Tactile augmentation: Reaching for tacit knowledge

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Abstract

The experiential knowledge of a practice lives within the practitioner and is out of reach for an outsider researcher. Only when practitioners have intrinsic motivation in researching their practice, can experiential knowledge reach an outside audience. The present case study is an attempt to access some of the issues forming the embodied knowledge in the act of throwing clay on a potter’s wheel. One of the researchers attempts to augment her tactile sensitivity and awareness by throwing porcelain clay blindfolded for five days. Her experience is documented and reflected upon through diaries, a contextual activity sampling system (CASS) and videos that includes thinking aloud accounts. The tentative findings reveal that the researcher was able to articulate her tactile experiences and share her experiential knowledge to a great degree. Patterns in the making, such as dividing hands into categories of active and perceiving, and metaphorical language use was identified that may be of value in an educational setting. Feelings were acknowledged as major contributors to risk assessment and decision-making in the material problem solving process.

Keywords:
Tactile augmentation; Clay; Experiential knowledge; Practice-led research, Embodiment.

It is in the interest of design research to gain access to the practice of skilled practitioners and to articulate in-depth knowledge from within the field. The embodiment of skills and materials is evident in professionals, and the theoretical and conceptual work on the issue of embodiment is sophisticated (Varela et al.1991; Merleau-Ponty 2002; Johnson 1987; Lakoff & Johnson 1999), but there is still little empirical research applying the work to documented design practices (Seitamaa-Hakkarainen et al., 2013). Ways of studying the making from the makers’ point of view has been discussed in the relatively young tradition of practice-led research (Frayling, 1993; Candy, 2006; Niedderer, 2007; Mäkelä & Routarinne, 2006; Pedgely, 2007; Niedderer & Reilly 2010; Nimkulrat, 2012). Method such as diaries and thinking aloud accounts are now supplemented by event sampling methods (ESM) (Seitamaa-Hakkarainen et al., 2013.)

The use of practice-led research methods has become increasingly common among practitioners in art, craft and design who wish to document, reflect and research on their own practice (for examples see AHRB 2007). The discussion on how to research in art
and design is still vibrant (Mäkelä et al., 2011; Candy, 2006). One major contribution in the field of experiential knowledge in practice-led research, is made by Kristina Niederrer (Niederrer, 2009; Niedderer & Reilly, 2010.) In this paper, we use a practice-led approach as a setting where the process of making, rather than the artefact, is in focus (Candy, 2006).

Practice-led research emphasises the reflection of experiential knowledge that the practitioner embodies. In his book, *The reflective practitioner*, Schön (1991 76) encourages the practitioner to *reflect in action* in order to get access to this knowledge. Nigel Cross (1982 5) supports this idea in his claim that there is a particular designerly way of knowing that is inherent in the designer, the process and the products themselves, and that can be gained through reflecting on one’s activity. Owain Pedgely (2007) admits that the multiple roles of the researcher and the respondent are complicated and that the results might be biased when having a subjective research setting. Therefore he argues for the importance of multiple data collection methods in order to triangulate data and results.

In our research, both qualitative and quantitative data, introspection and visual documentation, is collected and triangulated as supported by Norman Denzin and Yvonna Lincoln (2008, 5) in their handbook on qualitative research, where such a multimethod is seen as an attempt to secure an in-depth understanding about the phenomena. According to Pedgely, a practice-led research setting provides a suitable platform for investigating areas of interest that the conventional research methods may not be able to access (2007). As practitioners and researchers, we are able to do autoethnographic research about our own practice, and in this way we are able to articulate intrinsic knowledge from inside the field of design. This is also the position from which we argue throughout this paper - even though from this point onwards, we will call ourselves purely ‘researchers’.

In this present case, one of the researchers challenged herself with a demanding task related to her field of expertise. She used the act of throwing clay on a wheel as a tool for a tactual interface with the material and as a way of creating an event where making takes place. In addition, to augment the tactual experience, the visual modality was omitted through blindfolding. The main issue for the task was the challenge and control of the throwing process and the awareness of, or ability to judge the shape and form of the piece solely with her hands. Through this exercise, we aimed to collect data and analyse the embodied experiences of the researcher.

