Designing tangible tools to support collaboration in the co-design of healthcare services

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Abstract

As the challenges facing the Norwegian healthcare system are growing in scale and complexity, cross-disciplinary collaboration is needed between public and private sectors to rethink how we design services for care. Service design has emerged as a fruitful area of design practice and research that can support cross-disciplinary collaboration. It may do so by providing effective co-design communication tools that bridge the evidence-based culture of the medical world with working cultures, perspectives and languages of other fields. Despite the documented use of such tools, few examples in the literature describe the actual design process of developing three-dimensional communication tools and how designed attributes of tools may impact on their effectiveness and influence collaboration. This paper presents examples of tool prototyping as part of an ongoing PhD research. It includes three cases that are taken up to explore how to design context appropriate tools. This is done through the application of an analytical framework that draws on the use of metaphors and affordances in physical objects to offer an account of how tangible tools may be developed and implemented to support collaboration in the co-design of healthcare services.

KEYWORDS: collaboration, tangible tools, metaphors, affordances, service design, co-design, workshop facilitation, design process

Introduction

As the healthcare challenges of society increase with changing demographics, we are witnessing increasing pressure on the limited resources available to meet needs and services (Engström, 2014). Service design and co-design processes are being called upon to re-think healthcare service provision and to offer approaches and methods to facilitate collaboration and to harness available resources in new ways (Baxter, Mugglestone, & Maher, 2009). In this paper, my focus will be on the development of tangible tools specifically.

Services have been described as being complex, hybrid artefacts made up of things, places and systems of communication and interaction, but also of human beings and their organizations (Meroni & Sangiorgi, 2011). The context of healthcare consists of multiple stakeholders (i.e. consumers, patients, clinical staff, administrators, insurers) who interact with multiple services (from primary care to academic institutional networks) within multiple sectors (from clinical practice to insurance and government) (Polaine, Løvlie, & Reason, 2013).

High expectations are put on cross-organizational collaborations to produce innovative healthcare outcomes. This is despite the extensive challenges that often exist in relationships between stakeholders, such as a lack of an internal team culture, team communication (Sarin & O'Connor, 2009), and a common understanding and a shared vision of the object of development (Molin-Juustila, 2006). The motivations, needs and relations of stakeholders - and between them - need to be understood and regularly taken into account, as relationships also evolve and shift through time, (Clatworthy, 2013; Jones, 2013; Polaine et al., 2013; Sangiorgi, 2012; Wetter-Edman et al., 2014). Effective communication tools are therefore needed to bridge the evidence-based culture of the medical world with the working cultures, perspectives and language of the other fields.

Co-Design is used as a central approach in the design of services in support of multi-disciplinary collaboration. It may be defined as 'the creativity of designers and people not trained in design working together in the design development process' (E. Sanders & Stappers, 2008, p. 2). Co-design communication tools are becoming increasingly popular as a means to generate ideas and to establish a shared understanding and common vision and goal in the early stages of an innovation process. This is carried out through co-creation workshop settings where communication tools are taken up to facilitate knowledge exchanges and understanding between diverse actors.

In recent years, we have witnessed an increase in the use of specifically three-dimensional tools for these ends. This has been due to the effectiveness of the tangible nature of the tools in establishing a shared 'language' through physical form. Such an achievement is beneficial in contexts where verbal communication often breaks down due to professional jargon and misalignments between different professional working cultures. Although the use of tangible tools is often described in co-design literature, what is frequently not given attention are the design processes of such tools and accounts of how such tools could or should be designed.

Tangible tools are often described as having been successful because they were visually appealing, they catch the attention of participants, or facilitate a 'playful' atmosphere (Brandt, 2013; Buchenau & Suri, 2000; Clatworthy, Oorschot, & Lindquister, 2014; B. Gaver, Dunne, & Pacenti, 1999; Mattelmäki, 2008; L. Sanders & Stappers, 2013, 2014). Such accounts support the view that the aesthetics and visual aspects of tools are indeed successful, but say little about the design principles concerning fundamental ideas about the practice of designing tangible tools or the design choices that determined the final physical outcome. This in turn provides limited insights to support designers in further developing tangible tools. Consequently, tools are often developed on a trial and error basis. Further, when there is a poor match between the design of the tools and the people who will be interacting with them, the workshop tools themselves may hinder engagement and interaction. Resulting unsuccessful workshop interactions can therefore create challenges for service designers who are attempting to build ongoing trust with participating stakeholders.

