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## **Better user-developer communication in service development by collaborative physical modelling**

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**Abstract:** Making the service use experience visible and facilitating the communication between the users and the provider organisation are persistent challenges. We present a proof of concept for utilising a physical modelling approach called collaborative physical modelling (CPM) to reveal the different stakeholder interpretations of a service and to extract these interpretations in a format that can be easily shared and compared, thus facilitating user-developer communication. To demonstrate the use of this method, CPM is used in three differing cases. Our proof of concept brings relief to managers who understand the need for involving users in the service development but who are constantly bound by limited resources. We encourage managers to take advantage of this low-cost, time-efficient and easy-to-adopt physical modelling approach before jumping into more complicated and resource-intensive methods.

**Keywords:** service development; user-developer communication; physical representations; collaborative physical modelling; CPM; user involvement; service management.

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## 1 Introduction

Nowadays most companies agree that understanding the needs of the user is a key element in developing successful services. Sundbo and Toivonen (2011) identify two important perspectives concerning customers and users in service development: the role of user experience and the importance of elaborating information on user needs into shared understanding within the provider organisation.

Regarding the role of user experience, Sundbo and Toivonen highlight the phenomenological side (lived experiences) of the service and the social networks as the framework for experiences. Similarly, Payne et al. (2008) emphasise the view of the relationship experience that is interactive, longitudinal, individual, and contextual. A service experience can be understood as a holistic phenomenon, which is subjective, event specific, personal, individually and socially-constructed, and it is created together by the service and its tangible elements (Helkkula and Kelleher, 2010; Sundbo and Toivonen, 2011). Sundbo and Toivonen bring to the forefront also an important issue that the experiential approach is able to reveal: the different viewpoints of actors. What is seen as a novelty or an innovation in the eyes of the service providers is not necessarily regarded as one in the eyes of the user. This resonates with Helkkula et al. (2012a), who point out that a richer understanding of past, current, and imaginary value in the context in service customers' individual lifeworld contexts might generate novel insights for service innovations. Regarding the second perspective, Sundbo and Toivonen (2011) highlight the challenge of gathering user need information: it has to be structured, elaborated, interpreted and shared within the provider organisation in order to be applicable in service development. Nordlund's (2009) study shows that concept developers in the provider organisation interpret the customer information based on their existing explicit and tacit knowledge and experience, and it is hard to know if their interpretations at least approximate those of customers', i.e., if a shared understanding with the customer exists.

A persistent challenge seems to be how the service use experience embedded in the life and social networks of the user could be made visible, as well as how the communication between the users and the provider organisation could be facilitated. This

is not a new challenge, for instance The Standish Group (2013) has found the relations between the development team and other stakeholders to be the most critical factor to affect success and failure in IT projects, based on data from circa 90,000 cases.

Let us first take a look at existing methods and directions. Numerous studies have concentrated on the identification of user or customer needs and how these needs can be incorporated into products or services (e.g., Hauser and Clausing, 1988; Kaulio, 1998; Pals et al., 2008). Some methods aim at capturing an overall picture of how a user experiences a service (e.g., Dotson and Dave, 2009). Blueprinting, for example, is a technique which was applied in service development already in the 1980s in order to visually clarify the path of the customer against the process of the provider. Five components are typically included in the blueprints: customer actions, onstage contact employee actions, backstage contact employee actions, support processes and physical evidence (Bitner et al., 2008; Shostack, 1982). The essence of sociodrama (Moreno and Borgatta, 1951; Torrance, 1975), in turn, is simulation, where the purpose is to improve planning and communication in the early phases of product development. Its benefits have been argued to be more efficient development processes, better quality, and the avoidance of error costs. Although the simulation of service encounters requires a modified approach, it can respectively help to avoid 'error costs' or to provide new ideas for the development of offerings (Burger et al., 2009a, 2009b). In the Storytelling Group method, collaborative scenario building and focus group discussions are combined. In this method a fictive story of a customer journey is created to illustrate a 'what if' world. Users tell real-life stories about their service experiences, come up with new service ideas, and they are also asked about their opinions and attitudes (Kankainen et al., 2012). Finally, event-based narrative inquiry technique (EBNIT), which uses metaphors as a projective technique (Boddy, 2004, 2005), encourages customers to generate innovative ideas and 'out-of-box' thinking without limiting the study to technical capabilities or expertise in one specific field of business. It aims at offering researchers and managers a technique to trigger ideas for new service development on the basis of tacit needs and wants (Helkkula and Pihlström, 2010; Helkkula et al., 2012b).

