DESIGNING FOR PARTICIPATORY SENSEMAKING

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ABSTRACT

In this Research-through-Design investigation we explore the value of embodiment *for social interaction in collaborative settings, and how to support - rather than suppress or ignore – embodiment with interactive technology. We use Participatory Sensemaking (De Jaegher & Di Paolo, 2007), a theory which explains sensemaking as continuous embodied interactions between people in a shared action space. We discuss three prototypes supporting Participatory Sensemaking. We describe how our understanding of participatory sensemaking evolved through (reflections on) design. The first product creates tangible access to moments of reflection in group conversations. We came to understand the tangibles as traces of individual reflection, which become publicly observable and actionable within social interaction. In our second prototype we designed traces as floor-projections dynamically connected to people's body movements. The system mediates the social positioning of session participants. The final system integrates our earlier insights in a dialogue tool for two people. Here participatory sensemaking shows itself as a skill with special emphasis on the sensuality of mutual contact. We end with a more general reflection on how design can contribute to theoretical analysis through iterations of designing and observing what interactive artefacts concretely do within the full complexity of human practices.*

Keywords: Participatory Sensemaking, Embodiment, Design, Interaction, Sensorimotor Coupling, Social Coordination, Tools, Collaboration

1   INTRODUCTION

'We must therefore rediscover, after the natural world, the social world, not as an object or sum of objects, but as a permanent field or dimension of existence: I may well turn away from it, but not cease to be situated relatively to it.'
Merleau-Ponty 1962, p. 421

As designers-researchers we investigate *embodied* theories of human sensemaking (Merleau-Ponty, 1962; Suchman, 2007; Dreyfus, 2002) and we do so *through* design (Overbeeke et al, 2006). We do not use embodied theory merely to inform or inspire design: by analysing the designed artefact and its role in real-world practices we aim to refine and adapt the theory as well. In this paper we explore the notion of Participatory Sensemaking (De Jaegher & Di Paolo, 2007) in the concrete, that is, in terms of designing interactive systems in support of this process in real-world contexts. In order to introduce Participatory Sensemaking, we first sketch the general idea of embodiment.

2   EMBODIMENT

Our *embodied* perspective (Van Dijk et al, 2014) is inspired by phenomenology (Merleau-Ponty, 1962; Varela, et al 1991), Ecological Psychology (Gibson, 1979) Embodied Cognition theory (Clark, 1997) and Situated Cognition (Suchman, 2007; Rogoff & Lave, 1984). Cognition, or sensemaking, is conceived in terms of how people are always already *dealing with* the world, and how, in

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the course of that dealing, certain aspects show up as meaningful objects: meaning is 'enacted' (Varela et al, 1991). It asks how we *live* our world, rather than how we 'represent' it internally. *Making sense* essentially means 'getting a better grip' on what one is doing (Merleau-Ponty, 1962; Dreyfus, 2002). It relates to what Ryle called *knowing-how*, which is to be distinguished from 'knowing-that' (Ryle, 1949). According to the theory, facts, ideas, and even the most abstract forms of knowledge are ultimately grounded in embodied skills, in our 'knowing-how'. (Ryle, 1949; Dreyfus, 2002).

Embodied sensemaking is characterized both by ongoing loops of sensing and acting, which we call 'sensorimotor coupling' (Van Dijk et al, 2014), and by the ever present social context: our 'social situatedness' (ibid). We discuss each of these in turn.

2.1 SENSORIMOTOR COUPLING

Ongoing sensorimotor activity leads to temporary *couplings* of perception and action, which results in our 'grip' on the world, (Merleau-Ponty, 1962; Dreyfus, 2002). Instead of a sequential model, where perceptual input is processed in the brain to cause behavioural output, flows of action and perception evolve in parallel as *coupled systems* (De Jaegher & Di Paolo, 2007). I.e. what we see determines what we do, what we do determines what we see (Gibson, 1979). Importantly, aspects of the environment itself will be drawn into the loop and help to create and sustain couplings. For example, tools become part of our skilled dealings up until the point they can be said to be extended aspects of the body itself – which is when tools become 'transparent' in use (Heidegger, 1927).

2.2 SOCIAL SITUATEDNESS

Sensorimotor couplings are not purely individual relations with the physical environment: we always act within a *social situation* in which we relate to 'others'. Whether others are physically present or not, we are always already enmeshed in a network of social relations that make us act in terms of social norms and values. As Rogoff and Lave put it:

'Central to… everyday … cognitive activity … is interaction with other people … cognitive activity is socially defined, interpreted, and supported. People … guided by social norms… set goals, negotiate appropriate means and assist each other in implementing the means and resetting the goals as activities evolve. … Immediate social interactional context structures individual cognitive activity'. (Rogoff & Lave, 1984, p. 4).