This paper builds on the notion that tools can offer an aesthetic impact on participants (i.e. their interest, engagement, and the collaborative relations between participants). I explore how this impact can be specifically designed and the potential tangible artefacts may have in assisting shared perceptions and plans for the co-development of improved or new healthcare services. I present the design process of developing a variety of tangible tools in the format of three case-study workshops. I analyse these tools and their place early in a

wider innovation process through an analytical framework that draws on the notions and concepts of metaphors and affordances as applied to the physical objects used in workshop facilitation. I close the paper by arguing that there is ample room for the further development and critical co-design of these and other tangible tools in innovation and facilitation practices in healthcare service design and delivery.

Supporting collaboration through co-design communication tools

Re-thinking how healthcare may be provided and how the co-design of new healthcare services may be realised requires innovation across both public and private sectors. Although research on collaboration in public service has grown significantly, it is still commonly assumed that organizations within and across sectors will naturally collaborate (Morris & Miller-Stevens, 2015). In literature on co-design workshop facilitation within service design, collaboration is often mentioned as a wished outcome, but little is mentioned about what the nature of that collaboration should be. Many project initiatives within the field of healthcare are mandated; not all collaborations are voluntary and not all are equal. A particular collaboration may be perceived as a singular, monolithic interaction, but rather as a highly flexible, adaptable and fluid form of interaction (Morris & Miller-Stevens, 2015).

Looking towards organizational change and management studies, Pirinen sums up collaboration as 'A transformative capability that necessitates the crossing of the structural, cultural and other boundaries of individuals, organizations and networks and can be supported by strategic, operational and cultural integration, by the creation of trust and through the recognition of mutual value among the actors.' (Pirinen, 2016, p. 28). As many collaborations differ, the manner service designers approach the aim of collaboration in workshop settings influences the design of the methods they use and also the design of their tools. This is a core item for consideration in the inclusion of tangible tool design as part of service design innovation strategies in healthcare.

In such a context, service designers need to identify, understand and include the character and dynamics of cross-organizational service networks. They need to do so to effectively cross boundaries and align expectations and goals. Typically, co-design approaches used in such contexts involve visual methods and tools. Tools such as design games, graphic representations and artefacts facilitate the sharing of user knowledge, the negotiation of differences and the generation of new ideas and experimentation (Ehn, 1988). In the context of fostering shared activity, the use of 'boundary objects' (Star & Griesemer, 1989), such as diagrams or other visual representations, have been stressed as playing an important role in aligning interests among stakeholders and transferring knowledge and learning across distances and domains (Carlile, 2002; O'Flynn, Blackman, & Halligan, 2013).

To provide a clearer understanding of tools used within service design, Tassi (Chiara, Pacenti, & Tassi, 2009) developed an overview of available ones (Figure 1) according to the design activity they are used for, the kind of representation they produce, the recipients they are addressed to and the contents of the projects they can convey. The platform includes both two dimensional and three-dimensional tools. Such tools are connected to materials and materiality.
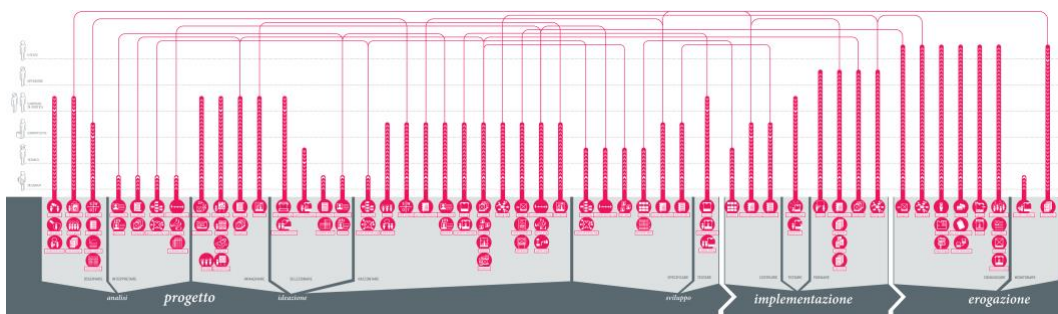

Figure 1: Tassi, 2009, www.service-designtools.org

Blomkvist, Holmlid and Clatworthy (Blomkvist, Clatworthy, & Holmlid, 2016) state that service designers need to have an understanding of how they use and relate to materials as part of their design process, as a part of their outcome and as a competence. However, there are few descriptions in the literature on the design process of communication tools and ways they can be most effectively designed to support collaboration in the service design process.