Services' unique characteristics such as intangibility, heterogeneity, perishability and inseparability (Lovelock and Gummesson, 2004; Zeithaml et al., 1985), their tendency to be interactive and embedded in relationships (Matthing et al., 2004), the fact that both users and suppliers of a service provide inputs in the service process (e.g., Sampson, 2000; Seppänen et al., 2014; Uz Kurt, 2010), and varying use contexts related to an individual's own life as opposed to the developer's estimated version of it, result in difficulties for making visible the different stakeholder interpretations of a service. Utilising physical models and representations collaboratively is a direction many have chosen. These methods include design games (Brandt and Messeter, 2004; Torvinen, 1999; Vaajakallio et al., 2010; Vaajakallio, 2012), toolkits (Clatworthy, 2011), probes (e.g., Mattelmäki, 2006), and tangible business modelling (Buur and Matthews, 2008; Mitchell and Buur, 2010), to name a few. The choice of leaning on physical representations is supported in the literature. Prototypes and visualisations are said to have a role as thinking and communication tools (Brandt, 2007; Ward et al., 2009). Stigliani and Ravasi (2012) review several studies on individuals relying on variety of material practices and artefacts, such as drawings and prototypes (Bechky, 2003; Carlile, 2002; Sutton and Hargadon, 1996), visual maps (Doyle and Sims, 2002), and Lego bricks (Oliver and Roos, 2007; Heracleous and Jacobs, 2008), and suggest that 'materialisation' of cognitive work supports the collective construction of new shared understandings.

Despite the availability of a variety of methods, there are challenges. Most methods require skills and competencies that often do not exist inside a company. Buying this competence from outside or educating employees inside the company can easily become expensive. This results in taking shortcuts where methods that are known in the company are applied even when they do not necessarily fit the purpose. Focus groups (Higginbotham and Cox, 1979; Krueger, 1988) for example have become an all-round method that is stretched to cover situations where they are not really applicable. For instance, focus groups serve their purpose when there is an existing product that can be discussed, but for developing and evaluating new product ideas it is not the right tool (Fern, 1982; Zaltman, 2003). Interpreting and sharing the collected user information within the service provider organisation creates another challenge. Often methods yield user information in a format that is not easy to handle, such as audio or video files, photographs, or physical outcomes.

Encouraged by the literature on using physical representations (reviewed in the next chapter), we report our experiences in using a method we call collaborative physical modelling (CPM) in service development. It comprises free-form physical modelling and the model's structured disassembly that translates into a textual format. As companies tend to utilise tools that are not complex and that require fewer efforts to understand and implement (Brady et al., 1997; Fotopoulos and Psomas, 2009; Jin et al., 2012), we have aimed in the design of CPM at making it low-cost, time-efficient, and easy-to-adopt, i.e., requiring special skills or competences neither from the organisers nor the participants.<sup>1</sup> We have been using CPM in a variety of service development cases in the past years, and in this paper, we demonstrate the use of this method in three differing cases: First, CPM is used for analysing an existing service both by users and developers. In the second case, users and developers generate a new service concept. In the third case, we use CPM with lead users (von Hippel, 1986, 2005), who generate a new service concept. With the help of the three cases, *we present a proof of concept for utilising a purposefully simple and inexpensive physical modelling approach, extendable to different types of service development situations, to reveal the different stakeholder interpretations of a service and to extract these interpretations in a format that can be easily shared and compared.*

Next we review the literature on physical representations. After that we present the process flow of the CPM method and our three cases. Discussion and conclusions follow.

## **2 Physical representations**

A challenge of service development – both for developers and users – is the immaterial nature of services, whereas physical prototyping is an integral part of the product development process. Various physical representations have long been used to support design activities considering, for instance, physical features, the context of use, socio-technical systems and services (Hillgren et al., 2011), experiences (Buchenu and Suri, 2000), social interaction (Kurvinen et al., 2008), or software (Budde et al., 1992). Prototypes can be virtual or physical, and they can be simple mock-ups or refined working prototypes (Ulrich and Eppinger, 2008). In user interface design, paper mock-ups are commonly used instead of running computer systems, as mock-ups are cheaper and quicker but enough for evaluating the functions in question (Benyon et al., 2005; Nielsen, 1993). Various approaches to prototyping can be divided, according to goals, into exploratory prototyping to clarify the focus, experimental prototyping to refine

ideas and test feasibility of the technical implementation, and to evolutionary prototyping for maintaining a continuous development process (Budde et al., 1992; Floyd, 1984).