Social situatedness extends from interaction with actual people to the way we perceive the tangible consequences of action: a coffee cup left on a table is immediately perceived as 'being left by someone', which makes every physical object that figures in human activities always a social object as well. In our present-day (Western) society our 'natural' habitat consists almost exclusively of such of man-made environments (Rogoff & Lave, 1984).

A recent theory explicitly attempts to unite the social and the sensorimotor aspect of sensemaking (De Jaegher & Di Paolo, 2007), to which we turn now.

3   PARTICIPATORY SENSEMAKING

For De Jaegher and Di Paolo (2007), sensemaking is the natural activity of an organism that tries to sustain its own identity in a dynamic environment:

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"An organism that regulates its coupling with the environment does so because [it aims at] the continuity of the self-generated identity …. [S]ense-making is an inherently active concept. Organisms do not passively receive information from their environments …they actively participate in the generation of meaning in what matters to them; they enact a world. (De Jaegher & Di Paolo, 2007, p. 488)".

In interactions with others, sensemaking becomes a *participatory* process grounded in embodied action, in a shared space. Instead of "a detached individual trying to figure out the other", the idea is that social interaction is a coordination between two or mode individuals. The coordination in turn influences the individual behaviours of the participants:

"As an activity, sense-making is intentional and expressive; it is directly affected by the coordination of movements in interaction. Indeed, the activities of sense-making may themselves become coordinated. If regulation of social coupling takes place through coordination of movements, and if movements – including utterances – are the tools of sense-making, then our proposal is: social agents can coordinate their sense-making in social encounters. …This is what we call participatory sense-making: the coordination of intentional activity in interaction. (ibid, p. 497)"

These ideas are supported by ethnographical work of for instance Goodwin, who shows the importance of bodily position and action in the way people together make sense of work or play (Goodwin, 2000).

In what follows we describe three projects, each building on the previous, that make concrete the notion of Participatory Sensemaking in the design of interactive tools that support creative conversations. Our initial aim was to explore the value of embodiment for designing collaborative tools. This general question evolved into the more explicit question of how to design for Participatory Sensemaking. The aim is first to make the abstract theory concrete at the tangible level of human-product interactions, leading to principles for designers of collaborative tools. Secondly, the particular role that the technology takes up in interaction with users will give further insight as to the role of external artefacts in Participatory Sensemaking.

4   RESEARCH APPROACH

In our Research-through-Design approach (Frayling, 1993; Koskinen et al, 2011), design, user study and theoretical reflection alternated over several iterations (Van Dijk & Van der Lugt, 2013). Theory is seen as a 'stakeholder', competing with other stakeholders in the context of an actual project where multiple interests compete in making design choices. Six stakeholder companies and organizations (a large design agency, a brainstorm facilitation company, two brainstorm room facilities, a city council and two engineering educations) provided the contexts-of-practice and participated in the co-design- and research activities. These included ethnographical analysis of people using various prototypes in natural settings, as well as generative workshops involving stakeholders (Buur & Matthews, 2008).

Theoretical reflection analysed design choices and resulting prototypes in terms of how design operationalized the theory 'in practice', what new design space is opened up by the theory as well as how the design process may inform further refinements or adaptations of the theory itself.

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5   CASE I: COUPLINGS AND TRACES

Figure 1. Participants in a brainstorm using NOOT. Further details in text.

NOOT consists of a set of tangible clips with RFID, a dispenser tray and a wireless 'play-back horn', placed in a physical meeting space. As people discuss ideas and insights, the conversation is recorded continuously. Grabbing a clip from the tray functions to *mark the moment*. (See figure 1). Technically this puts a time-stamp in the audio-file which is connected to the tangible. The idea here is to temporarily 'hold on' to the moment, in order to be able to return to it late. The clip can be placed anywhere in the physical space. Approaching the clip with the horn causes play-back of the audio-file starting ten seconds before the marked moment.

5.1 INTERMEDIATE REFLECTION

Ethnographical observation revealed that the clips do not so much 'store' insights. Rather *marking a moment* is an embodied routine, by which people acknowledge the emergence of a new line of thought, temporarily put it away, and where the physical clip is an invitation in the environment to pick up on it again later. In other words, the clip functions to temporarily suspend, and later reinitiate a *sensorimotor coupling*. In contrast, if we interpreted the system as creating *external representations* of internal thoughts, design would focus on the nature and form that this representation can take. Will it be text-based? How to search in the database? How to organize and present representations? Does the system do summaries? As the system came to support sensorimotor couplings, the focus was on the action dynamics: How does the system afford action? How does it create new ways of perceiving?