The researcher documented and analysed her own activity, experiences and emotions through the combination of three methods: 1) a diary method for qualitative data, 2) a contextual activity sample system (CASS) query for contextual and quantitative data, and 3) video recordings for visual data and ‘thinking aloud accounts’. In this case study tactual augmentation by blindfolding was used to enhance tactual awareness and making tactile sensory experiences more explicit. In the following, we will introduce the research setting. Then we explain the methodological framework and present the case. Finally, we discuss the interim analysis process and the tentative results.

**Research in a studio setting**
One of the researchers spent five days working blindfolded in her studio recording one clay-throwing event daily. Each event consisted of throwing 12 kg and later 24 kg of porcelain clay on a potter’s wheel and lasted 1 1/2 – 2 hours. All the events were video recorded, which also enabled ‘thinking aloud accounts’ made by the researcher while working. In addition to video and related thinking aloud accounts, the researcher made a diary entry just before and just after each of the throwing sessions. The CASS query was also entered in connection to the event and consisted of 12 questions to answer before the event and 10 questions to answer after the event.

Using thinking aloud accounts (Ericsson & Simon, 1993) we are able to track the cognitive processes of an individual during an activity, as the method provides content-rich information about, for example, solving a design task (Akin, 1986; Goel, 1995 217; Seitamaa-Hakkarainen & Hakkarainen, 2001). In our case, thinking aloud accounts were combined with video documentation as the researcher spoke to the video camera while performing her task. In this research setting the method also enabled capturing various aspects of the actual activity and later to analytically reflecting on actual experiences. Especially critical incidents (Flanagan 1954) were actively reflected on in the talking aloud accounts. To enable triangulation, the data was supplemented with the diary and the Contextual Activity Sampling System (CASS) query.

The diary method is a well-established way of collecting autoethnographical data (Bolger et al., 2003; Chang, 2003). The value of the method has also been recognised in the art and design field, especially when the practice-led research approach is applied. It allows the maker-researcher to document features related to her creative process and in addition, it provides a medium for analytically reflecting on her process (Mäkelä & Nimkulrat 2011). The diary has been used in diverse ways (Pedgley, 2007; Mäkelä, 2003, 2003; Turpeinen, 2005; Nimkulrat 2009; Mäkelä, 2011; Kosonen & Mäkelä, 2012).

Usually, the diary is entered regularly along side the working and thinking process documenting the whole creative process from initial thoughts to the final outcome - including drawings, images and text, test results, personal experiences, or feelings. In our case, we utilise the method in a more formal way as the researcher entered the diary before and after the events of throwing, answering a set of questions. The questions before the event encouraged describing the challenges faced and the emotions related to the upcoming event. The questions after the event encouraged describing the success or failure of the event and elaborating on the critical incidents that facilitated or hindered the process and related emotions. In the analysis skill emerged as the dominant theme of the diary text, second was challenge followed by material and emotions. Evaluation of the process, critical incidents and problem solving constituted the bulk of the text with some room for environment and conditions.

The third method used was the Contextual Activity Sampling System (CASS) (Muukkonen, et al. 2008). CASS is a research instrument under development that uses 3G mobile phones for sampling various aspects of learning, designing or making in their actual context of occurrence. Event sampling is a generic term, which refers to the research strategy for studying on-going daily experiences as they occur in everyday life (Reis & Gable, 2000). The richness of the data collection captures occurring events, experiences, emotions or social activities at specified time intervals depending on the
focus of the study. The event sampling method is new in the study of design practices (Seitamaa-Hakkarainen et al. 2013). For our case, we developed a specific set of questions that were answered during the actual event through entering the CASS query sent twice daily to the researcher’s mobile phone.

Figure 1. CASS application query on mobile phone, 08.04.2013. Photo by Camilla Groth.