While the majority of user involvement with prototypes once concentrated on users evaluating prototypes, Bødker and Grønbaek (1991) emphasise the possibilities of using prototypes in stimulating user participation in the design process, calling it cooperative prototyping. Using low fidelity prototypes, i.e., mock-ups to represent a feature without any functionality can further lower the threshold for user participation, as according to Ehn and Kyng (1991) mock-ups encourage hands-on experience and are understandable, cheap, and fun to work with. In the literature on business models that are intangible by nature, there are examples of physical models or aids being used in engaging people in the innovation process (e.g., Buur et al., 2013; Lübke, 2011; Osterwalder and Pigneur, 2010; den Ouden and Valkenburg, 2011).

Moving further on towards collaborative aspects of utilising physical models, collaborative design features a large family of techniques and methods that take place in workshops and utilise representations of work and technology to translate information and understanding between developers and users (Bødker et al., 2004; Greenbaum and Kyng, 1991; Muller and Kuhn, 1993). Collaborative design games are another option amongst collaborative techniques. They have been built for multiple purposes and with notable variation, for instance in envisioning information system make up and work redesign (Torvinen, 1999), design opportunities (Jacucci, 2004), exploring data for service design and collaboration opportunities (Clatworthy, 2011; Vaajakallio et al., 2010; Vaajakallio, 2012), and creating shared image of prospective users of new technology (Brandt and Messeter, 2004). Quickly assembled and easily adjustable physical representations allow for quick iteration, participants' building on each other's ideas, flexibility in changing the level of detail and focal points of attention as well as dealing with the system as a whole in a graspable manner (Brandt, 2007; Bødker and Grønbaek, 1991; Kyng, 1995; Snyder, 2003; Säde, 2001). Moreover, as Brandt (2007, p.191) states the advantage of physical representations in regards to mock-ups: "tangible mock-ups are perceptible by more senses than models on paper and in computers, and because of this, they seem to evoke more reflections from each individual participant".

In their ethnographic study in a product design consultancy, Stigliani and Ravasi (2012) found various material micro practices that support the following cognitive sub-processes: recreating experiences, visual referencing, sorting things out, parking ideas, keeping the bread crumbs, connecting brains, getting in the right frame of mind, capturing ideas, organising thoughts, building on each other's ideas, and walking the client through. They show that different tangible artefacts can, for instance, support the conscious examination and elaboration of emerging interpretations; enable drawing connections between early ideas and integrate them into more complex mental representations; facilitate the exchange of feedback by providing a common visual referent to lead and structure the discussion; enable the embodiment of cues and ideas in material form that supports conversational practices and cognitive work by extending the capacity of members to store, retrieve, and share mental content; provide 'common reference' for collective conversations and, by doing so, help bring out potential inconsistencies among members' provisional understandings of relevant concepts and of the emerging relationships among them, and so on.

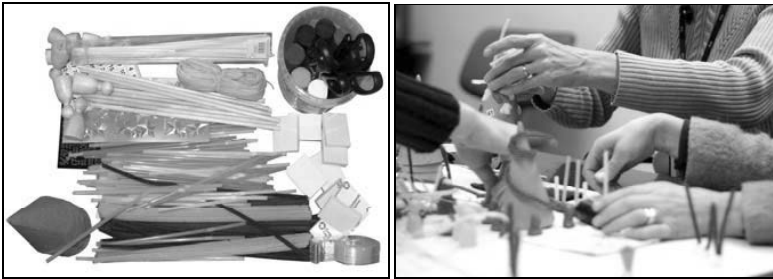
### 3 Collaborative physical modelling

In the following, we present the basic idea of the CPM through its process flow. CPM requires three to five participants from the *same* stakeholder group, such as users or developers, for one session that lasts for two to three hours. Stakeholders are not mixed together in the CPM sessions, rather separate ones are conducted for each group. We have used two facilitators to ensure the flow and documentation of the process.

