non-contextual audio-drama. The story is a love story, where the performer describes a secret affair she had with a well-known person where certain places in the center of the city gained significance to her. The total time for the walk and experience of the audio drama is 30-40 minutes depending on how fast the audience member walks.

Point-of View/ Tense	Past	Present	Future
1st - Me	**1. Concept phase: Accessing past bodily sensations (actress)**	***2. In situ* recordings: Actress going to specific places (actress)**	**3. Development: imagining future use (programmer)**
	5. (users)		
2nd - You	**5. Empathic interview: interviewing audience (researchers)**		
3rd – He/She	**6. Use data analysis: analysing data on use (actress, researchers)**	**4. Analytical observation: observing audience (researchers)**	

Table 4. The design process of case 2.

The application was developed in collaboration between the actress, a programmer, two student researchers, as well as a producer (one of the authors) who oversaw the process. The development of the base application and the creation of the audio drama took place concurrently, which also made it possible to test the app with real audio material. Regular meetings in the team ensured a mutual understanding between the actress, the producer, the researchers and the programmer. The three team members made use of different perspectives in different phases of the project as illustrated in Table 4.

Phase 1. In the first part of the development of the interactive audio drama app, the actress herself recounted her story and wrote a script based on that. During this first conceptual phase, the 1st person approach was of essence to the design and the embodiment of the story through location. The concept being based in the actress' own memory of being at a specific place, made the use of *1st person – past*.

Phase 2. When having a well-developed script, that she had run by colleagues for feedback, the next phase was the act of recording. The actress took the audio drama to the recording level by going to the specific sites and recorded the separate chapters at each original location, bringing the project into *1st person - present*, through the recreation of her memories.

Phase 3. The next step was taking the audio drama app into the hands of a developer to implement it. The developer was the only one who worked on the technical part, programing everything from scratch, for iOS and android phones. The programmer envisioned a future use, but only from his own perspective, because he had no test users yet, making the project stay in *1st person – future*.

Phase 4. After the application was fully developed, two researchers ran user studies of the actual audio drama on the app. They conducted observational studies of users real-time experiencing the drama, utilizing a *3rd person – present* perspective. They followed test users throughout their journey with the app and noted observations of the test people's body language and reactions.

Phase 5. After observing the use of the app from afar, they interviewed the test users, trying to empathize with them, gaining a closer *2nd person - past* perspective. Similar to the other case study, this phase also utilized the 1st person perspective by trying to illicit a personal experience from the participants, and thereby span two cells.

Phase 6. Finally, a data log of all use within the app over several months was generated and given to the actress for her own analysis. She used it to look at how many people had listened to the audio drama and how many had listened to all the chapters or only a subset. This brought the project to reflect on use from a *3rd person – past* perspective.

Filling in the blanks

One way of utilizing the framework for analysis is to look at the blank cells and consider what activities could potentially fill those. We are not claiming that body centered design projects should necessary fill all possible cells in the matrix, but considering the blank ones can illuminate obvious missed opportunities. The first empty cell is *2nd person – present*. One example of activity here could be walking together with the users to gain empathic insight into their experience onsite.

2nd person – future and *3rd person – future* could have been done as various kinds of enactments and user tests with potential users, with both an analytical focus on use patterns and an empathic focus on felt experiences.

Value of point-of-view/tense analysis

Analyzing the project through the lens of the point-of-view/tense framework made us aware that the audio drama was developed particularly from a first person perspective (phases 1 and 2). It was developed from a concept imagined by one individual and then developed without any actual attempt to understand the setting or use cases from second or third person perspectives, until the finished product was ready for release (phases 4, 5 and 6).

Although this does not correspond with standard design thinking methods where the user context is explored first and prototypes developed and tested, this type of product development is not uncommon either [53]. The unique point in our case was that the actress was such a firm believer in the concept that she had no qualms developing it from her personal perspective.

In hindsight one could argue that the process has strong similarities to an art production process, starting out with the first-person experience of the artist, with little involvement of users (audience) until the art piece is presented in a gallery. We therefore find the self-biographical story in the *1st person – past* square, where the actress used her own experiences to write and perform the audio drama.

1st person – present encompasses the producer's perspective and self-understanding of how the application will work and be understood. *1st person - future* is covered by the programmer who envisioned the future use, and programmed the app accordingly.

Concerning skills and needs for skill acquisition, actors are trained in being mindful of their own emotions and reactions. The actor was consequently well prepared for phases 1 and 2. The programmer on the other hand had no such training as preparation for phase 3. Similarly, the researchers had training in field studies, but less on empathic observation (phase 5). Training in *somaesthetic reflection* and *kinesthetic empathy* could have prepared the programmer and the researchers better for these phases.

