MAGIC-MIRROR-SPIRAL: LOOKING INTO THE ROLE OF 'DESIGN IDEAL' IN INTERACTION DESIGN RESEARCH PROJECTS

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ABSTRACT

There is an ongoing discourse arguing for Interaction Design Research to contribute to theory-about-interaction on one hand, and advancement of particular situation on the other. While there is an acknowledgement of the dialectic relation between theory and situation, however, pointers to embrace the dialectic during a research practice are missing. In order to embrace this dialectic, in this paper we suggest the formulation of a Design Ideal as the interface between theoretical concept and situation. We support our suggestion by a retrospection of our ongoing exploration of Magic-Mirror-Spiral, explicating the relation between theory, concept, design ideal, designed artifact, and situation.

We propose this formulation of 'design-ideal-as-part-of-the-compositional-whole' as a step towards an Interaction Design Research process that embraces the 'theory-situation' dialectic, and aims to contribute to, both, theorizing and advancement of situation.

INTRODUCTION

In recent years the Interaction Design Research community has been engaged in an ongoing discourse for establishing itself as a discipline, moving away from the natural science leaning.

Mackay et al propose a model for research that aims to take into consideration a tension between natural science and design practice (Mackay et al 1997); however, they downplay the role of putting on display the design process itself as part of the contribution. Meanwhile arguing for a more designer oriented discipline, Binder and Redström propose a research approach where the contribution is defined by the expansion of a 'design program' brought about by a series of design explorations (Binder and Redström 2006). Further, Zimmerman et al set interaction design research as separate from the traditional HCI research, and argue for *design as a form of inquiry* in dealing with real world 'wicked' problems (Zimmerman et al 2007).

Thereby, this ongoing discourse can be summarised as being driven by the broader goals of:

- Setting a discipline that considers design as a form of inquiry, moving away from the natural science leaning of traditional HCI; and
- Articulating an Interaction Design research process that reflects the way we do research: being engaged in a dialectic relationship between theory and situation, and being explicit about it.

A core aspect of this ongoing discourse is to articulate what are the research contributions of such a research process. In this respect, there have been proposals that argue for contributions oriented towards advancing a particular situation to possible desired states on one hand, and contributions oriented towards theorising on the other.

Zimmerman et al claim that the main contribution of 'research-through-design' is to explore the solutions for a real-world problem through a series of alternatives forming a design space (Zimmerman et al 2008). Meanwhile, Stolterman and Wiberg argue for an interaction design research process that aims to contribute to advancement of 'theory *about* interaction design' (Stolterman and Wiberg 2010). They explicate concept-driven interaction design research as complimentary to the situation-driven interaction design research (see Figure 1). The concept-driven interaction design research is driven by a theoretically constructed concept and the design of an artefact (the Designed Artefact) that manifests the desired theoretical concept. The concept and the Designed Artefact form a '*compositional whole'*. This compositional whole is what constitutes a research contribution as an argument of possible new understandings of interaction thereby advancing the current theoretical understanding.
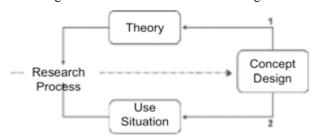

Figure 1: Two complementary cycles of interaction design research. Cycle 1 is concept-driven research; cycle 2 is situation-driven research (Stolterman and Wiberg 2010)

Stolterman and Wiberg, while acknowledging the dialectic relation between theory and situation, however, defer the discussion of the role of the compositional whole in advancing the current situation to preferred states.
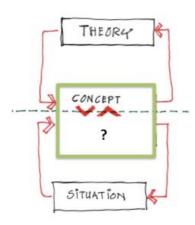

Figure 2: Need for a formulation oriented towards advancement of situation in the IxD research process

Meanwhile reflecting on MagicMirror, our on-going interaction design research project, we realized that we are enmeshed in the 'theory-situation' intertwinement, as emphasized by the above-mentioned work. Answering the call to describe our research process reflecting closely the ways we are engaged in it, we

found a need to formulate an interface between concept and situation; a construct that is oriented towards an advancement of situation, as is concept oriented towards advancement of theory (see Figure 2).