#### 3.1 Preparation

Preparing the setting for CPM requires ensuring a table and a wall with cleared surfaces, some chairs, plain paper sheets, and an accessory kit (see Figure 1). Recording requires a still camera, audio recorders (and possible video recorders), and note-taking equipment. Facilitator roles in CPM are typical to workshops and tests, in Snyder's terms 'flight attendant, sports caster, lab scientist' (Schuler and Namioka, 1993; Snyder, 2003).

**Figure 1** (a) The accessory kit (b) Model building under way (see online version for colours)



(a)

(b)

#### 3.2 Warm-up

CPM begins by introductions and explaining the steps of the process. The first step is a warm-up drawing and ideation to get people to loosen up and accustomed to voicing, tangibilising, and sharing ideas in a quick pace. We have used warm-up exercises where participants have to generate ideas fast first individually and then collaboratively, having to also build on each other's ideas (e.g., Liikkanen et al., 2009).

#### 3.3 Model building

After the warm-up, the accessory kit (see Figure 1) is brought to the table and divided evenly in a way that allows all of the participants to reach everything. The participants are then asked to build a model of the concept in question in physical 3D format using the available materials. All participants work in parallel, they do not take turns.<sup>2</sup> Facilitator emphasises that all solutions are good and artistic beauty is not a target. Participants are encouraged to 'get their hands dirty', and the only physical limits are set by the dimensions of the table. We have advised them to think of an element of the product they

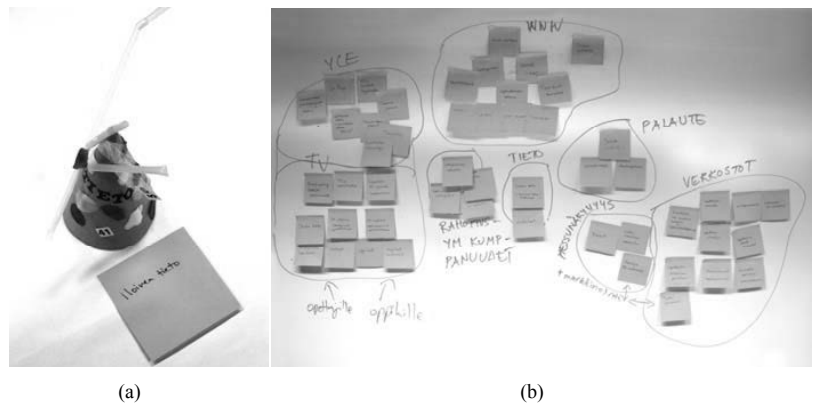
want to construct out of the given materials, rather than thinking about what they could create out of the available materials. Modelling lasts from 60 to 90 minutes depending on the nature and complexity of the product in focus and how participants work. When the model is ready participants are asked to briefly present its main elements (see Figure 5 for an example)

The model building resembles the techniques used by for example Buur and Matthews (2008), who in their study on wastewater plants used foam pieces in different colours and shapes for the participants to attach meaning to. By naming, shaping and placing game pieces representing a specific type of component (such as a sensor, pump or display), the participants explored the wastewater plant step-by-step.

### 3.4 Disassembling

The participants are then asked to remove and identify the elements, one by one. Facilitators write element labels on separate post-it notes (which all should be of the same colour, see Figure 2), photograph each element, and collect them on the white board in consecutive order. This continues until every element has been labelled and there is nothing left of the model. This step is inspired by reverse engineering (e.g., Otto and Wood, 2001), which aims at understanding and representing the current instantiation of a product.

**Figure 2** (a) Element removed from the model and labelled (b) Elements grouped into entities (see online version for colours)



### 3.5 Grouping

In the last phase, the participants group the post-it elements on the wall according to affinity into entities and label every entity (see Figure 2). Resulting entities represent the main components of which the whole product consists – as perceived by the participants.

This step follows the principles of the affinity diagram, a method of organising qualitative data into subgroups based on similarities or any intuitive relationships such as



dependence, proximity, issues, or problems (e.g., Beyer and Holtzblatt, 1999; Otto and Wood, 2001).

### 3.6 Analysis

The analysis of results can take many forms. The quickest way is to visually inspect the grouped elements of a workshop as well as to compare visually grouped elements from different workshops. A more detailed view of comparing workshop results is to list elements and groupings and form ordered pairs (see below). Documenting CPM in audio, video, and still pictures also allows for full transcript-based interaction analysis either in total or in selected parts. For design project purposes this latter option is mostly too laborious.

