Practicing Somaesthetics: Exploring Its Impact on Interactive Product Design Ideation

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ABSTRACT
Somaesthetics has been adapted as a theoretical foundation for explaining the aesthetic experience of interaction. However, the practice of somaesthetics remains relatively unexplored in HCI, and it has potential to improve the ideation process of interactive product design by improving designers and developers' sensibility of haptic, dynamic, and invisible qualities of movements. We introduce somaesthetic reflection, a somatic introspection method in pragmatic somaesthetics, and explore its impact on the ideation through a practical workshop. This study revealed that somaesthetic reflection helps the participants experience and recognize *unconscious movements* and *coordination of movements*, which further contributes to discovery of design issues in the ideation, and more effective experience prototyping of interaction with moving products. The characteristics of the design approaches found in this study are discussed.

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Somaesthetics; product design; design method; somaesthetic reflection; movement-based interaction

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H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
Somaesthetics [41, 42, 43], an interdisciplinary field of theory and practice grounded in pragmatist philosophy with the focus on the attunement of the body-mind or soma, has been adapted as a theoretical foundation for several experience-centered approaches to interaction. Wright et al. [48] developed a dialogical and holistic approach to design of aesthetic experience based on the pragmatist aesthetics of Dewey [4] and Shusterman [41]. Somaesthetics' interactionist perspective regarding aesthetic qualities, which explains the aesthetic quality in terms of the interaction between the user and the artifact, form the ground for conceptualizing aesthetic interaction [31], interaction gestalt [20] and interactivity attributes [16, 21, 22]. The impact of somaesthetics can also be found in applications, especially art installations which place bodily engagement at the core of their contents. It has motivated research to explore physically engaging mobile services [45, 46] and to develop artworks that trigger reflection on bodily movements and physiological status [23, 27, 35, 36, 37, 38]. Ferreira and Höök used somaesthetics as a basic frame for understanding the physical burden around mobile device usage in their ethnographic study [8].

Current applications of somaesthetics in HCI tend to focus on borrowing its perspective and concepts for explaining the nature of our bodily perceptions and practices, which can be seen as an influence of analytic somaesthetics [41].

However, somaesthetics' two other branches (so far hardly studied in HCI) have the potential to be incorporated in this field as a part of design practice. One is pragmatic somaesthetics, which involves developing specific methods of somatic improvement. It formulates and critically analyzes methods to enhance our somatic sensibility. The other is practical somaesthetics, which involves the actual 'doing' part of somatic improvement. In Shusterman's words, it is "engaging in programs of disciplined, reflective, corporeal practice aimed at somatic self-improvement" [44]. Thus, somaesthetics can offer not only theoretical frameworks, but also methods and practices for cultivating our somatic sensibility.

Practicing somaesthetics has the potential to improve the ideation process of interactive product design. A recent trend in product design appreciates tangible aesthetics and movement-based interaction [5, 6, 13], emphasizing functional, corporeal and emotional aspects of movement to design for beauty, fun, comfort, or excitement in use. It also resonates with the works in HCI which accentuate in-depth bodily engagement [1, 28, 34].

Crafting the experience of such bodily interaction requires aesthetic sensibility of haptic, dynamic, proprioceptive, and other invisible qualities, and developing such a "sense of quality" is considered to be an important part of interaction

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design ability [10, 25]. Along with this, there is a growing interest in developing tools and methods that help designers capture, articulate movement qualities and design expressive movement-based interaction [3, 9, 15, 19, 24, 32, 38, 39]. These methods take phenomenological approaches related to dance and somatics [11, 26, 40], and they are distinguished from theater-based techniques [2, 30, 33] like role playing and improvisation by deliberately focusing on the felt experience of movements.

The potential that we see here is that the practice of somaesthetics could be a means to help designers develop the sense of those qualities, and utilize that sensibility for designing. As Noë [29] puts it: "what we perceive is determined by what we do or what we know how to do", the importance of tools and methods for quality perception is critical [17, 25].