In this paper, as a solution to this gap in the compositional whole, we suggest the formulation of a *Design Ideal* as an interface between concept and situation. We understand it as the ideal driving the design situation from the current state to preferred states, but we explicate what is a Design Ideal by describing our exploration. In articulating the Design Ideal, we take from what Löwgren and Stolterman call as an interaction design *practitioner's* 'vision': something that emerges when a designer encounters a design situation (Löwgren and Stolterman, 2007). The quality of the vision depends on the designer's experience and repertoire, and drives the design process towards articulating specific preferred states. Similarly, the Design Ideal is the initial vision that emerges when the interaction design *researcher* encounters a particular design situation; the quality of the Ideal depends on the theoretical understanding of the researcher combined by reflection on previous experiences. While the design *practitioner* can be esoteric about how the vision emerged in a particular project, the *researcher* has a responsibility to make explicit, and put on display, the process of how the Design Ideal emerges from the interaction between theory and situation.

We expect that our formulation of 'design-ideal-as-an-interface-between-concept-and-situation' is a step towards embracing the 'theory-situation' dialectics; and towards articulating an interaction design research process that aims to contribute to both, theorising about interaction and advancement of particular situation.

Below we describe the MagicMirror exploration, explicating the relation between theory, concept, design ideal, designed artefact, and situation. We conclude by discussing how Design Ideal relates to the ongoing discourse, thereby pointing to the significance of our suggestion to the interaction design community.

EXPLICATING THE ENGAGMENT WITH THE DIALECTICS: MAGICMIRROR

MagicMirror broadly explores the design of digital technology to facilitate successful physical rehabilitation of senior citizens.

In MagicMirror the concept is Embodied Self-monitoring, which is informed by the theory of Embodied Interaction. The design situation is designing for post hip replacement therapy and the design ideal, Magic-Mirror-Spiral, drives our exploration by envisioning desirable future situations. Further, we briefly describe how we explored the design ideal through a process of sketching with therapists and senior citizens.

THEORY INFORMING DESIGN

The MagicMirror exploration is informed by: theory about Embodied Interaction, and theory about successful rehabilitation of senior citizens.

Rooted in Phenomenology, Embodied Interaction is the nature of human interaction with the world through which people *make* meaning out of their actions (Dourish 2001). The theory about Embodied Interaction stresses the role of human body in the interaction with the world, the everyday practices within which this interaction is situated, and the nexus of equipment that the humans employ within these practices, in the meaning-making process. It provides us a holistic perspective on the situations of physical rehabilitation of senior citizens, and the direction for our research to explore the design of digital technology to be nested in these situations.

Simultaneously in the recent years, the field of physiotherapy is increasingly calling the attention of the therapists for a more holistic view on the nature of human body and its relation to the world. These recent works (Nicholls & Gibson 2010, White paper 2004, for e.g.) call for a shift in the therapists' perspective from the current occupation with body as a bio-medical phenomenon, to one that takes into consideration the fact that humans are actively involved in the everyday meaning-making through a bodily awareness built on an ongoing practice of interacting with the world. They also call for considering the holistic everyday situations within which the rehabilitation process unfolds.

FROM THEORY TO CONCEPT: EMBODIED SELF-MONITORING

We construct the concept of 'Embodied Self-monitoring' from the above two theoretical understandings. In its current articulation, Embodied Self-monitoring is the embodied way of monitoring different aspects of engaging self with the world of physical rehabilitation. It focuses on three aspects:

- The prospects offered by the bodily awareness in providing immediate feedback while exercising,
- The ongoing practice of rehabilitation process,
- And the nexus of things—people, physiotherapists, family and friends, physiotherapy equipment, and other everyday things—within which the senior citizen's rehab process is situated.

The focus on these three aspects facilitates a more holistic self-monitoring opportunities for the senior citizens during their rehabilitation process. These Embodied Self-monitoring opportunities open up the possibilities for the senior citizens to be more aware of their progress and their situation. We speculate that this self-awareness further leads to a more successful rehabilitation process.

Thereby, at a broad level, we are exploring the role of digital technology to facilitate the concept of Embodied Self-monitoring in different situations of physical rehabilitation of senior citizens, as way to promote a more successful rehabilitation process.

THE SITUATION

The particular situation of the MagicMirror exploration is the physical rehabilitation of senior citizens after a hip replacement surgery. Currently the senior citizens after the surgery undergo a six-week therapy, during which, they visit the clinic twice a week to perform the exercises under the supervision of the therapists. Additionally, the senior citizens are recommended to exercise at home. However the therapists don't have much information on how the senior citizens managed to do these exercises, and the senior citizens don't have clearer instructions during exercising at home.

FROM THE SITUATION TO THE DESIGN IDEAL: MAGIC-MIRROR-SPIRAL

This situation of isolated exercise practices led us to explore the possibilities that are opened up by the movement of the exercise data from the rehab centre to home, and back. We formulate the *'Design Ideal'* of Magic-Mirror-Spiral exemplifying these possibilities.