DISCUSSION

The rationale for conceptualizing the point-of-view / tense matrix for categorizing design activities and skills was not to be prescriptive on method or process, but to provide a language for talking about different ways designers and co-designers can utilize their bodies and lived experiences as resource in body-centered design projects.

For the two design cases presented here, we found it useful in several ways:

- The trajectory of the design phases through the matrix gave a new perspective on the design processes, with its detailed focus on the skills and working modes of designers and other stakeholders.
- The analyses also made us aware of potentials for skill training. Designing for the body is to a large extent not about designing artifacts, but about orchestrating bodily user experiences. For both design cases, we believe that much could have been gained by training in *somaesthetic reflection* and *kinesthetic empathy*.
- By looking at the blank cells in the matrixes for the two cases, it became apparent that alternative design methods could have been applied in the projects. This was for us one of the most important insights from the framework: the lost opportunities for utilizing our and our co-designers' intra- and intersubjective skills and sensitivities.

We acknowledge the limitations of not having validated the framework as a tool in one or more projects from beginning to end. However, as illustrated by recent examples [22, 52], value can come from frameworks that were not validated with new projects at the time of publication.

We have in the design cases made use of methods that rely on verbal accounts, but the results could just as well be drawings or prototypes.

One objection against making the 1st and 2nd person perspectives relevant in body-centered design is the problem of validity and reliability. The further we are from the real bodily user experience of a real user in a real use situation, the more potential threats to validity and reliability exist. Although "3rd person" data, such as accelerometer measurements of user movements, may seem more objective than verbal accounts of how it feels for the user, such data also pose problems of validity and reliability. The data have always been recorded with a focus on certain aspects of the use situation, leaving others out, and they need to be interpreted.

The framework is also not intended to capture all aspects of body-centered design. It has several blind spots that are better dealt with by other frameworks:

- With its focus on the intra-subjective and inter-subjective skills and sensitivities involved in the design process, it does not provide knowledge on how to plan an iterative user-centered design process. A number of frameworks already exist for this purpose (e.g. [5]).
- Further, the framework does not give advice on how to characterize user experiences or structure user data. Others frameworks and methods are useful for this purpose (see [26]).

CONCLUDING REMARKS

To sum up, we argue that there are basically three ways for a designer to relate to his/her body and the bodies of the users´ in body-centered design:

1. Accessing one´s own bodily user experiences through *somaesthetic reflection* (1st person).
2. Gaining insight about the bodily user experiences of the users through *kinesthetic empathy* (2nd person).
3. Being a *detached observer* to oneself and the users (3rd person).

All three stances can be utilized for analyzing the *past*, the *present* and *possible futures*. Based on the insights gained from analyzing our two design cases, we believe that the 3x3 matrix of point-of-view and tense can be of value in the planning, execution and analysis of body-centered design projects.

It is further our belief that the framework can help designers reflect on their own design practice, and on how to improve their own somaesthetic and empathic skills and sensitivities.

To improve and reflect on the framework, we suggest using it in the planning of future body-centered projects, but also in co-reflection on earlier projects.

ACKNOWLEDGEMENTS

We would like to thank all participants in the two design projects, including Rebecka Pershagen and students Martin Solheim, Olivia Lennero and Simson Schweitz.

REFERENCES

[1] Augusto Boal. 2005. *Games for actors and non-actors*. Routledge.

[2] Martin Buber. 1970. I and thou (W. Kaufmann, Trans.). *New York: Charles Scribner's Sons 57*.

[3] Natalie Depraz, Francisco J Varela, and Pierre Vermersch. 2003. *On becoming aware: A pragmatics of experiencing*. John Benjamins Publishing.

[4] John Dewey. 1934. Art as experience. *New York: Minton, Balch, and Company*.

[5] ISO DIS. 2009. 9241-210: 2010. Ergonomics of human system interaction-Part 210: Human-centred design for interactive systems. *International Standardization Organization (ISO). Switzerland*.

[6] Paul Dourish. 2001. *Where the action is*. MIT press Cambridge.

[7] Cumhur Erkut and Sofia Dahl. 2017. Embodied Interaction through Movement in a Course Work. In *Proceedings of the 4th International Conference on Movement Computing* ACM, 23-33.

[8] Yan Fan, Niall W Duncan, Moritz de Greck, and Georg Northoff. 2011. Is there a core neural network in empathy? An fMRI based quantitative meta-analysis. *Neuroscience & Biobehavioral Reviews 35*, 3, 903-911.

[9] Sarah Fdili Alaoui, Thecla Schiphorst, Shannon Cuykendall, Kristin Carlson, Karen Studd, and Karen Bradley. 2015. Strategies for embodied design: The value and challenges of observing movement. In *Proceedings of the 2015 ACM SIGCHI Conference on Creativity and Cognition* ACM, 121-130.