If we look towards the field of design thinking in service design and the involvement of graphic designers, Natasha Jen from the design studio Pentagram (Jen, 2018) calls for more critique on the process, materials and tools used in design thinking. Jen questions why design thinking, for example, has been reduced to the use of only 3M post-it notes. In support of such a call for critique of the materiality of tools, this paper questions how design specifications and design support can be developed for tangible tools that support increasingly complex design problems. This is approached by researching how tangible tools are designed, what role tangibility in those tools plays, which metaphors and affordances within those physical forms produce positive results and why that may be so.

The design of tangible tools for workshop facilitation

Tangible tools are defined as 'material components used in participatory design activities' (E. B.-N. Sanders, Brandt, & Binder, 2010, p. 2). They are becoming popular as a physical means to develop common ground between diverse stakeholders in co-design workshops (Figure 2). Wetter-Edman et al. (2014) argue that tangible tools can change the perspective of service design from a specific interaction to transformation, change and value creation. In describing design games as a workshop facilitation tool, Brandt (2011) explains how game materials create common ground that everyone involved can relate to. She describes how game materials simultaneously become 'things to think with', where the reflections from different participants result in re-seeing the task at hand, which in turn may provide new meaning.
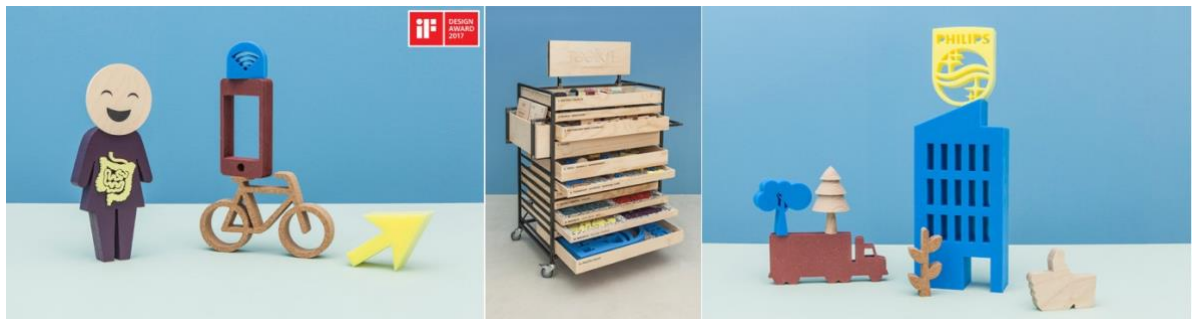

Figure 2: Philips co-create toolkit (Palthe, 2017), photo: Raw Color

Aguirre et al. (2016) define three categories of tools for facilitation that are also applicable to tangible communication tools: *generic tools* (tools that lack specificity and are regarded as products for facilitators), *template tools* (tools that have a predefined format used as a starting point for a particular application) and *contextual tools* (tools that are designed specifically for a certain context or tailored for an activity). Contextual tools are a category of tools that calls for designers' aesthetic skills as these tools need to be designed specifically for the professionals and the contexts they will be used in. For instance, a tangible tool aimed at facilitating policy-making among civil servants in government have different aesthetic requirements than physical tools used in conversation with children, where the tools need to, for example, stimulate play in order to facilitate interaction.

Examples of context specific tangible communication tools include design games (Brandt, 2013), Philips Co-Create Toolkit (Figure 2.); cultural probes (B. Gaver et al., 1999; Mattelmäki, 2008); Terra Nova Mini Maatschappij workshop tool (Figure 3) supporting

children in discussing societal challenges, Value Pursuit workshop tool (Figure 4) for aligning expectations and goals amongst stakeholders (Rygh, 2013); 'Boat' tangible tool (Figure 5) for strategic conversations (Clatworthy et al., 2014) and the Multi-sensory relational tool (Figure 6) for creating a shared understanding of the role of relationships in the development of complex services (Aguirre-Ulloa & Paulsen, 2017).

Figure 3 (top left): Terra Nova workshop tool for children to discuss societal challenges (Hu, 2013), photo: M.Haller. **Figure 4** (top right): Value Pursuit workshop tool to align expectations and goals amongst stakeholders (Rygh, 2013), photo: K.Rygh. **Figure 5** (bottom left): Boat tangible tool for strategic conversations (Clatworthy et al., 2014; Ekblom, Langnes, Nordli, & Owren, 2013), photo: AHO. **Figure 6** (bottom right): Multi-sensory relational tool visualizing the role of relationships through physical materials, in the development of complex public services (Aguirre-Ulloa & Paulsen, 2017), photo: Aguirre-Ulloa/Paulsen.