## 4 Elaborating CPM through real life cases

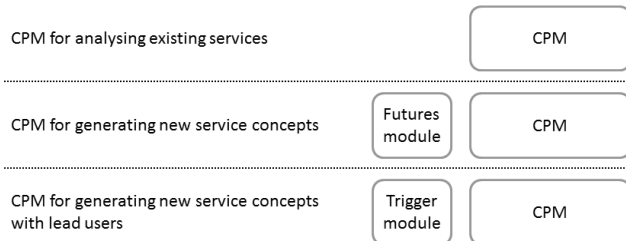
### 4.1 Data and methods

Our dataset consists of three differing cases where we have used CPM, altogether six workshops. The workshops were captured in audio recorders, and the audio tracks have been fully transcribed. Photographs were taken in frequent succession throughout the CPM sessions. Selected parts of the workshops were also recorded on video. The outcomes of the workshops are saved in a textual format, as it naturally emerges in the course of the CPM process. Immediately after the workshop, there was always a short feedback session, where participants expressed their feelings and thoughts about CPM.

Our analyses rely on transcriptions and photos, backed up by watching the video on unclear moments, and on the outcomes of the workshops, i.e., the elements that are grouped into entities. The comparisons we make of the yield of different CPM sessions below are based on ordered pairs of elements. We explain the pair ordering procedure in detail below.

Regarding all three cases, we have had follow-up interviews. In the first and the third case, we have been following the developments in the provider organisation by interviewing the key players yearly for the past three years. In the second case, we had follow-up interviews with the provider organisation two years after the CPM workshops took place.

**Figure 3** Architecture of different CPM workshop settings (see online version for colours)



Next, we present how CPM is used in three different settings. The architecture of the settings is presented in Figure 3.

#### 4.2 CPM for analysing existing services

In this setting, CPM is used for analysing an existing service. The case service is a web service for teachers called Opettaja.tv (‘Teacher.tv’), provided by Yle (Finland’s national public service broadcasting company). CPM was applied in order to learn how the present web service is perceived by its users and developers. Three CPM workshops were consequently organised: our pilot one with three young teachers, one with four experienced teachers, and one with four developers.

**Figure 4** Paired comparison of elements and entities in developers’ and experienced teachers’ models (only a section of a complete list) (see online version for colours)

Developers		Experienced Teachers	
Entity	Element	Element	Entity
Yle	Iso Paja (=Yle Headquarters)	Yle	Institutions
Yle	Bureacracy of Yle	Administration	Institutions
Yle	Editorial staff		
Yle	Members of editorial staff		
Yle	Teema TV channel		
Yle	Cooperation of editorial staff		
Yle	International joint projects		
Yle	Digital media		
WWW	Assignments	Assignments	Features
WWW	Video	Videos	Materials
TV	Pupils	Different learners Weaker Stronger Auditory learner Learns by doing Special needs pupils Visual learner Logical learner Kinetic learner Content differentiation Assignments according to learner types Materials according to learner types	Learners Learners Learners Learners Learners Learners Learners Learners Learners Learners Learners
WWW	Audio	Audios	Materials
TV	Teachers	Teachers	Institutions
Networks	Teachers' networks		
Networks	Teachers' insight		
Networks	Networks between teachers		
Networks	Teachers' view to the service		
Financing etc. services Developing etc. without resources	French National Board of Education Teacher's union (NEA)	French National Board of Education	Institutions

The young teachers’ model of the service consisted of 16 elements that formed five entities, and the model of the experienced teachers that formed eight entities. In the developers’ model there were 52 elements forming eight entities. The differences in developer and user constructions of Opettaja.tv were approximated by comparing in ordered pairs the overlaps and level of detail in elements of the models. We used an approach similar to analysing free list data by focusing to co-occurrences of items (Borgatti, 1998). Instead of identifying elements based on their co-occurrences when mentioned together, we used pairing to find direct overlaps and used groups created by participants and our knowledge of the service as a basis for closeness and extended pairing. For instance, experienced teachers mentioned Yle as an element while developers listed detailed elements comprising an entity they called Yle (see Figure 4).

Experienced teachers had one more detailed element about Yle, administration, which was paired with developers' element Yle bureaucracy as a direct overlap. All developers' detailed Yle elements were included when counting extended overlaps for experienced teachers' Yle element.