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At the end of the project we came to use the word *traces* to refer to the tangible results people leave in the creative space, such as NOOT clips stuck on the wall. Traces come out of, and figure in sensorimotor couplings, but they are also public and therefore mediate social interactions as well. For example, I may see that you grab a NOOT clip while I am speaking, which triggers a reflection in me: what did I just say that made you grab that clip? We elaborate on this in the next case.

6   CASE II: TRACES FOR SOCIAL COORDINATION

Figure 2. Floor-It. Details in text.

Floor-It consists of a large floor projection where photographs, taken by participants in a brainstorm, form personal circles that move along with one's body. Participants can enlarge, reorganize and flip orientation of the pictures in support of the conversation (See figure 2).

6.1 INTERMEDIATE REFLECTION

Initial co-design workshops with companies resulted in a strong focus on the social: relations and interactions between people proved to be crucial for the success or failure in creative meetings. In user studies we observed how bodily orientation and interactions between people and floor pictures mediated this

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social level relating. Using nonverbal signs such as pointing, people refer to their pictures not just to convey information, but also to make themselves heard, take turns, weave their own line of thought into that of others: in other words, a coordination process (De Jaegher & Di Paolo, 2007). Importantly, this coordination process was mediated by bodily interactions with external artefacts: the traces on the floor (See Goodwin, 2000).

Interestingly, the coordination process entailed a *micropolitics*, in which sensemaking became equivalent with the process of 'finding your position' – literally and metaphorically - relative to other participants in the group. In other words, collaborative sensemaking is all about how people relate to each other *as people*, where 'the other' is not just a 'source of information' but a person with which one engaged in a social relation, a relation sustained by bodily interactions.

The insights so far operationalize Participatory Sensemaking as being grounded both in sensorimotor couplings and in social coordination, where these two aspects are interlinked by bodily interactions with tangible *traces* in the public space. The micropolitics we observed lead us to further explore how external artefacts can help people be 'in touch' with other people *as people*.

7 CASE III: SKILLFUL TOUCHING

The Design & Sensemaking (D&S) Studio is developed for two-person design workshops to envision future societies and explore new directions for innovative product-service systems. The D&S Studio consists of a stage with tangible interactive objects to boost engagement and develop concepts, a RFID scanner with RFID stickers to connect digital content to physical scaffolds, and a set of iPads, iPods, a local server and a database to store and access digital information next to recording and retrieving the workshop sessions. These recordings (audio, video, and RFID time-stamped markers) are for use during the session as well as afterwards to inspire others and for ones own recollection. The physical character of the D&S studio facilitates the social coordination process between the two participants through their sensorimotor skills (See figure 3).

7.1 INTERMEDIATE REFLECTION

The D&S Studio is based on physical objects to boost engagement via so-called Engagement Catalysers (Trotto and Hummels, 2013) and to boost imagination through our Ideating in Skills toolkit. In researching the effect of emphasizing physical interaction and skill-based interaction, we observed how close physical interaction through Engagement Catalysers speeds up the social process. Playfulness, ambiguity, open-endedness, subtlety, sensitivity, and unavoidability were elements for the participants to get to know each other on the base of how they related to the world, and not through categories (titles, job description, family situation, income, origin, …). Most of the participants started to relate to each other in an open way, completely ignoring (or overtaking) etiquette boundaries, and laughing and physically playing with each other like only kids do generally. Regarding the results of the workshop, we observed that the physicality became an important part of the solution. The physical qualities of the toolset were incorporated in the design concept. Moreover, the sensemaking process was amazingly fast. The participants came within 15 - 20 minutes to acted-out concepts for complex design brief, such as enhancing the social fabric

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of neighbourhoods through product-service systems. Other experiments showed similar results and a clear difference between a bodily approach (bodystorming) and a more indirect approach (brainstorming) regarding attitude and outcome (Jaasma et al., 2014). Starting from physical interaction, including actual physical contact, seems to boost and speed-up the participatory sensemaking process.

Figure 3. The D&S studio. Details in text.

8   DISCUSSION

The concept of Participatory Sensemaking explains how people actively make sense together in concrete physical-social situations. It may guide the design of artefacts that support both the social- *and* the sensorimotor aspect of sensemaking, in a unified manner. By reflecting on how Participatory Sensemaking took concrete forms in our artefacts we were able to touch on some issues that may help to further develop the theory, to which we turn next.