The use of affordances and metaphors in tangible tools

How workshop participants go about interacting with context specific tangible tools depends to a considerable degree on the designed attributes of the physical objects. What it is about these physical objects that supports and enables communication and interaction may be understood through reference to the affordances and metaphors embedded and embodied in the design of such tools.

The concept of affordance was originally proposed by the American psychologist James Gibson to describe what the environment 'offers the animal, what it provides or furnishes, either for good or ill' (Gibson, 1979, p.127). Donald Norman then introduced this concept to the field of design and Human Computer Interaction in his book The Psychology of Everyday Things. Norman regards affordances as relationships rather than properties and defines affordance as the relationship 'between the properties of an object and the capabilities of the agent that determine just how the object could possibly be used' (Norman, 2013, p. 9). Norman states, 'A chair affords ("is for") support and, therefore, affords sitting. Most chairs can also be carried by a single person (they afford lifting), but some can only be lifted by a strong person or by a team of people. If young or relatively weak people cannot

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lift a chair, then for these people, the chair does not have that affordance, it does not afford lifting'. (2013, p. 9).

For Gibson (1979), affordances are the action possibilities of objects with reference to the physical condition of the user, while for Norman it is the perceived information with reference to the mental and perceptual capabilities of the user. This paper focuses on the latter, while taking into consideration that specific interpretations of this general idea differ in various research contexts.

The concept of affordance has been especially appealing to designers of graphical user interfaces. Unlike traditional industrial designers, user interface designers can more freely and easily define visual properties of the objects they create (Kaptelinin, 2017) and are therefore well positioned to create what Norman (Norman, 2013, p. 10) calls 'strong visual clues to the operation of things'. Affordances are closely linked to metaphors in the sense that they have the potential to build associations between conceptually separate entities whereby the attributes that relate to one entity are used to understand or represent another (Wee, 2005). In this way, incorporating metaphors in tangible tools can make abstract concepts tangible for the user, allowing them to more easily express and discuss topics through representations and associations.

Metaphor has long been acknowledged as a linguistic device, but there has been growing recognition that the use of metaphors is not confined to spoken or written language but that it underlies how we think, reason and imagine in everyday life. Building upon the Contemporary Theory of Metaphor (CTM) outlined by George Lakoff (1993), Lynch and Fisher-Ari explain that metaphors are not limited to only linguistic expressions but also 'reveal the positionality from which we both form and express interpretations of concepts and experiences, regardless of one's native language, culture, nationality.' (Lynch & Fisher-Ari, 2017, p.196).

It is important to consider metaphor and correspondence in meaning making. A linguistic metaphor consists of an association between a target and a source, through establishing a conceptual correspondence between two words. Product metaphors differ in the sense that products are tangible entities. The target is the 'product' that is employed in a metaphor and the source is the remote entity that is associated. Nazli Cila, in her thesis *Metaphors we Design By* (Cila, 2013), states that in order to create a product metaphor, designers are required to make the appearance of a source visible in the appearance of its target. For this reason, product metaphors involve two different kinds of mappings from source to target. First there is a conceptual mapping as in linguistic metaphors, to build the metaphorical link between target and source; secondly, a physical mapping takes place to manifest this link in tangible form.

Although many examples of the use of metaphors exist in design domains, less is known about the way in which metaphors are generated by designers. This is a topic that is mostly overlooked, even in the linguistics domain. In *Memory and Cognition*, Holyoak and Koh (Holyoak & Koh, 1987), describe the source selection of metaphors as the least understood decision among all the decisions that are made during analogical reasoning and metaphorical thinking processes.

Considerations for the design process of tangible tools using metaphors

In order to include metaphors in the design of products, it is important to evaluate which particular quality of the product is best to emphasize, what kind of experience one wishes to offer users, and thereafter choose a relevant source for the metaphor. When incorporating product metaphors in tangible communication tools, rather than products, the source selection process may be even more complex. Several aspects need to be taken into consideration: the aim of the workshop in which they are to be used, what activities support this aim and where, and specifically when, it would be beneficial to incorporate physical

tools. Furthermore, the selected metaphor also needs to trigger engagement and participation in facilitated workshop activities. Then participants need to perceive tangible tools not as products, but as tools at their disposal that they feel inspired to use for making sense out of complex contexts. Gaver (W. Gaver, 1996) and Kaptelinin (Kaptelinin, 2017) emphasize the importance of active exploration and suggest that the role of metaphors in design should guide users' explorations of a system rather than conveying exactly how the system is to be used.