Another example of differences in orientation was the fact that developers very quickly in the beginning concluded that the students (represented by wooden pawns) should be excluded from the model: "Pupils have no role in Opettaja.tv. They are not part of it". However, as the workshop progressed, pupils re-emerged in the model in two peripheral locations made out of play dough. In both user models, students were brought to the table right in the beginning and they held a central location in the model. Similar detailed attention to learning and teaching settings is evidenced in the long list of problems and suggestions for improvements which the experienced teachers listed in regard to Opettaja.tv, entirely missing in the developers' and teacher students' versions.

### 4.3 CPM for generating new service concepts

In this case, CPM is used for generating a new service concept. In a project with a medium-sized Finnish insurance company, we ran two CPM workshops, one with developers and one with users, with a focus on creating a totally new service: next generation health insurance. The foresighted time perspective was 15 years.

Since it can be difficult to start generating a physical model of a new service concept for the future from scratch, we added a *utures module* in the beginning of CPM (see Figure 3). The participants were given 12 tangible trend cards that we had prepared beforehand and that described possible development directions in the area of health care. Each card included the trend title and an image describing the trend, for example 'customised pharmaceuticals and treatments', 'superfood and functional food products', and 'pandemics'. The participants were also provided with two blank cards that they could use if they found a relevant trend missing. The process was started with a free-floating discussion about the trends, after which the participants had to select three trend cards that they considered the most interesting and important for the future of the health insurance services. The trends provided a starting point for the second part of the workshop: the CPM.

The developers' model of the next generation health insurance consisted of 23 elements that formed seven entities. In the users' model there were 30 elements forming five entities. We started analysing the models by organising the elements into pairs as was done in the case of Opettaja.tv (see Figure 4). This approach ran into problems almost immediately – we were able to spot only two pairs. Why was this different from our experience with Opettaja.tv? It is visible through the elements that both groups have touched the same themes (the role of the customer, physical and mental wellbeing, family and social networks, declining years, for instance) but as they were generating a novel concept, the level of abstraction took off in various directions making the element pairing challenging. Very shortly after the beginning of physical modelling, both groups also started generating their own vocabulary for the features in their health insurance concept, which made the pairing of elements even more difficult.

The differences in the concepts are still visible, although not as quantitative as in the case of Opettaja.tv. For example, the degree of commitment was seen in a very different way in the two concepts. In the users' concept, the insurance was 'a missing piece'" in the users' health-related social network and the network was controlled and managed by

the users themselves. The developers built a concept in which insurance users were members of a network controlled by the company (see Figure 5). They created an insurance membership community which required commitment from the users. Also, following what we already saw in the case of Opettaja.tv, the developers spelled out richly the features and organisational issues surrounding the health insurance concept, while the users concentrated in the overall experience of the health insurance user. Two of the five entities that formed the users' model dealt with using the service – in the developers' model only one of the seven. Orientation to future seemed easier to the users than to the developers. Several times during the workshop, the latter group noted that it was a challenge to untangle themselves from the restrictions of today's business or legal issues. The users' ideas were more detached from limitations of time, implementation, and from the insurance business itself.

**Figure 5** Developers' model of a next generation health insurance (see online version for colours)



#### 4.4 CPM for generating new service concepts with lead users

In this case, CPM is used for generating a new service concept with lead users. In the CPM workshop we had five lead users generating a novel concept of an ideal online service to support learning. This workshop was a part of the same project with Yle (Finland's national public service broadcasting company) as the workshops in the first case (see Section 4.2). Lead users are defined as users that currently experience needs still unknown to the public and who also benefit greatly if they obtain a solution to these needs (von Hippel, 1986, 2005). In the project with Yle, we used the lead user method (e.g., Lüthje and Herstatt, 2004; Churchill et al., 2009), where the lead user workshop is the final step of the process.<sup>3</sup> The goal of the workshop is to transfer the lead user knowledge and solutions to the company.

Since lead users ‘live in the future’ relative to representative target-market users, experiencing today what representative users will experience months or years later [Lilien et al., (2002), p.1044], a futures module was not needed in the beginning of CPM. One could say that when it comes to lead users, the futures component is built-in. In place of a futures module, we gave the participants 19 tangible *trigger cards* (see Figure 3) representing concepts related to teaching and learning, such as ‘social media’, ‘learning from peers’, ‘curriculum’, ‘homework’. Like in the futures module, the participants were also given two blank cards. After discussing the cards for approximately 30 minutes, the lead user participants were advised to choose three to five cards and use those as starting points for the following CPM.