In this context, we examine whether and how the practice of somaesthetics can influence the interactive product design ideation process through a workshop that we carefully structured for this exploration. Particularly we introduce somaesthetic reflection, an introspection method in pragmatic somaesthetics, as a main object of our exploration. We also discuss in depth the characteristics of design approaches that the workshop participants used.

SOMAESTHETIC REFLECTION

Somaesthetic reflection [43] involves the method of somatic introspection, by which we mean an organized inward-looking inquiry by the individual about his or her bodily perception and its related affective experiences. It aims to heighten somatic awareness. In this study, somaesthetic reflection is regarded as a means to help designers develop the sensibility of aesthetic experience of bodily interaction.

Somaesthetic reflection is guided by six strategies that Shusterman derived from William James' psychology [14] and Feldenkrais Method [7]. These strategies serve to heighten attention and interest:

1) *Questions*: Asking questions about different aspects and relations of what we perceive.
2) *Division into parts*: Subdividing the body and directing our attention to each part, one by one.
3) *Contrasts of feeling:* Discriminating the different feelings in one part from those in another.
4) *Associative interests:* Making the noticing of what we are trying more precisely to feel a key to something we care about.
5) *Avoiding distracting interests*: Warding off competing interests to what we are trying to attend to and feel.
6) *Pre-perception*: Preparing our attention to notice what we are trying to discriminate in what we feel.

This set of strategies provides us with a systematic way to enhance our sensibility of sensory experience. It deals with how to direct our attention to perceptions and appreciate them in detail. Equally important, it explains how our whole body and mind can be *immersed* in a particular mode of inquiry by considering our interest in what we perceive, our readiness or anticipation for what we expect soon to perceive, and our exclusion of distractions caused by the external environment.

There are several reasons that somaesthetic reflection is particularly suitable for the interactive product design context. Firstly, the reflection strategies do not exclusively deal with the body but also deal with the context and situation that the introspector lies in. Secondly, the object of reflection is not limited to the internal feelings. Somaesthetic reflection also appreciates the tactile and kinesthetic qualities that we perceive when moving or contacting with external objects. Thirdly, the reflection strategies guide us to consider how our awareness of what the artifacts and the environment do to our somatic feelings could shape the experience of interacting with them. This has not been fully addressed in existing approaches based on dance and somatics [23, 24, 38]. These characteristics of somaesthetic reflection enable reflection on an individual's solo body movements as well as on bodily interaction with physical products and even with other individuals.

Somaesthetic reflection is not narrowly standardized to a specific sequence of bodily actions; it needs to be planned for the particular context where it is performed, based on the strategies. It can be done in many different situations as long as we can control our attention.

WORKSHOP

In this section, we present how we structured and conducted our workshop aimed at exploring the impact of somaesthetic reflection on interactive product design ideation.

Since our trial was the first to integrate somaesthetic reflection into the design process, it was important to observe the impact of somaesthetic reflection on ideation purely. For that, minimizing the influence of irrelevant activities was an important issue, and we needed the subjects to be willingly immersed in somaesthetic reflection and the design process for a certain period. We also wanted them to be free from the constraints relevant to stakeholders' interests which are common in commercial projects. Thus, we chose the workshop as our study format.

Structuring the Workshop

To explore the impact of somaesthetic reflection on interactive product design ideation, the structure of performing somaesthetic reflection followed by ideation was the essential logic for our workshop. Since what our participants actually experience in real time from somaesthetic reflection is momentary and subjective, we faced a critical problem of identifying whether and how

those experiences were used in the ideation. To solve this, we introduced an activity for externalizing the somatic experiences between somaesthetic reflection and ideation. Thus, the workshop was composed of three essential steps, namely *training, sharing*, and *enacting*. The following paragraphs explain the rationale behind this structuring at each step.