The metaphor generation that needs to take place is an example of a creative process where a considerable amount of decisions need to be made. A phase of divergent thinking is needed when designers search for a source to associate with a target and ideate a set of potential sources, while convergent thinking is necessary when deciding on an appropriate source. The same applies to incorporating physical attributes of tools to afford various actions to be taken by the user. When converging to choose one specific metaphor or attribute over another, there is a need for constraints for this decision making.

I argue that it is these constraints that form the basis for design principles for a designing tangible tools that use product metaphors. One approach to defining design principles for tangible tools is to study the use of such tools and to prototype various tools as a means to observing user interaction and the benefits that tangibility in communication tools may offer. This I illustrate with reference to three different workshop case studies.

Workshop case studies

As part of doctoral research into the design of tangible communication tools supporting cross-sector collaboration, I have conducted multiple case study workshops within the context of co-designing healthcare services. The case studies consist of practice-based explorations through and by facilitating co-design workshops, where the analytical framework draws on the use of metaphors and affordances in tangible tools. The work was conducted at the Institute of Design at the Oslo School of Architecture and Design (AHO) and is part of the wider research project C3 – Centre for Connected Care. C3 is a Centre for Research-based Innovation (SFI), funded by the Norwegian Research Council. The project is collaboration between the Norwegian public healthcare system, the medical industry, and academia with the aim of innovating in healthcare service provision in Norway.

The tangible tool 'Actor Mapping Flags', was designed as a prototype by the author (a multi-domain design professional at the European level). The prototype was created to be utilized in the facilitation of case study workshops with the purpose of mapping projects and/or stakeholders in cross-sector service design projects within healthcare. The intention was to test how participants interacted with the tool, how they related to and embraced the metaphors incorporated within the physical objects and what added value the tangibility of the tools could offer. The design of the tool has been iterated between each workshop test, incorporating observations, insights and findings from both action research (Sanders & Stappers, 2013) and through theoretical research based on literature from relevant fields.

The prototype has so far been tested in five service design innovation projects focusing on the development of healthcare services in Norway, three of which are described in this paper.

1 - Project mapping through a metaphorical landscape – Centre for Connected Care (C3)

Tangible tool: Actor Mapping Flags, Prototype #1

Metaphors used: Map of landscapes and ocean, metaphorical landmarks, flags

Number of participants: 30

Participants: AHO, the Norwegian Business School, Institute for Informatics at the University of Oslo, Akershus University Hospital, Oslo University Hospital, Oslo municipality, Larvik municipality, Sunnaas Rehabilitation Hospital, Abelia, Accenture, Dignio, Dynamic Precision, Induct, Norway Health Tach, Lillehammer Rheumatism Hospital, Siemens, Sykehuspartner.

Aim of workshop: To co-create an overview of C3 projects and shared understanding of the project development process, visualizing the networks of both projects and project partners.

Description:

Due to the complexity of the C3 as a Centre for Research Innovation and its network with its vast number of stakeholders and projects, combined with the speed in which projects develop, early in the project it was difficult to create an overview of all projects and processes. All project participants were therefore invited to a workshop where they could contribute a status update of their individual projects in order to contribute this in the co-creation of an overview of all C3 projects.

Lowering the threshold for engagement and to create a common language in regards to different process terminologies, the existing project process diagram was visualized as a map of a metaphorical landscape (Figure 7). Each landmark represented a specific process stage as seen in Figures 8 and 9. Flags had different colours depending on which pre-defined healthcare theme a project belonged to. Each C3 project was also part of larger project work packages, which were represented by coloured pegs so that these could be attached and detached to the flags according to discussions on the organization of projects and linked work packages.
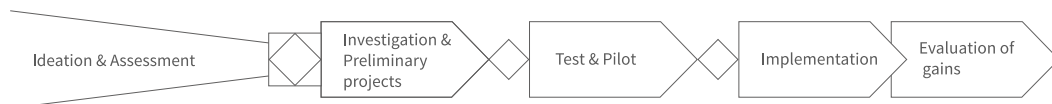

Figure 7 (top): Innovation process that was used as the basis for the metaphorical process map. **Figure 8 & 9** (bottom left & right): The innovation process phase 'investigation and preliminary projects' was translated to 'the lagoon of preliminary projects', the 'test & pilot' phase into 'the depths of trial and error', and the 'implementation' phase became 'the peaks of implementation'. This workshop was hosted

to co-create an overview of all service design projects within C3 – Centre for Connected Care. Photo: K. Rygh.