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8.1 TOOLS MANAGE SENSORIMOTOR COUPLINGS

Tools designed to support (collaborative) sensemaking often provide *external representation* (Clark, 1997). The idea is to help people 'offload' internal processing to objects in the environment (Kirsh, 2010) which then can be shared. Instead, our tools support *sensorimotor couplings*. To use Suchman's terminology, they function "to orient or position ourselves in a way that will allow us, through local interactions, to exploit some contingencies of our environment and avoid others."(Suchman, 2007, p.185)

8.2 TRACES BIND SENSORIMOTOR COUPLING TO SOCIAL INTERACTION

Traces are generated *by* sensorimotor interactions of individual people, which, when left in the environment, are picked up by (other) people in order to guide further sensemaking activity. As such, traces are both part of an individual sensemaking intention as well as an invitation for others to respond and connect. This is why we believe traces can be very powerful in supporting participatory sensemaking.

8.3 PARTICIPATORY SENSEMAKING AS EMBODIED MICROPOLITICS.

Dealing with traces in a social context is not a value-free exchange of information messages: interaction with a trace is a *personal expression* by which someone *positions herself in relation to others*. This finding aligns with the idea of sensemaking as the process in which learning to deal with certain objects goes hand in hand with becoming a member of a community of practice. As Lave puts it (in the context of learning):

"I … consider learning not as a process of socially shared cognition that results in the end in the internalization of knowledge by individuals, but as the process of becoming a member of a sustained community of practice. Developing an identity as a member of a community and becoming knowledgeably skillful are part of the same process, with the former motivating, shaping, and giving meaning to the latter' (Lave, 1991, p. 65)."

We see opportunities for artefacts that cater for such skilled social activity, the use of which enables every participant to become recognized as a valuable member of a community.

8.4 TOUCHING EACH OTHER

In the final study we became aware of the special value of *literally* touching each other, for which a certain playfulness and the overcoming of etiquette needed to be catalysed first with our tools. Touching a body is a very special, sensual form of interaction that is always immediately meaningful, while at the same time it seems furthest removed from the idea of sensemaking as a form of 'information exchange'. We speculate that touching each other may be the strongest form of Participatory Sensemaking, where bodily posture, gesture, gaze, speech and the public manipulation of external artefacts are its derived forms.

8.5 DIRECTIONS FOR DESIGN

In summary, we invite designers to create:

- *Artefacts that* manage sensorimotor couplings

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- T*races* that are both part of individual sensorimotor loops as well as being publicly shared with others
- Artefacts and spaces enabling *realtime social coordination* by which people make sense together in a shared action space
- Artefacts which cater embodied micropolitics, by which every participant becomes recognized as a valuable member of a community.
- T*ools* enabling *skillful and sensual ways of connecting.*

8.6 MAKING SENSE OF SOME*ONE* OR MAKINGS SENSE OF SOME*THING*

De Jaegher & Di Paolo present sensorimotor dynamics as the basis for a theory on 'social cognition'. This suggests the explanatory goal is to show primarily how people understand each other (albeit rejecting classical theories on the subject, De Jaegher & Di Paolo, 2007). We see the connection between social coupling and sensorimotor coupling essentially running both ways: if you and I are skillfully dealing with an artefact positioned between us, this may help us to connect to each other *as people*, but equally so, the social coordination ensuing from our shared activity may help us to understand, not so much 'each other', but some*thing*, viz. whatever it is that we are engaged with (e.g. a creative challenge). In fact, we suggest that both 'directions' are actually part of one and the same holistic process that is Participatory Sensemaking: getting a grip on each other through doing things together, means at the same time that together we get a grip on what it is we are doing. De Jaegher & Di Paolo hint at this bidirectional causality when they state:

 "[In] a joint process of sense-making. …[t]he phases of action and perception typically used to describe individual sense-making now acquire collective aspects and sense is created through the stabilization of patterns of joint activity. … novel meanings may be established in interaction. (De Jaegher & Di Paolo, 2007, p. 500)"

We dare to speculate that in most cases this joint process of sensemaking is the norm rather than the exception, and that it forms the starting point rather than a final state: individual sense-making develops out of joint sensemaking (as when I suddenly see new sense in my own talk after I notice you marking what I just said with a NOOT clip, see case I, section 5, above).

8.7 HOW TO DEAL WITH EXTERNAL REPRESENTATION

In this section we briefly discuss the issue of external representation. Embodied Cognition theory is either very critical of representation (Chemero, 2009), or tries to hold on to it as an ultimate basis for the cognitive machinery (Clark, 1997). As designers, we found ourselves trying to get away from traditional representational forms such as information screens, icons, text; searching for more direct technological mediations of sensing, acting and social coordination. Yet, in todays world, representation is ubiquitous, and so our artefacts, which evolved in real project settings with external stakeholders, always contained representations in some form (recorded speech, photographs, movies, etc.).