Training

The first step was *training*, doing somaesthetic reflection to enhance somatic sensibility. As mentioned previously, somaesthetic reflection is not standardized to a specific sequence of bodily actions. In our trial, Richard Shusterman, who originally established somaesthetics, planned and led the training session to ensure the best possible benefit from somaesthetic reflection. The sequence of somaesthetic reflection that we used was intended to cultivate the somatic sensibility in general, rather than to support designing particular forms or movements of product. The specific sequence is stated in the next section.

Sharing

The second step was *sharing*, verbalizing within a design team what they felt from somaesthetic reflection. As mentioned above, what the participants can feel from the somaesthetic reflection is a momentary and subjective experience that cannot be easily noticed by other people, and we could not predict whether or how they would externalize it. What we mean by subjective experience includes comfort and felt quality of movements, physical fatigue, emotional arousal, and any perceivable changes in proprioception and other feelings.

Once subjective experience (at least some aspects of it) is put into words, the words become a strong conceptual tool for communicating and reprocessing the experience; with the words, a design team can easily share an idea about the experience, relate other ideas to it, and make sense of it within their ideation context. Through the verbalization, we could also ensure that those experiences were shared and reviewed as design resources. We did not provide further specific guidelines for verbalization because the way the participants capture, express, and use their subjective experiences could inform how their ideation proceeded.

Enacting

The last step was *enacting,* exploring design ideas by "doing". We required a skit about the final design idea at the end of the session in order to encourage the designers to explore the kinesthetic and emotional dimensions of movements in detail. We also instructed individual designers to choose their own design approaches, activities, and materials in order to examine the impact of somaesthetic reflection in a natural setting. We provided various materials for sketch drawing and low-fidelity prototyping. We also set up the space for designers to freely move around, and work either at the table or on the floor.

Settings

We recruited designers and engineers in fields relevant to designing and developing intelligent and interactive products, 16 graduate students from KAIST(Korea Advanced Institute of Science and Technology) who have been researching for 1 to 6 years. Out of 16, 13 were industrial designers, but their educational background and expertise are diverse including product design, interaction design, robot design, and architecture. The other three were robot engineers from the mechanical engineering department. None of them were professionally trained in the field of dance, somatics, martial arts, or music.

The design theme we explored was *cooperative movements*. We wanted to address how we can create more comfortable, pleasurable and natural physical interaction between a user's moving body and an artifact (which can also be moving). We expected that this theme would encourage the participants to consider the physical forces between the two elements in interaction and how the user and the artifact move in relation to each other. This theme was also considered suitable for exploring movement from not only visual, but also tactile and proprioceptive perspectives.

We asked our participants to design an interactive product with *cooperative movement* features, and to present its use scenario by performing a skit. We did not specify any product types in order to promote more open exploration and to motivate them to use their own expertise and interests.

The workshop was held for two full days in the summer of 2012, each day from AM 10:00 to PM 06:00, at KAIST. Table 1 shows the full schedule. Each day had two training sessions. Both days' training sessions were similar in structure but sequential, the second building on lessons from the first. The second day's experience focused on the reverse body side of the first day. Placing one night between those two training sessions was designed to allow the participants to experience for a longer time the strong feeling of somatic asymmetry that was created the first day and then relieved by the second day's other-side lessons to restore the balance.

At the start of the first training session, the trainer briefly lectured about somaesthetic reflection and explained the six strategies of somaesthetic reflection. The training started with *body scanning*, a type of somaesthetic reflection without any voluntary physical movements (Fig. 1-a).

At first, each participant laid down on a yoga mat with their eyes closed. This helps participants focus on their bodily sensations by liberating them from visual information and efforts to maintain or change their postures, which is based on the fifth reflection strategy, *avoiding distracting interests*.

Then, they were verbally guided to consciously concentrate on a particular body part, and then another. This started from the extremities to the core, for example, from the left

heel (where there is contact with the ground), the left big toe, moving on to the next toes, the sole, the ankle, the calf, the knee, and the thigh. Then they examined their feelings of the core (pelvis, spinal vertebrae, ribs, shoulders), head and neck area, and then the arms and fingers.