The spiral starts off at the rehab centre, by video recording the exercises the senior citizen performs under the supervision of the therapist. The senior citizen takes home this video and uses it as the 'reference' exercise to monitor self while exercising at home. During this the MagicMirror tracks the body movements, and overlays it on the instructional video, thus giving the senior citizen a self-referential video for exercising. The senior citizen takes back this home video to the centre to discuss the progress in detail with the therapist (see Figure 3).
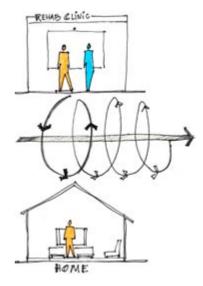

Figure 3: the Magic-Mirror-Spiral

As a Design Ideal, the Magic-Mirror-Spiral points to desirable future situations that we foresee the present situation could advance to. Specifically, we foresee how by engaging in the Magic-Mirror-Spiral may induce a

collaborative articulation of the rehab process between the therapists and the senior citizens, by recording and sharing the exercises between the centre and the home. We see this process as a two-way consultation between experts of each their kind. The senior citizens can let expertise on their own everyday lives meet with the expert knowledge on rehabilitation held by the professional therapist.

FROM THE CONCEPT TO THE DESIGN IDEAL

In this situation the Magic-Mirror-Spiral as *'Design Ideal'* translates the Embodied Self-monitoring concept to concrete pointers for desirable future situations. From the abstract understanding that facilitating Embodied Self-monitoring promotes a more collaborative rehab process, the 'Magic-Mirror-Spiral' design ideal drove our exploration by pointing to concrete possibilities for facilitating a collaboration between senior citizens and therapists, through the exchange of recorded data in the spiral between rehab centre and home.

SKETCHING AND CO-EXPLORING THE DESIGN IDEAL

We further explored the possibilities brought forward by the Magic-Mirror-Spiral design ideal through engaging in a process of sketching and co-exploration (see Figure 4) with a group of 4 physiotherapists and a senior citizen.

From our initial discussion with the therapists we identified the three 'key' things the therapists want to monitor during the exercise process: the vertical body position, balance of weight on feet, and knowledge about hip muscle activity.

We sketched a 'balance board' with pressure sensors measuring the weight balance, a belt with an accelerometer for vertical position and a digital counter for counting the number of exercises (see Figure 5A). All these sketches were connected to a laptop with a

webcam. The laptop video recorded the exercises, and displayed the sensor information over the video in real time. This immediate feedback enables the senior citizens to monitor their exercise while practicing.
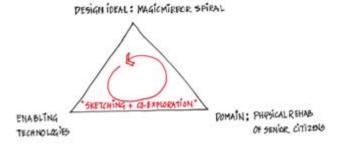

Figure 4: the Process of Sketching and Co-exploring

We co-explored the sketches in a mock enactment of the first cycle of the Magic-Mirror-Spiral: recording the exercises at the rehab centre, exercising at home, and discussing the home exercises back at the rehab centre (see Figure 5 B, C, D). We then summarized the three-part exploration in an extended discussion with the citizen and the therapists.

FROM DESIGN IDEAL TO DESIGNED ARTEFACT

Acting on the insights from the initial co-exploration, we are currently exploring the sketch of 'MyReDiary', a personal device for the senior citizens (Bagalkot and Sokoler, 2011a, 2011b). We envision it as a *tool for collaboration*, providing the senior citizens a language to share with their therapists their recorded exercises practices from home (see Figure 6).

While the in-detail description of the process is not in scope of the paper, in the next section we summarize the reflections on the MagicMirror exploration.

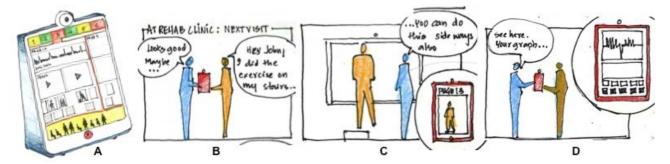Figure 5: Sketching and Co-exploring the Magic-Mirror-Spiral

Figure 6: MyReDiary, a Personal Device of senior citizens for collaboration

REFLECTIONS: THE DESIGN IDEAL AS AN INTERFACE

In the above retrospective description we have highlighted the role of the Magic-Mirror-Spiral in driving the research process. We now reflect on how this design ideal acted as an interface between Embodied Self-monitoring concept and the situation of rehabilitation post hip replacement.
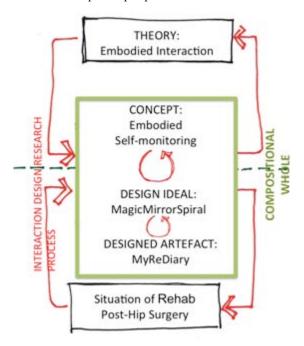