Participants were asked to place their project flag onto the map in relation to the different landmarks according to whether the project was in the start-up phase ('the lagoon of preliminary projects'), going through experimentation and testing ('currents of iteration') or if they were ready to be offered as concrete services ('peaks of implementation').

Findings:
As participants placed flags onto the map, they also discussed their placements with others in order to adjust their own positioning of the flag in relation to other projects' developments. It was the top of the wooden stick poking out from the paper flag that afforded the action of picking up the flags, rather than pushing them around on the map. This physical act of placing and arranging project flags triggered discussion and questions about why the flags were in one area rather than another. This in turn led to conversations on the challenges projects were facing in their development process and possible opportunities they could consider, based on the experiences of actors in other projects.

The result of co-creating an arrangement of projects on a metaphorical landscape was a visualized, shared overview of active projects and the status quo of their development. This had not previously been possible to achieve via email and Excel spreadsheets. Furthermore, gaining an understanding of which stage of the development process the projects were in, created common reference points for conversations between actors in different projects. The co-created overview was later digitalized and shared with all participants. Unprompted, participants commented widely during and after the event that this tool generation, its tangible qualities and its affordances for shared understanding, were valuable.

2 - Actor Mapping and visualizing value exchanges – Children´s Social Services

Tangible tool: Actor Mapping Flags, Prototype #2

Metaphors used: Flag poles, flags, flags with faces representing children (the users)

Number of participants: 17

Participants: Centre for Connected Care, AHO, Oslo municipality with Østensjø, Nordre Aker and Frogner city districts, the Norwegian Business School, the Norwegian Directorate of Health with the Department of Improved Interdisciplinary Collaboration (BTI).

Aims of workshop: Firstly, to define the various phases in discovering and reporting neglect and/or abuse in children and to map out existing and potential actors in each phase. Secondly, to explore and make explicit the value exchanges that occur between actors.

Description:
'Barnehjernevernet' is a C3 project lead by the municipality of Oslo focusing on increasing awareness, competence and interaction between municipal service providers in the early intervention and prevention of neglect and abuse for children in vulnerable family situations. The project addresses significant systemic challenges, the role of empathy and the change needed in regards to mental models and relational coordination.

In an 'Actor mapping' workshop, participants were divided into two groups and presented with a persona of a child in a vulnerable situation, a customer journey map and blue paper strips and markers. Participants placed the blue strips and markers on the map to define the various phases of the journey of a child's situation. They then defined which actors were present in each phase and which new actors could be relevant to consider, representing them by Actor Mapping Flags. These flags were then placed onto the map visualizing an overview of the actor network in each phase (Figure 10). To maintain user centricity, one flag

representing the user (the child) was made for each phase and was represented by the face of a child on the flagpole.

The design of the Actor Mapping Flags was iterated from the previously mentioned workshop in order to improve the legibility of the text on the flags. This was done by altering the straight position of the flagpole to placing it on an angle so that the attached flags could be more visible to a person standing next to the table. In addition, the design and material of the flag bases was changed from wood to concrete in order to make the bases heavy enough to support flags being connected to each other with string.

Once all actors were defined and placed, participants chose one phase of focus where emotion cards (AT-ONE Touchpoint Cards, Clatworthy, 2011) were placed under flag bases indicating how various actors were potentially feeling in a certain situation (Figure 11). The cards acted as a stimulus for discussion on what needs various actors had and how these needs could be met by other actors. This exchange of resources (or values) were visualized by writing down needs and contributions on pieces of paper that were hung on string between connected actors.

Findings:
Through co-creating a customer journey map and visualizing the exchange of resources between actors, participants were able to identify new actors and new relations of value between them. In addition, participants gained a greater understanding of how actors experienced the various phases and how their needs could potentially be better addressed. Through the re-design of the flags, the movements of the actor flags changed where, instead of being picked up and placed, the 'actors' were now rather pushed and slid across the table. It was almost as if participants were enacting interactions between the flags as though they were people. However, an unexpected outcome of the design iteration was that by altering the angle of the flagpole, the flag metaphor was also broken, where the flags were interpreted by some participants as 'canons' pointing at each other. This in turn was embraced by participants who used the flags to point in certain directions, using the poles to visualize what they were explaining.

Figure 10 (left): Iterated Actor Mapping Flags prototype, visualizing the relevant actors in the process of reporting potential neglect or abuse in children. **Figure 11** (right): At-One emotion cards used as a trigger for discussion, addressing various actors´ needs in the different phases of the journey.

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3 – Supporting youth with intellectual disabilities in entering the workforce – InnArbeid

Tangible tool: Actor Mapping Flags, Prototype #3

Metaphors used: Flag poles, flags, landscape and ocean with details such as currents, topographic elevations and islands, as a customer journey map. A wooden figure of a person represented the user.