	DAY1	DAY2
10:00AM-	Day 1 Training I	Day 2 Training I
12:00PM-	Lunch	Lunch
01:00PM-	Day 1 Training II	Day 2 Training II
02:40PM-	Sharing	Sharing
03:00PM-	Break	Break
03:20PM-	Design Session Introduction	Enacting
03:40PM-	Enacting	
05:00PM- 06:00PM	Skit / Day 1 Closing	Skit/ Day 2 Closing

Table 1. Workshop Schedule

Participants were asked to be conscious of what they feel in one body part (both through inner proprioception and from the contact with the external environment, i.e. floor, air) and compare it to the feelings of other body parts. Frequently asked questions include how this body part makes contact with the external environment, how it is connected to other body parts, which part feels longer, which part feels heavier, how much space there is between the body parts, and how comfortable it feels. Such a process is also based on the reflection strategies like *Questions, Division into Parts,* and *Contrasts of Feeling.*

The next lesson of somaesthetic reflection was performed with physical movements (Fig. 1-b). The participants lay on their left side, moved their hands slowly within a very small range, and then gradually expanded their movements to feel the connections between body parts and how they moved together. The exercise emphasized the feeling of harmony between breathing, limb, and core (torso) movement. After that they walked around slowly to feel the difference between both sides of their bodies (Fig. 1-c). The movements were easy and slow and required no special knowledge to execute. Again, the participants were verbally guided to notice bodily feelings in a given body part and compare them with the feelings of other parts. Nevertheless, the training session required participants' attentive and active involvement.

Figure 1. a) body scanning, b) somaesthetic reflection with movements, c) somaesthetic reflection with walking (from top to bottom)

After that, three to four participants formed a team, which made four teams in total, and moved onto *sharing* and *enacting* sessions as explained above.

After the workshop, we conducted a questionnaire to collect reports about individual somaesthetic training experiences through e-mail. The two main questions were:

- Whether they sincerely followed the instructions
- Whether they experienced any change in the perception of the body during the training

We also conducted debriefing interviews team by team in person to scrutinize how they developed their design ideas in relation with the training experiences. One of the authors showed them the posters and the prototypes they made to help them recall their experiences. The half-structured inquiry took about 30 minutes for each team, and the main questions concerned:

- Overall design process
- Experiences from the training that they shared/verbalized in the sharing session
- Whether or how they utilized those experiences for design

RESULTS

We present our discoveries from the workshop in the following four sub-sections. First, we summarize each team's idea development process to provide an overview of how they interpreted and applied what they learned from somaesthetic reflection in exploring their own specific design object in various ways. Other three sub-sections delineate what kinds of movement quality recognition and idea exploration the somaesthetic reflection triggered through each step of the workshop. We explain them in detail in each sub-section.

The findings are elicited from our qualitative analysis of the data from the questionnaire, debriefing interview, and observation of the workshop. We obtained responses from seven participants through the online questionnaire, and interviewed ten participants. We categorized the transcribed interview data and questionnaire responses to training, sharing, and enacting, according to the workshop steps, and put it through iterative coding to uncover further issues. To maintain objectivity, we counted the influence of somaesthetic reflection only when the participants explicitly mentioned it. We translated all the excerpts shown in this paper to English.

How Each Idea Was Developed

Team 1: Drift Cart

Team 1's concept was "Drift Cart," a cart designed to be easy to turn and empty. The cart detects changes in the user's center of weight, and tilts as if drifting when the user tries to change direction. This feature is based on what participants learned from the training: that they were not previously conscious of the different movements of their body parts in turning, that their body parts are connected in movement in a coordinated way, and that the quality of movement can be improved by consciously improving that coordination. To develop the idea, they acted out the user and the cart in pairs, with the cart improvising reactions based on the user's posture and actions.