[10] Maiken Hillerup Fogtmann. 2011. Designing with the body in mind: Kinesthetic Empathy Interaction Aarhus School of Architecture.

[11] Vittorio Gallese, Luciano Fadiga, Leonardo Fogassi, and Giacomo Rizzolatti. 2009. Action recognition in the premotor cortex. *Brain 132*, 1685-1689.

[12] William W Gaver. 1991. Technology affordances. In *Proceedings of the SIGCHI conference on Human factors in computing systems* ACM, 79-84.

[13] Eugene T. Gendlin. 1996. Focusing-oriented psychotherapy: A manual of the experiential method. New York, EUA: Guilford. Barcelona, España: Paidós.

[14] James Jerome Gibson. 1966. *The senses considered as perceptual systems*. Houghton-Mifflin.

[15] Eva Hornecker, Paul Marshall, and Jörn Hurtienne. 2017. Locating Theories of Embodiment along Three Axes: 1st–3d Person, Body-Context, Practice-Cognition. In *Proceedings of the Workshop Position Paper for CHI 2017 Workshop on Soma-Based Design Theory, Denver, CO, USA*, 6-11.

[16] Caroline Hummels, Kees C Overbeeke, and Sietske Klooster. 2007. Move to get moved: a search for methods, tools and knowledge to design for expressive and rich movement-based interaction. *Personal and Ubiquitous Computing 11*, 8, 677-690.

[17] Edmund Husserl. 1931. Ideas (WR Boyce Gibson, Trans.) London: George Allen & Unwin.

[18] Kristina Höök. 2018. *Designing with the Body: Somaesthetic Interaction Design*. MIT Press.

[19] Kristina Höök, Baptiste Caramiaux, Cumhur Erkut, Jodi Forlizzi, Nassrin Hajinejad, Michael Haller, Caroline Hummels, C M, Katherine Isbister, Martin Jonsson, George Khut, Lian Loke, Danielle Lottridge, Patrizia Marti, Edward Melcer, Florian Müller, Floyd, Marianne Graves Petersen, Thecla Schiphorst, Elena Segura, Márquez, Anna Ståhl, Dag Svanaes, Jakob Tholander, and Helena Tobiasson. 2018. Embracing First-Person Perspectives in Soma-Based Design. *Informatics 5*, 1 (2018-02-01). DOI= http://dx.doi.org/10.3390/informatics5010008.

[20] 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*, 3131-3142. DOI= http://dx.doi.org/10.1145/2858036.2858583.

[21] Kristina Höök, Marianne Graves Petersen, Baptiste Caramiaux, Cumhur Erkut, Jodi Forlizzi, Nassrin Hajinejad, Michael Haller, Caroline Hummels, Katherine Isbister, and Martin Jonsson. 2018. Embracing First-Person Perspectives in Soma-Based Design. In *Informatics*, 1-26.

[22] Victor Kaptelinin. 2018. Technology and the Givens of Existence: Toward an Existential Inquiry Framework in HCI Research. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* ACM, 270.

[23] Ilpo Koskinen, Katja Battarbee, and Tuuli Mattelmeaki. 2003. *Empathic design*. IT press.

[24] Merlijn Kouprie and Froukje Sleeswijk Visser. 2009. A framework for empathy in design: stepping into and out of the user's life. *Journal of Engineering Design 20*, 5, 437-448.

[25] Astrid Twenebowa Larssen, Toni Robertson, and Jenny Edwards. 2007. The feel dimension of technology interaction: exploring tangibles through movement and touch. In *Proceedings of the 1st international conference on Tangible and embedded interaction* ACM, 271-278.

[26] Effie Lai-Chong Law, Virpi Roto, Marc Hassenzahl, Arnold POS Vermeeren, and Joke Kort. 2009. Understanding, scoping and defining user experience: a survey approach. In *Proceedings of the SIGCHI conference on human factors in computing systems* ACM, 719-728.

[27] Wonjun Lee, Youn-kyung Lim, and Richard Shusterman. 2014. Practicing somaesthetics: exploring its impact on interactive product design ideation In *Proceedings of the 2014 conference on Designing interactive systems - DIS '14*, 1055-1064. DOI= http://dx.doi.org/10.1145/2598510.2598561.

[28] Lian Loke and Toni Robertson. 2013. Moving and making strange. *ACM Transactions on Computer-Human Interaction 20*, 1, 1-25. DOI= http://dx.doi.org/10.1145/2442106.2442113.

[29] Elena Márquez Segura, Laia Turmo Vidal, and Asreen Rostami. 2016. Bodystorming for movement-based interaction design. *Human Technology 12*, 2, 193-251. DOI= http://dx.doi.org/10.17011/ht/urn.201611174655.