Figure 7: The Compositional Whole from MagicMirror Exploration

Looking back, we find that Magic-Mirror-Spiral design ideal is a *situated manifestation* of the Embodied Self-monitoring concept. When the more abstract articulation of Embodied Self-monitoring concept faced the concrete situation of senior citizens' rehabilitation post hip surgery, it led to the formulation of the Magic-Mirror-Spiral design ideal. The Magic-Mirror-Spiral holds both:

• The intent of advancing the present situation to a desirable one of a more collaborative articulation of the rehabilitation, as experienced by the therapists and the senior citizens; and,

• The intent to further the articulation of the Embodied Self-monitoring concept, and its role in promoting a successful rehabilitation process.

Further on, exploring the first cycle of the Magic-Mirror-Spiral led to MyReDiary, a concrete Designed Artefact.

In Figure 7, we summarize this inter-relation between Embodied Self-monitoring concept, Magic-Mirror-Spiral design ideal and the MyReDiary designed artefact, as a *compositional whole*. In the next paragraphs we explicate how this compositional whole contributes towards, both, an advancement of the situation, and an enhancement of the concept pointing to theoretical advancement.

COMPOSITIONAL WHOLE FOR AN ADVANCEMENT OF THE SITUATION

The initial exploration of the first cycle of the Magic-Mirror-Spiral lead to some concrete initiatives pointing to an advancement of the situation from the current state to possible desirable states. During the co-exploration, we found out that:

• While the therapists were actively involved in exploring the sketches and setting up the exercises for the citizen in the first round, they were not so impressed by the amount of time it would take to go through the home videos of the citizens. The therapists rather found the sensor data to be more useful than the video material. The sensor data was more close to their expert language and they could relate to that closer than the video.

• However, the citizen also stated that recording her exercises at home to show it to the therapists would mean that she has to commit herself to the practice. This would mean an external motivation for her to be engaged in the process: a "whip" in her terms.

Both these reflections highlight the fact that while the therapists have an established language to talk about physiotherapy, the senior citizens lack this. This throws up the possibility of providing a language for the senior citizens to talk about their experiences of exercising at home with their therapists, thereby increasing their role in the articulation of their rehabilitation process.

As mentioned above, this led us to sketch 'MyReDiary', a concrete manifestation of the possibility of giving a language for the senior citizens to engage in a more collaborative rehabilitation process.

COMPOSITIONAL WHOLE FOR AN ADVANCEMENT OF THE CONCEPT
During the exploration

- The citizen expressed that the video from the rehab clinic would help her in reflecting on her progress. While, the senior citizen was not comfortable with the overlap of exercise videos from the rehab clinic over the live video while exercising (as was manifested in the sketch), she suggested that she would rather look at the videos from clinic separately for reflection on her progress.

This suggestion pointed us to the possibility that this period of reflection could help the citizen to prepare for the meeting with the therapist, by making notes, selecting specific parts of the video to highlight achievements and problems, etc.

Thereby, Embodied Self-monitoring may also support a more reflective way of monitoring one's progress, along with providing immediate feedback while exercising. The Magic-Mirror exploration provided a refinement in our understanding of the concept, offering a concrete example of a reflective aspect of Embodied Self-monitoring for promoting a more collaborative rehabilitation process.

CONCLUDING REMARKS
In our retrospective account of the MagicMirror exploration, we explicated that the Design Ideal is a situated manifestation of the concept, acting as an interface between the concept and the situation while doing interaction design research. We further explicated how the Concept, the Design Ideal, the Designed Artefact and their inter-relation are brought together in a *Compositional Whole* (see Figure 7). We embraced the 'theory-situation' dialectic through this compositional whole where the concept facilitates towards an advancement of the theory about interaction, the design ideal facilitates towards an advancement of the situation.

Thereby we added the Design Ideal to the compositional whole as articulated by Stolterman and Wiberg (Stolterman and Wiberg 2010). We propose that this formulation of 'design-ideal-as-part-of-the-compositional-whole' is a step towards an interaction design research process that embraces the 'theory-situation' dialectic, and aims to contribute to, both, theorising and advancement of situation. In general, we expect that this formulation is a step towards describing

a research process that reflects the way we engage in interaction design research.

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