Team 2: Illumaet

Team 2's concept was "llumaet," a mat that senses its user's activities and changes the lighting by moving the light wirelessly connected to it. From the training (where they spent many hours lying, sitting, and moving on mats), they recognized they are not conscious of all their movements do, and they decided to explore the mat as an input device, which detects both conscious and unconscious movements of the person on it. They experienced the coordination of the body too, as Team 1 did, and they extended this idea to movement-based interaction with a remote object, lighting. They explored a number of lighting effects created by the movement of the light in relation with the movement of the user, relying mainly on their imagination. The scenario they presented include the lighting that traces the book the user is reading, swings as the user dances, and changes its direction as the user falls asleep to create indirect light.

Team 3: UP

Team 3's concept was "UP", a bed that wakes up the person with gentle reactive physical movements. Also inspired by the coordination of the body, they explored the sub-design theme of reaction: physically triggering enjoyable whole body movement. They did improvisational acting to feel and explore such movement. One person played the user, while another person moved the mat to prop up the user player from different parts with different movement qualities.

Team 4: Incraddible

Team 4's concept was "Incraddible," interpersonal haptic communication between a driving mom in the front seat and her baby in the back seat; when the mom touches the steering wheel with a pre-defined gesture, the baby seat moves according to the gesture type. They could not say clearly how they perceived their bodies differently after the training, but they said the experience of somaesthetic reflection was influential to their design; it led them to consider the movement and shape of the safety belt. Overall, they focused on utilizing the baby blanket metaphor in driving context; they tried to deliver cuddling, swaying, and bouncing actions through the movement of baby seat. They also explored the emotional aspect of remote haptic communication; one of their major concerns was which gestures of the mom are natural and effective for giving herself the feeling that she takes care of the baby when driving.

Training: Somatic Insights and Its Influence on Design Ideation Process

Here we examine what kinds of recognition about the body status and movements were enabled by the somaesthetic reflection based on what the participants mentioned. We could identify that they recognized and experienced that the actual effective performing of a movement involves a number of body parts in coordination, even though one's consciousness in making a voluntary movement is usually directed only to the particular body part one wills to move. The importance of such somatic insights is not only in that they intellectually understood the nature of the body more deeply, but also in that, more importantly, they *experienced* it through the body, and those experiences provided the ground for important design ideas and decision-makings as the ideation proceeds.

Consciousness of Parts, not the Whole Body

The participants all recognized that we are usually conscious of a few number of body parts, not the body as a whole. Participant 1 in team1, P1(1), pointed out that his team began to feel the unconscious movements that the body performs: *"We thought we all knew how to move the body, but we felt there are a lot more things happening (in our body) but we don't really know what they are" (verse 1_48).* He also realized that body movement is not completely at will at the very moment of moving, but is

shaped by learning: *"I thought, of course, I can move my body as I wish. I am not disabled. Now I understand my movements are the result of my learning and practices" (questionnaire).*

Participants also learned to focus their attention more closely on one body part. Participant 3 in team1, P1(3), described this with various metaphors: *"The body scanning was quite effective. It made me feel that sensors are moving around my body. As the focus moves on and scans the body, it was like my consciousness is separated from myself, like I am watching myself" (questionnaire)*. P4(2) clarified that what he experienced was about intentional control of attention: *"I felt it was different from Qigong or meditations. It's not about feeling the energy or something, and I learned how to sharpen my attention to feel the body" (questionnaire)*. Those phrases convinced us that they experienced *consciousness of body parts* from body-scanning.

This experience directly influenced Teams 1 and 2's designs to detect habitual movements and provide somatic comfort. When we want to turn a cart, we just want to turn the cart; we are not usually conscious of how we push the cart with each hand and arm or step with each foot. Team 1's cart design focused on detecting such habitual movements to facilitate turning. Team 2's mat also dealt with habitual movements of the user, such as changing the angle of a book when reading, to optimize the angle of the lighting according to the user's posture.