The query consisted of 22 Likert type structured questions, which called for ratings according to a seven-step scale as well as open questions and instructions for taking photos (Figure 1). The questions 1, 3, 4 and 21 related to the query of the context of physical space. The researcher was requested to respond to questions concerning the place she was working in, to evaluate how well the place supported her work and to photograph the space. Questions 2, 5, and 6, were related to physical tools and instruments as well as used materials i.e. tool and material space. For the mental space questions 7-14 and 20, we utilized part of Jackson and Marsh’s (1996) ‘Flow state scale’ as we were interested in the mental states that the researcher passed between during the events. Questions (15-19) were related to the particular interest of this research i.e. the ability to control the material and to augment the tactile ability. Question 22 enquired about the collaboration the researcher had, with whom she was interacting and how or if it supported her work (i.e., social space). The entire query was designed to be completed in 5-10 minutes. The CASS data captures occurring experiences and emotions at specified time intervals - in this case - the ability to control the material and to augment the tactile ability. CASS query data is quantitative data and can be presented in flow charts; however, due to the small sample size we were here not able to perform any larger statistical analysis. Feelings were being elaborated on also in the diary but presented in a flow chart through the CASS data, as will be presented later in the paper.

**Throwing clay blindfolded**

Although the researcher is a proficient thrower, throwing blindfolded was a new experience for her. Except for the pilot study related to this case (Groth et. al, 2013), the researcher had not tried to throw blindfolded and the event was on the limits of her skills.
The main challenge of throwing a large amount of porcelain on a wheel in general is the fact that porcelain is not very plastic and therefore difficult to throw. The researcher had chosen porcelain as her material for this experiment in order to yet enhance the tactual experience. For judging the result of the event the researcher aimed at throwing a straight cylinder that would meet the aesthetic and technical criteria used commonly within the community of potters (Dormer, 1994 18). In this section, we give an account on how the chosen exercise proceeded. It is based on the data collection as explained in the previous section. By triangulation of the collected data, we aim to reveal the embodied knowledge of a craft process in this case throwing clay. We seek to articulate some of the tacit knowledge involved in the making process and we explore tactile augmentation and its benefits in connection to knowledge making. We will start with excerpts from the diary.

Figure 2. The researcher throwing blindfolded. Screenshot from the video.

**Insights from the diary**

On the first day, before starting her first throwing task, the researcher reports her feelings in the diary before the event:

‘I must admit I’m a bit nervous. I don’t really want to fail in throwing a 12-kilo porcelain cylinder on my potters wheel, which is my task today and every day of this week.’ (First day morning diary. Monday, April 8, at 10.15)

Over the period of five days, the events went smoothly, with some disruptions in the process. All events were successfully documented with the three data collection methods. On the first day, the requirements of the task were not met, and the result was a failure.
As the researcher reflected on her activity in the diary she was able to give quite an exact account of what had happened with the clay even though she had been blindfolded during the whole activity. Mistakes were analysed and problem solving occurred both in the making and in the reflection on the making. The tactual memory (see Nicholas 2010 13) became a tool in the attempt to “see” through the hands. It was important to remember the felt sensation of the shape in order to judge how to act in the next movement. There was also a new sensation in the way that her hands conveyed a “false” size of the piece to her mind. Before starting her second day task, she notes in the diary:

‘I’m ready for today’s challenge and am determined to concentrate better and to respect the material and the centrifugal power. I will strive for to “see” the piece better through my hands, try to sharpen my tactile memory if possible.’ (Second day morning diary, Tuesday, April 9, at 10.00)

Already the second day the researcher found herself more comfortable with the situation of not seeing what she was doing while working on the wheel. There was still a gap between her understanding about the shape and the real shape when taking off her blindfold. The thinking aloud accounts, taken during the video recording of the event, give a description of what the researcher is doing and what she is thinking at the different points of making. Although at first it was a step out of the researchers comfort zone to start talking out into the empty studio:

‘About talking to the camera while working, it feels much more natural now than yesterday. I feel that it is useful because I would otherwise never remember exactly afterwards what I was thinking while I was working. It also keeps my mind with me as I am aware of what I am doing all the time.’ (Second day afternoon diary, Tuesday, April 9, at 12.30)

After succeeding with her task on the third day, there is a clear increase in confidence and positive spirit. The researcher is redefining her goals, as she feels confident that she can master an additional challenge, and decides to double the amount of clay for the next day.