Number of participants: 18

Participants: University of Agder, Norway, (Center for Healthcare Research South, Institute of Psychosocial Health and Centre for eHealth), AHO, IT firms Edge Consulting and JodaCar, the Confederation of Norwegian Enterprise (NHO), Sogndal municipality (the Norwegian Labour and Welfare Adminstration, Habitation services and the leader of Research and Development, FoU), Grimstad municipality (Grimstad Activity Centre, Habitation services, Jobcentral), Mjåvann workplace training center, the Norwegian association for people with disabilities

Aim of workshop: Firstly, the aim was to map out existing and possible actors within the different phases of the customer journey map. Secondly, it was to determine the roles of various actors and discuss the value exchanges between them.

Description:

The project InnArbeid focuses on inclusion of youth with intellectual disabilities in the workplace and is led by the University of Agder, Norway, in collaboration with the municipality of Sogndal and the Oslo School of Architecture and Design (by Associate Professor Lise Amy Hansen and PhD Fellow Frida Almqvist). The initiative aims to support the transition from school to the workplace through services and technology enabling young adults to make best use of their individual abilities. An Actor Mapping workshop was hosted to create a shared understanding and overview of the participating actors in the different phases of the transition journey: high school and skill development, the search for employment and the phase of being employed.

Participants were divided up into three separate groups where the customer journey map (designed as a landscape and ocean, see figure 12) was cut into three pieces, where each group worked on one piece (phase) of the map: high school - solid ground (land), searching for a job - a phase of uncertainty (the ocean) and employment - solid ground again (land). To maintain a user centred focus, the user (the young individual) was represented by a wooden figure, visually different from the flags.
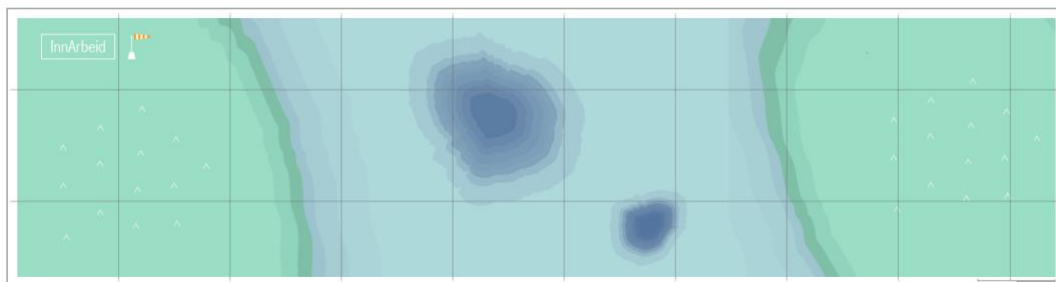

Figure 12: Map of metaphorical landscape. The map was later cut into three pieces, one for each group of participants.

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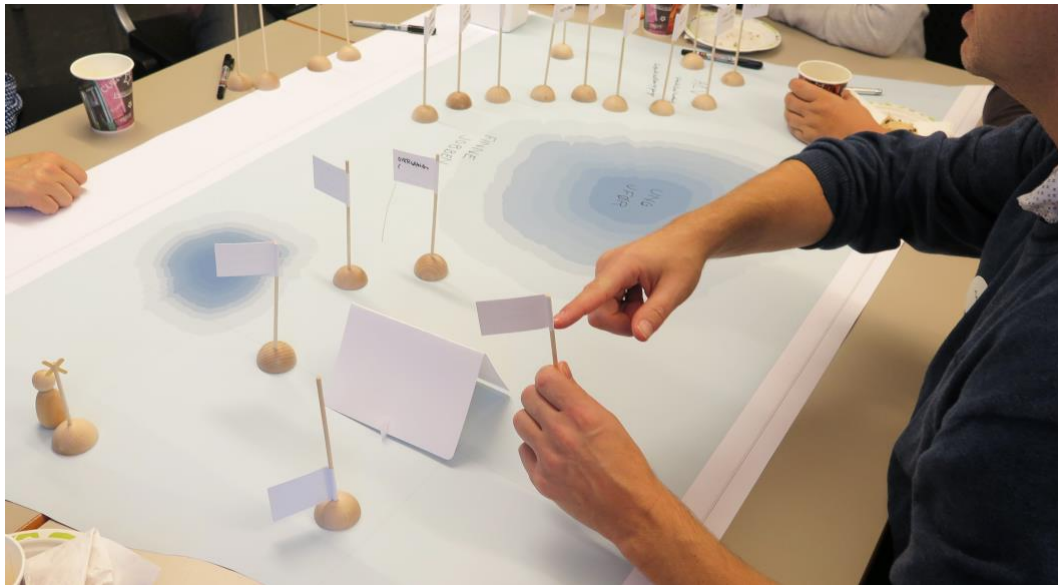Linköping University Electronic Press

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Figure 13: Workshop participant uses a flag representing an actor to explain the challenges this actor faces in this part of the journey.