Coordination

As aforementioned, *coordination* of the body, by which we mean how a body movement is achieved by multiple body parts connecting and interacting with each other in a functionally organized, harmonious way, was another common experience among the participants. P1(3) responded that she recognized *"how each part of the body can cooperate to move."* P2(1) mentioned that she could feel that performing a movement is not exclusively moving one body part but moving the connected and organized whole: *"When I perform a certain movement with the body, not only the directly related parts are moving, but a number of parts of the body are influencing and interacting with each other. It was impressive to me because I vaguely knew it before, but I could actually feel it while I was doing it" (questionnaire)."*

Every team explicitly mentioned that they experienced the *coordination* and it contributed to their design idea development. Team 1 tried to apply the idea that "*as one thing moves then others should follow that, and they move all together (verse1_171)*" to coordinate the movements of the cart and the user's body as if those movements are of one entity. Team 2 considered "*the connectivity in use, how it (the system) can move in a closer relationship (with the user) (verse2_165)*" to specify the movements of the smart lighting. Team 3 focused on *"applying reaction, (…) just like we crouch before running, what we wanted to do was… a movement that triggers users to do the kind of movement they want in the opposite way"* based on their interpretation of the *coordination*. Lastly, Team 4 tried to design the in-car haptic communication with concentrating on the "*movements and gestures that captured the bodily connection between a mother and her child. (questionnaire)"*

We could not specify which part of the training enabled the participants to experience the *coordination* from the verbal script. We suspect that it is because all the lessons in the training deal with *coordination* in movement, directing attention to how each body part interacts with other body parts in performing the movement and showing how attention can improve the coordination and then use it to make the movements smoother, easier, and more enjoyable.

This finding is in an intriguing relationship with the previous one, because they tell us that our movements involve a large number of body parts but we can be clearly conscious only of some of them at a given time. Thus, it is important to deliberately consider how each part of our body moves and how their movements are organized for understanding and imagining the whole body movements fully.

Sharing: From Articulation of Somatic Experiences to Design Issue Identification

The sharing session's original goal was to provide the participants a chance to externalize their subjective corporeal experiences. Therefore we can say that the findings in the previous section already showed that its goal was achieved in some degree. Beyond that, we also identified the role of sharing the experience as a *design issue identifier*, which shows how verbalization of invisible, dynamic, and corporeal qualities of movement can help the design process.

We could observe that not all participants delivered detailed verbalization about their own experiences from the somaesthetic reflection. P4(1) stated that "*It was interesting to truly evaluate our body in a very specific and analytical way through our minds and perception.*" and "*After the training sessions, there was something quite different about my body.*". P4(2), and P4(3) mentioned that the change in their proprioception is confusing and unclear. Compared to P1(1), P2(1), and P3(1)'s description in the previous section, most of these phrases echo the verbal instructions given in the training sessions without any further specificity or particularity. It is not clear whether those who did not articulate their feelings in depth were less successfully sensitized or they just regarded their experiential changes as not worth mentioning.

However, sharing sometimes provided the root of further specific design considerations. Team 1 started with sharing fragments of experience like P1(3): "*After the (training) sessions, when we talked about it, it was awkward, and we*

said, this was strange here, or here it felt peculiar to be in touch with something, (…) in the beginning, we said 'I can't see how it's related to design.' (verse1_36-38)".

As their reflection proceeded, they could verbalize their experiences in a more organized way as *consciousness of parts*. Such interpretation led them to come up with a design issue, as P1(1) described: "*We thought maybe there are some products that we use and we think we are comfortable with, but actually they are not, so we did think about… what are they… and the problems (relevant). (verse1_49)*" The process of this design issue identification was not obvious at first.

We suspect that verbalizing and sharing experiences facilitated their interpretation of those experiences, which discovered design issues to tackle.