On the fourth day, the added challenge affects the researchers feelings and adds an equal amount of nervousness and slight uncomfort. Now that the challenge was to throw an even larger amount of clay, the additional challenge of keeping aesthetic preferences on a
high level seemed overwhelming. But for the motivation it was still essential, as the researcher would not be content with just meeting technical criteria. In her fourth day diary, she refers to the aesthetic criteria in the context of good craftsmanship:

‘I managed what I set out to do, to centre and to throw an amount of clay weighing 24kg into a shape that I felt was aesthetically pleasing and was meeting technical requirements of skill. But the shape was not the intended cylinder.’ (Fourth day afternoon diary, Thursday, April 11, at 13.15)

The event was hindered by several critical incidents that followed on each other and complicated the successful end of the event. But the feeling of being able to handle the material blindfolded is still reflected on in a positive manner.

The challenges for the fifth and last day of the case study are laid out in the morning diary:

‘I’m excited but fear that I am not feeling concentrated enough at this point. But taking it bit-by-bit, concentration may build up later through the centring process. I just have to remember to keep feeling actively with my hands and fingers and keeping the overall memory of the piece present in my tactual understanding. And enjoy.’ (Fifth day morning diary, Saturday, April 13, at 11.00)
Although the aesthetic criterion of throwing a straight cylinder was not achieved during the last day, the technical criterion was met, and although there were critical incidents, these did not hinder the outcome of the event. Feelings were caught up with through the process of making and confidence grew during the unfolding of the event. The reflections in the diary did not reveal much detail of particular actions and even less about the sensory experiences, but highlighted the emotional aspects. The challenges and the decision-making and problem solving were at the forefront in the diary. So were the emotions that initiated motivations for adjusting the actions and behaviour in a more beneficial direction. The CASS query was also a good tool for capturing feelings and moods along the events.

**Capturing the mental space**

Two CASS questionnaires, ten in total, were answered each day. Some of the results of the mental space section of the afternoon queries are displayed in figure 1, showing for example positive and negative feelings, comfort in working blindfolded and feelings of clumsiness, over the five days of events.

![Cass chart over mental space result during five day pilot tactile augmentation](image)

**Figure 1. CASS data: Mental space section of the afternoon queries.**

As the result of the first day’s throwing session was a failure, this was reflected in the low mood of the afternoon CASS query. Despite this, orientation and the ability to find tools around the throwing wheel were experienced as surprisingly positive. The feeling of clumsiness, gaining low scores means that there was less feeling of clumsiness as the question is posed in a negative way. On the fourth day, the added challenge of doubling the amount of clay is shown in a dip of spirits. Otherwise there is an over all synchrony in the curves over the five days with a tendency towards more positive experiences in the end of the time period. The feeling of clumsiness is higher as the challenge grows and demands are higher but still the ability to feel the shape is on a high level on the last day.
Reflections on the analysis process

As we collected reflections in action and reflections on action – together with diary notes after the event, the analysis is partly situated within the knowledge production process. Analysis is often an evolving process starting in the mind of the researcher already in the midst of collecting the data, as the researcher starts to see patterns of knowledge forming. Especially in the case where the researcher is already an expert in the practice she is researching, it is impossible to exclude the embodied knowledge of the subject of research. In this research this is an asset as we aimed at exposing exactly this insider’s knowledge. The video recordings of the events serve as a living memory from which the researcher may reactivate also sensory experiences and embodied knowing about the time of collecting the data. It may be hard to differentiate the real memory of that particular event with countless other memories from similar experiences. On the other hand, the embodiment of a skill is depending on this bulk of information processed through the body countless times (Sennett 2008 38) and as a video of one event can make the researcher recall the sensory experiences she usually has in a similar situation these reflections may also be of interest.

For the purpose of creating rigorous research also from autoethnographic and self-analytic processes it was still important to find a suitable analytical frame that includes the messiness of self-reflection, the particulars of sensory experience and at the same time facilitating a credible and systematic analysis. Therefore in addition to the reflective analysis of the researcher that allowed for the sensory data to speak its voice, we used the qualitative analysis program Atlas Ti for the diary data. The thinking aloud accounts are partly analysed through protocol analysis i.e. we analysed the first and last video and related thinking aloud accounts by transcribing the accounts and making notes on the actions and sensory experiences connected to the spoken accounts.

Thinking aloud accounts have been criticised for affecting the performance of the subject, and that the accounts would be incomplete or irrelevant (Cross et al. 1996 2). Through this case, we found that these verbal accounts, situated within the making process, were valuable in capturing in particular the emotions that were not seen in the actions of the video. The accounts gave detailed explanations on what the researcher was thinking and doing and why it was necessary to make those actions. Together with the CASS data and the diaries, our research included multiple types of data that shed light on the studied activity from many directions. The resulting artefacts are documents of the events and as such part of the research data. (figure 6).