[30] Elena Márquez Segura, Laia Turmo Vidal, Asreen Rostami, and Annika Waern. 2016. Embodied Sketching. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems - CHI '16*, 6014-6027. DOI= http://dx.doi.org/10.1145/2858036.2858486.

[31] Maurice Merleau-Ponty. 2013. *Phenomenology of perception*. Routledge.

[32] Florian 'Floyd' Mueller, Richard Byrne, Josh Andres, and Rakesh Patibanda. 2018. Experiencing the Body as Play. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* ACM, 210.

[33] Donald A Norman. 1988. *The psychology of everyday things*. Basic books.

[34] Claudia Núñez-Pacheco and Lian Loke. 2016. Felt-sensing archetypes: Analysing patterns of accessing tacit meaning in design. In *Proceedings of the 28th Australian Conference on Computer-Human Interaction - OzCHI '16*, 462-471. DOI= http://dx.doi.org/10.1145/3010915.3010932.

[35] 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*, 3-4, 229-269.

[36] Søren Bolvig Poulsen and Ulla Thøgersen. 2011. Embodied design thinking: a phenomenological perspective. *CoDesign 7*, 1, 29-44. DOI= http://dx.doi.org/10.1080/15710882.2011.563313.

[37] Dee Reynolds and Matthew Reason. 2012. *Kinesthetic empathy in creative and cultural practices*. Intellect Books.

[38] Thecla Schiphorst. 2011. Self-evidence: applying somatic connoisseurship to experience design. In *CHI'11 extended abstracts on human factors in computing systems* ACM, 145-160.

[39] Donald A Schön. 2017. *The reflective practitioner: How professionals think in action*. Routledge.

[40] Richard Shusterman. 2008. *Body consciousness: A philosophy of mindfulness and somaesthetics*. Cambridge University Press.

[41] Wina Smeenk, Janienke Sturm, and Berry Eggen. 2017. Empathic handover: how would you feel? Handing over dementia experiences and feelings in empathic co-design. *CoDesign*, 1-16.

[42] Wina Smeenk, Oscar Tomico, and Koen van Turnhout. 2016. A systematic analysis of mixed perspectives in empathic design: Not one perspective encompasses all. *International Journal of Design 10*, 2, 31-48.

[43] Jane Fulton Suri. 2001. The next 50 years: future challenges and opportunities for empathy in our science. *Ergonomics 44*, 14, 1278-1289.

[44] Dag Svanaes. 1997. Kinaesthetic thinking: The tacit dimension of interaction design. *Computers in Human Behavior 13*, 4, 443-463.

[45] Dag Svanaes and Martin Solheim. 2016. Wag your tail and flap your ears: The kinesthetic user experience of extending your body. In *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems* ACM, 3778-3779.

[46] Dag Svanæs. 1999. Steps to a Phenomenology of Human-Computer Interaction. *Ph. D. Dissertation, Dept. of Computer Science, Norwegian University of Science Technology, Trondheim, Norway*.

[47] Dag Svanæs. 2013. Interaction design for and with the lived body: Some implications of merleau-

ponty's phenomenology. *ACM Transactions on Computer-Human Interaction 20*, 1, 8.

[48] Oscar Tomico, VO Winthagen, and MMG Van Heist. 2012. Designing for, with or within: 1 st, 2 nd and 3 rd person points of view on designing for systems. In *Proceedings of the 7th Nordic Conference on Human-Computer Interaction: Making Sense Through Design* ACM, 180-188.

[49] Vasiliki Tsaknaki, Madeline Balaam, Anna Ståhl, Pedro Sanches, Charles Windlin, Pavel Karpashevich, and Kristina Höök. 2019. Teaching Soma Design. In *Proceedings of the 2019 on Designing Interactive Systems Conference* ACM, 1237-1249.

[50] Danielle Wilde, Anna Vallgårda, and Oscar Tomico. 2017. Embodied design ideation methods: analysing the power of estrangement. In *Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems* ACM, 5158-5170.

[51] Peter Wright and John McCarthy. 2008. Empathy and experience in HCI. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems* ACM, 637-646.

[52] Jason Wuertz, Sultan A Alharthi, William A Hamilton, Scott Bateman, Carl Gutwin, Anthony Tang, Zachary Toups, and Jessica Hammer. 2018. A Design Framework for Awareness Cues in Distributed Multiplayer Games. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* ACM, 243.

[53] Claudia Zapata. 2015. Integration of usability and agile methodologies: a systematic review. In *International Conference of Design, User Experience, and Usability* Springer, 368-378.

[54] Xiao Zhang and Ron Wakkary. 2014. Understanding the role of designers' personal experiences in interaction design practice. In *Proceedings of the 2014 conference on Designing interactive systems* ACM, 895-904.