So, the question before us is what to do with representational forms, from the perspective of Participatory Sensemaking. To us, it matters most what representational *artefacts actually do* in human practice. Their role in social coordination is analysed by ethnomethodology (Suchman, 2007). However, since we design physical objects with interactive properties, we need to know more about how they relate to sensorimotor coupling and bodily skills as well (Van Dijk et al, 2013).

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Historically, one could argue that out of our most basic embodied and situated activities, representational artefacts evolved, along with cultural practices such as formal education, the practice of writing, systems of rules, laws, and the like (Malafouris, 2007). As such, representational artefacts can be seen to create an extra control loop, as it were, piggy-backing on embodied and situated couplings (Clancey, 1993). On the other hand, representational artefacts evolved in close alignment with *disembodied* theories and methods in science. The computer is the prime artefact developed together with disembodied theories of mind (Clancey, 1993). Following this one could argue that interaction with technology based on representation draws us out of our more natural embodied being-in-the-world. The traditional graphical interface may serve to illustrate how interaction design has a tendency to neglect our embodiment.

In practice the question is not whetjer, but *how* to incorporate representation in design. Representation does not need to be design's Alpha and Omega, it can play a more modest role. We encourage going beyond a straightforward representation of a task mapped onto the form and behaviors of a device. Deliberately trying to avoid representation may be a useful strategy opening up new opportunities, leading to new kinds of products that a focus on representation would easily overlook.

The question is what *can* the role be of external representations such as pictures, words and schema's, in the context of Participatory Sensemaking. We have not fully resolved this question yet. Our designs at least suggest a rethinking of what icons, text, image, picture, movie, visualisation, graph, and so on actually (should) *do*, when reconceptualised as elements within a larger, participatory sensemaking activity. For starters, we suggest to seriously rethink the role of the 'screen', that physical boundary which mercilessly separates its artificial, 'digital content' from 'the rest of the world' as we live it. (cf. Janlert & Stolterman, 2014). Further research is much needed on whether and how screens should figure within Participatory Sensemaking practices.

8.8 METHODOLOGICAL DIRECTIONS: DESIGN AS A TOOL IN THEORY DEVELOPMENT

We end by reflecting on our approach: Research-through-design. Given an embodied perspective on human sensemaking, understanding how human engage with designed artefacts seems relevant, as the creation and dealing with man-made artefacts (either crafted tools or on-the-fly created *traces*) are assumed to play a crucial role in embodied sensemaking (Kirsh, 2010; Hutchins, 1995). Moreover, the complexity and contextuality of embodied sensemaking makes it that studying a person in isolation, in a predefined laboratory task, will be insufficient to fully grasp the nuanced ways in which people create meaning in interaction in real-world contexts. In discussing methods required to study participatory sensemaking, De Jaegher and Di Paolo state:

"High level of participation in sense-making [is] ubiquitous. It happens in all kinds of human social contacts to the extent that it is rather difficult to see. Many obvious cases come to mind (e.g., collaborating in a joint research project, reaching an agreement after group negotiation, …). But these examples are hard to unpack. To illustrate participatory sense-making, we must drastically reduce the complexity of the situation. (p. 500)"

However, Research-through-Design may complement experimental studies without the need to reduce complexity in traditional ways. Confronting the theory with the messy reality of designing for real practices, and iteratively operationalizing the evolving insight into a prototype; an 'ultimate particular'

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(Stolterman, 2008), provides a grip on a phenomenon without having to reduce real-world situations into lab-friendly toy problems. Design interventions, which probe human practices and enable assessing their resulting transformation, can complement standard experimental methods. Furthermore, present-day sensing and actuating technologies can be used to create artefacts that are more 'bodily extensions' (augmenting our sensory systems and action repertoire) than use-objects (E.g. Stienstra et al, 2012). Design may also produce *ambiguous* artefacts that live along a dimension ranging from 'being part of my body' to 'a social object mediating interactions between people'. As a tentative example, Floor-It (case II) for instance can be seen both as an *mediating space between people* as well as a *bodily extension of each participant*.

In general spirit of Braitenberg's classic concept of a 'synthetic psychology' (Braitenberg, 1984), we claim that designing artefacts and assessing their appropriation in complex real-world situations should have its proper place in methods of researching human cognition and behavior. In all, our studies attempt to bring theory and practice – meaning both design practice as well as human 'praxis' as close together as possible, with the hope of a cross-fertilization that is fruitful for both fields.

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