![Finished pieces each day](figure6.jpg)

Day 1  Day 2  Day 3  Day 4  Day 5

Figure 6. Finished pieces each day. 8-13.04.13. Photos by Camilla Groth.

While transcribing the thinking aloud accounts that were expected to consist mostly of references to the actions made, accumulating text material describing sensory
experiences started to emerge. While the verbal account had not yet even started, the reflection on actions and particularly on sensory experiences were already filling the transcript page. Since the researcher herself had acted in the situation, her experiential knowledge was intact in her body. When she looked at the video recorded data, she could detect her breathing rhythm in connection with muscle straining in the actions. While the thinking aloud accounts only states ‘Mmmmmph’ at the same time the following sensory experience account emerged:

‘Pushing the clay hard from the sides with both hands, arms stretched unsupported in the air, straining belly and upper back. Keeping the breath until the release of the pressure.’ (Sensory experience account 18:38 minutes into throwing on the fifth day.)

Consequently the transcribing process elicited the need to make a third column that consisted of the researcher’s reflection on action. The third column deepened the transcript process to include more specific sensory experiences, such as orientation, temperature, sounds, wetness, stickiness of the clay surface and muscle pressure that would not be known to any other researcher than the maker herself (see figure 7).

Figure 7. Screenshot of the video transcript process. 10.10.2013.

The researcher experienced that she knew more than she could say, at the time of making. The protocol analysis gave a possibility to reflect on the events in slowmotion, following each second of the video and writing out all that the information she felt she had about that instance, without having to control the material in a making situation simultaneously. As the video transcript advanced, the researcher discovered a pattern in relation to her way of using her hands. She named her left hand the ‘looking hand’ as she used it for keeping track of where the clay was on the board and seldom let go of the clay to use for other purposes. She named the right hand the ‘acting hand’, as it would be the
one used for taking more water, using tools like the sponge or the needle, reaching for new clay or adjusting the speed of the throwing wheel. Also other metaphors for how the clay felt and how the clay should be treated emerged:

'(The clay)...feels like a pregnant belly that should not be pressed too hard'
(Transcript of thinking aloud account 06:35 minutes into throwing on the fifth day.)

These insights may be developed into an account for teaching through metaphors and visual language in an educational setting. The ability to “see” with the hands grew in only five days.’ A verbal account from the first day video transcript reveals some of the sensory experience of throwing clay blindfolded at the beginning of the event:

'I know what the shape feels like but I have no idea what it looks like. I cannot see with my hands. It's a different world. It's a different...I don't know...perception. Just feeling. I guess the feeling does only exist in the feeling world, or something, and the visual world is now not here. But I know what it should feel like when it's done.'
(Transcript of talking aloud account 20:43 minutes into throwing on the first day.)

On the last day the diary account reveals a different attitude:

'I felt almost full control of what I was doing, only sometimes I really felt like taking the scarf off my eyes to do a reality check. But then my hands convinced me I had sufficient information to continue blindfolded.' (Fifth day afternoon diary, Saturday, April 13, at 14.15)

**Tactile knowing**

Blind touch has been a topic of interest in many different professions, not the least in philosophy (Merleau-Ponty, 2002 267) but also in anthropology (Ingold, 2004). In architecture blind touch and the awareness of the space and atmosphere may be helped by the knowledge of blind that take the tactile experience into consideration in a more concrete manner (Vermeersch, 2011; Pallasmaa, 2005 20). Also in this case we seek to understand that special skill of accumulated sensuous awareness in the making process of a clay vessel thrown on a wheel. Are we able to reach, and do we benefit from a heightened tactile awareness? Surely through the accumulation on skill in normal conditions the sensory awareness needed for that skill is accumulated naturally. Here we try to add an extra sensory awareness of the much taken for granted tactile sense. In addition to this, the challenge of throwing an unusually large amount of clay on the wheel is pursued in the hopes of enhancing the tactile experiences and to point out more clearly the special events and critical incidents occurring.