Participants brainstormed about possible challenges a generic persona (user) faced in each specific phase, and mapped out existing and new potential actors within this phase with actor mapping flags (Figure 13). The design of the flags was again iterated on since my previous workshop and had round, wooden bases and straight flagpoles, with blank paper flags. The new design of the bases afforded the possibility of both picking up and placing the flags as well as holding the rounded bases, pushing and sliding them across the map. The flagpoles were redesigned to be in a straight position in order to re-establish the visual perception of a flag.

After all actors were placed, a second map of an island was introduced where each group chose one challenge to focus on. Participants placed the relevant actors onto the island, on the illustrated topographical lines, in relation to which actors offered most support to the user. With the user in centre, actors that offered direct support to the user were placed closest (higher up) to the user and other relevant, but less involved actors, were placed further away (on a lower level). Workshop participants thereafter discussed what challenges the actors on the island faced and how their needs could be met by other actors´ resources. This exchange of value between actors was visualized by drawing lines between actors and writing down the specific exchanges on the map.

Findings:
In summarizing the workshop day, the different pieces of the landscape were joined together again by placing the different group tables next to each other (Figure 14). The tangible representation of the actor network was the first overview of the transition phase that the participants had seen. Their immediate conclusion was that there were far too many actors involved in the overall transition, where it was suggested that actors in each phase needed to be reconsidered. In addition, by having the complete overview in front of them, the various groups could discuss their phase of the transition in relation to the other phases, comparing, pointing and moving flags to visualize their thinking. The physical flags also created common physical reference points enabling participants in having a democratic, round table discussion about the how the various actors related to each other. The tools remained in front of the participants, which ensured that the conversation stayed on point and did not move into the more abstract complexities of the project.

Figure 14: The individual parts of the map were joined together to create the complete user journey, visualizing the relevant actors in each phase. Participants used the arrangements of actors to explain their findings in the round table discussion facilitated by Associate Professor Lise Amy Hansen.

Conclusion: Towards design principles for designing tangible tools

As seen in the case study workshops, tangibility in service design, facilitated through the use of tools, enables multimodality in communication. Through seeing, moving, pointing, building and rearranging physical objects, workshop participants are able to co-create shared understandings with other stakeholders. By communicating through physical form the focus on hierarchy and power relations may be shifted to the objects in front of participants. Further, breakdowns in verbal communication due to professional jargon are bypassed through hands-on communication. Dialogue is motivated through the placements, movements and arrangements of the physical objects, initiated by the affordances and metaphors in the designed form of the tools.

Pieter Jan Stappers, in referring to the use of tangible tools in workshop facilitation, describes the act of placing an object in front of workshop participants as 'dropping the phenomenon onto the table' (Rygh, 2013). As seen here in the case study workshops, visualizations of arrangements of tangible objects make the intangibility of healthcare services and the diverse expertise needed to design them more understandable and accessible to all involved actors. In complex collaborations consisting of a mixture of working cultures and languages designers therefore need to be critical in regards to what they 'place on the table' and how that could or should be designed, not only to be context appropriate, but to also add value through its tangibility.

From practice, one often hears that unsuccessful co-design workshops occurred because a group of participants weren't familiar enough with co-design methods, or mature enough to properly interact with the given material. This paper instead questions how can we design tools that can be effectively taken up with little or no knowledge of co-design practices. One approach to embedding these factors in tools supporting 'boundary spanners-in-practice' (Levina & Vaast, 2005), agents who engage in negotiating the boundaries of diverse fields to create new joint fields of practice, is the use of affordances and metaphors in physical objects.

In a context where health meets design to bring different knowledge together to innovate healthcare services, tangible tools cannot add value on their own. They are also part of a set of techniques for supporting the designerly practice of workshop facilitation in orchestrating events and activities more deliberately (Aguirre et al., 2016). It is here that product designers can support service design workshop facilitation with contextually designed tools, applying their competence and training in creating three-dimensional cognitive scaffolds that accelerate and enable collective sense-making.

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