Enacting: Qualities and Context of Movements in Acting out the User and the Artifact

Team 1 and 3, who actively and effectively explored the movement qualities with their bodies, mainly used improvisation, and acted out two interactive agents, the user and the artifact (Fig.2 and 3). We explain the characteristics of such experience prototyping in detail.

Firstly, acting out these two agents enables prototyping of unexpected experiences. It is directly related to the sixth strategy of somaesthetic reflection introduced before, *pre-perception*. Team1's Drift Cart concept needed to seamlessly follow the user's body movement so that the user remains unaware of the cart's movement. In the case of Team3, the user of UP is supposed to be sleeping; the user player should not be able to predict when the bed is going to push him or her up. The team can only re-create such situations when the user player is free from thinking about the artifact. Such unexpectedness is especially important in designing haptic experience which is regarded to be intimate and personal.

Secondly, it facilitates the ideation based on instant two-way communication. In team1's case, the seamless integration of the cart's and the user's movement is to be achieved by wordless signs and signals [12], delicate detecting through the body and reacting instantly to its movement. To deal with such subtle 'bodily conversation', acting out the two agents can be an effective way for seeing how the user's felt experience will be in relation with what the artifact will do to the user.

Acting out as an artifact is not solely dependent upon cartoonish imagination. In our cases, it involves carefully considering the qualities and context of performed actions by both agents. It also involves physically touching or moving other people. Thus cultural and safety issues need to be considered. Moreover, such acting out could provide initial ideas for exploring movements from the system perspective [24].

Figure 2. Team1's skit – Drift Cart

Figure 3. Team3's skit sequence – UP: the man standing on the right side is playing the artifact role (by moving the mat), and the man on the mat is playing the user role. In their experience prototyping, they tried various movement qualities of the mat to craft the sensory and emotional experience of getting up reactively.

DISCUSSIONS

Holistic Exploration of Corporeal and Emotional Quality of Movements for Utility and "Experience"

As shown in the results section, during the ideation process the participants recognized and explored the corporeal and emotional quality of movements holistically. For instance, Team4 explored the gesture not only as an input medium but also as a means for provoking particular feelings to the mover. However the primary focus of the design theme given to them, cooperative movement, does not explicitly address emotional aspects. This type of exploration could be partly induced by somaesthetic reflection, since it encourages them to appreciate the holistic quality of felt experience, rejecting the Cartesian dichotomy of body and mind.

The holistic exploration of movements seems to result in an interesting pattern in design ideas. A noteworthy commonality among the design ideas suggested from our study is reconciliation between utility and experience of movement quality. For example, in Team 1's design, the tilting feature of Drift Cart facilitates changing directions and provides more a comfortable kinesthetic experience. In Team 3's design, the reactive movement of UP helps the user to get up and triggers an enjoyable movement experience. More studies of this kind would confirm whether and how somaesthetic reflection influenced such holistic exploration.

In a similar context, the harmonization between interaction aesthetics and usability was already addressed [6]. Our study adds design cases that show how such "design for bodily engagement and the expressiveness of product movements" [6] can be promoted by the practice of somaesthetics in detail.

Reorganization of Movements: Design for Interaction between the Moving Body and the Moving Artifact

Tracking how the experience of *coordination* in the somaesthetic training influenced each team's idea development process revealed approaches for designing whole body interaction with a moving physical artifact. We call this *reorganization* because the focus is on changes in the coordinated *sequence of movements* throughout the whole body rather than exclusively on particular body parts. This shares the underlying perspective on movements with Loke et al. [24]. We present two types of this approach, *following the sequence,* and *triggering the sequence*.

Following the Sequence

This approach is to make an artifact follow the user's movement sequence. It is about providing passive physical support with the movement of the artifact so that the user can more easily perform desirable movements with it. For example, in Team 1's Drift Cart concept, tilting the cart according to the user's body movement was a way to create the quality of comfort when turning the cart.