In the process of working with the material, from centring the clay on the wheel and towards pulling up the sides of the cylinder the researcher experienced that there were not many choices to be made. The concept of affordances, based on Gibson's (1979) ecological psychology, involves possible actions in the environment and the situation that the actor may recognize as opportunities. The affordance of the throwing situation guided the explorative progression of the events in a manner that left only a small space for other
opportunities. From previous encounters, the researcher knew what was at stake in each situation and she performed according to the best of her skills, concentrating to the fullest on the contact point of the fingertips and the soft and wet, moving and constantly changing, clay surface. Many times there was only one action possible at that specific time, any other action would have been risking the successful continuation of the process.

By writing these actions out and looking at the process in detail even on the sensory experience level, and in slow motion, the analysis helped in gaining a clearer understanding about these choices that were made and why they were inevitable. In the process of transcribing the sensory experiences of the throwing sessions a pattern of anticipating the next stage was eminent. A few second before a verbal statement of a critical incident or change of direction in the process, the same reflection had already been made in the sensory experience section of the transcript. The thinking aloud accounts were in the end only the top of an iceberg when it came to describing the meaning of the actions involved in the process. The sensory experience given as reflections on actions gave the real dimension of the events:

'The sponge puts something in between the skin and the clay, but as it numbs the fingers sensitivity it also gives protection and a tool for handling the situation with a new means.' (Reflection on sensory experience 09:31 minutes into throwing on the fifth day.)

A subjective standpoint has traditionally been looked down on in the field of research as impossibility, especially subjective self-analysis on one's own activities (Cross, 1996; Pedgely, 2007). In the field of practice-led research however, it has been noted that the combined profession of the researcher and the maker gives an access to the inside knowledge of a practice (Pedgely, 2007). This intrinsic motivation to reveal the particulars of the actions and to visualise and articulate them has an advantage over interviewing experts as an outsider of that practice. In this exploration, experiential knowledge plays a large role. The previous experiences gathered through working with clay - the tactile memory collected over time in the researcher’s body and particular muscles and sensors, situations encountering this particular material countless times, the feeling of a change in a situation before it is understood cognitively (explicitly) – all play a part in the decision making process that carries the event towards it’s successful or unsuccessful result.

**Decision-making**

When throwing clay walls, the only part that touches the clay surface is the tip of the fingers. Through them, the maker receives enough information on the orientation of the work, the temperature, the resistance of the material, the wetness or softness. These haptic experiences directly give a feel or a feeling of the working conditions and the possibilities available in working the material. These conditions and affordances may change within seconds, so an update of the conditions at hand is continuously made through the sensory points of the fingertips.

When conditions start getting unfavourable, for example the clay is getting too wet and soft, this is experienced as a negative feeling, the maker knows that the available choice for action is cut down and decisions have to be made whether or not to pursue certain actions or if these can be considered too risky. The feelings gathered by the sensory
experiences thus instantly affect risk assessment and decision making for the next steps. Making in a material can be seen as a continuous risk assessment including constant decision making and problem solving, thus feelings play a key role in the assessment of risk. As a result of this research, we think that feelings need to be further investigated in connection with decision making in material problem solving.

Conclusion
In this case study, we experimented with ways to enhance the sensory experience with in a practice-led research framework. Although pursuing an autoethnographical research we acknowledged the difficulty in researching makers’ activities through spoken accounts only. For overcoming this dilemma, we included sensory experiences in the data collection and this allowed us to investigate the experiential knowledge involved in the research event. We found that sensory experiences are in a key position in the formation of knowledge in a making process. They affect emotions and initiate decision-making processes.

For revisiting the sensory experiences, we utilised video that gave access to the embodied experience of the event, and enabled a slow motion analysis and reflection in detail. We propose that this method can be utilized in cases where maker-researchers are recording an event to gain detailed and articulated information on the embodied tactile knowledge they possess. Our results revealed unexpected patterns of behaviour and language used when describing sensory experiences. These may be developed to account for teaching through metaphors and visual language in an educational setting. Finally, we propose that exclusion of the visual modality might help to make meaningful insights about sensory experiences and reveal embodied knowledge in a making context. Although this research setting was conducted within the ceramic practice we believe that the research design can be transferred to many other fields where practice-led research is taking place.

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References:


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