Triggering the Sequence

This approach is to trigger the user to perform a certain movement sequence. Here, the initial triggering action that the artifact exerts is different from the resulting movements that the user happens to perform. It is derived from Team 3's design concept UP; once the bed bounces up the user's knees, the user can enjoyably raise up the upper body in reaction.

Experience-centered Design and Corporeal Empathy

Our contribution to design for aesthetic experience reflects the pragmatist perspective, underlining the value of somatic experience. Even among the experience-centered design researchers, the soma's felt sensory experience has been largely neglected [19, 48]; it has been dialogically conceptualized [47, 48] rather than experientially crafted.

This study suggests a way to promote somatic empathy with a user in *a particular situation*. Our point is not simulating disabled or elderly people with additional equipment. It is about meticulously considering the somatic conditions that we usually blur in the name of 'situational, contextual factors', and directly experiencing those conditions: user's posture, attention, anticipation, and the physical interaction going on between the body and the surroundings. Such emphasis on somatic experiences distinguishes our study from bodystorming and other similar approaches [2, 30, 39].

We can get a clearer idea of this by reflecting on an example reported in existing research. In Lee and Lim's study about utilizing heat as an interpersonal communication medium [18], they introduced an example from their in-situ prototyping study that a child could not even tell whether he received warmness or coldness once he got distracted by the surroundings.

What it implies here is that if we do not properly understand the user's somaesthetic condition (bodily and mental altogether), we might end up failing in delivering the experience that we intended. We believe improved somatic empathy (through heightened body consciousness) could improve our ideation not only in movement-based interaction but in any interaction that deeply engages our body.

Suggestions from the Participants: Themes for Further Exploration with Somaesthetic Reflection

P3(1), a robot designer, mentioned that somaesthetic reflection could provide a valuable approach to deal with the 'uncanny valley' problem by helping us appreciate the *coordination* of the body. She explained: "*If a robot looks like a human and it doesn't match people's expectation about its human-likeness, it feels creepy. In robot design, we call it 'uncanny valley'. (...) we don't just move the arm alone, consciously or unconsciously we move the core (torso) too, but the robot doesn't. I think that's why their movement is awkward, (...) so I think, if we consider this*

process, then the movement could be much more realistic and natural. (verse3_195-197)".

P2(4), a robot engineer, mentioned that energy efficiency is critical in designing the movement of humanoids. He added that the *coordination* of the body could be a good starting point of developing a new approach for designing energy efficient movements.

CONCLUSIONS

We explored how somaesthetic reflection could influence the interactive product design ideation process, particularly in the context of applying movement-based interaction to everyday product design. For this exploration, we designed a workshop with three semi-structured stages, *training, sharing*, and *enacting*. Through this, we aimed to see whether and how designers could develop and use their sensibility of movement qualities during their ideation.

Our analysis revealed that somaesthetic reflection can cultivate designers' sensibility of movement qualities in ways that enable them to consider *unconscious* movements and how multiple body parts are *coordinated* to perform a movement. We also discovered two benefits from the enhanced sensibility in the ideation process; verbalization of the somatic experiences can promote further discovery of design issues, and deliberate consideration of the role of two interactive agents (user and artifact) and the somatic conditions of the user can lead to more effective experience prototyping of interaction with moving products.

We discussed how somaesthetic reflection helped the participants holistically explore corporeal and emotional aspects of movement experience and eventually consider in a common vision both utility and movement experience. We also presented the *reorganization of movement* approach which could be particularly beneficial in designing interaction between the moving body and the moving artifact.

Cultivating sensibility or awareness to movements is known to require considerable efforts [7]. Thus, it would be valuable to investigate what the impact of a long-term practice of somaesthetics would be for design ideation and other aspects of design. Developing a pedagogical program or an idea exploration method also seems promising.

We hope that our exploration and the discoveries that we introduced can accelerate further the exploration of movement-based interaction in everyday product design contexts, and in general HCI.

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