The lead users’ model consisted of 24 elements that formed six entities. Functionalities and using the service were emphasised in the model, as could also be expected according to lead user literature, where lead users are described as being very good at envisioning functional solutions to their problems (e.g., von Hippel, 2005). What is notable compared to our first case, where users and developers were analysing the existing web service, lead users did not separate teachers and students but used an umbrella term ‘users’ including teachers, students, and also parents of the students.

## 5 Discussion and conclusions

The tangibility of CPM proved inspiring and engaging, and capable of demonstrating the differing service interpretations of users and developers. Bringing tangibility into the intangible seems to hold advantages: Having to give a concrete form to each thought and idea supports participants’ attempt to construct and maintain a shared conception of a problem. The relationships between different elements in the physical model are easy to perceive and modify, and since everyone’s ideas are being physically and simultaneously developed, ideas do not vanish or drift away as commonly occurs in workshops. The fact that each element of the model looks different is a strength. If we did the same with just sticky notes, keeping track of the whole would require reading through the identical-looking notes over and over again, thus slowing down the process. The nature of the materials being common arts and crafts materials many of us have used as a child also makes the barrier to start modelling very low and probably also helps to move away from an ‘office mentality’ that can limit one’s imagination and creativity.

Several of our findings here are in line with our assumptions drawn from the literature presented earlier. In Stigliani and Ravasi’s (2012, p.1245) work, for example, in the case of experiences and ideas embodied in tangible form such as pictures, cards, sticky notes, or thumbnails, they observed that “the possibility to ‘see’ their thoughts and ideas right in front of them and to physically ‘move them around’ facilitated the detection of commonalities, emergence of themes, and their assembly into broader groups or categories that the informants would later label and define verbally”. The same was demonstrated in our cases. Our experience with physical model building is consistent also with research on ‘boundary objects’ by Bechky (2003) and Carlile (2002), and shows that toolkits, being material artefacts, acted as ‘tangible explanations’ facilitating the transfer of understandings from user to researcher. We saw that CPM appears to bring to the forefront substantial differences in how developers and users interpret an intangible service (cf. Mashhadiabdol et al., 2014). In particular, it is of interest that the method appeared to spell out the richness in each group’s primary orientation and concern, in

activity theoretical terms the 'object' of their work (Engeström and Escalante, 1996; Kuutti, 1996). When it comes to the first case of analysing the existing Opettaja.tv web service, in both built models as well as in the flow of discussion in the transcript, developers spelled out richly the features and organisational issues surrounding the service, but glossed over the 'pupil'. Users (teachers) described in rich detail 'learners' and organised their models around learner-teacher relations (see Figure 4). This recapitulates the core message that comes across from activity theoretical studies on developer-user relations: making a transition from developer orientation to user orientation is crucial for technology projects' success as developer priorities tend to override those of users (Engeström and Escalante, 1996; Hasu, 2001).

Our three cases provide a proof of concept for how this purposefully simple physical modelling approach can reveal the different stakeholder interpretations of a service and extract these interpretations in a format that allows easy comparing and sharing. Just a couple of separate workshops of a few hours with low-cost material support and equally short analysis time were enough to render richly visible the remarkably different constitutions of the relevant characteristics of Opettaja.tv web service, for example. While the same task can be fulfilled by different means elaborated earlier, CPM appears to hold some advantages in comparison to its alternatives. Sufficient field observation demands significantly more time, and interviewing the participants in turn, even if done in groups and even if facilitated, would have to rely on analysis of transcripts or some very advanced note taking technique. On the other hand, when the outcome of a workshop or a session is a physical prototype or visualisation, it becomes difficult to share the results within an organisation in a way that those who were not present in the workshop would still be able to grasp what was created. In addition, comparing physical workshop results of different stakeholder groups objectively can be unfeasible.

CPM's advantage is that the tangible trace can be documented at each step and so can model reconsiderations by participants as well as the inclusion and exclusions of final service elements. All these should help to ensure that participants', not facilitators' categories that are captured in the final model. Even with an open exploratory modelling phase included in the method, the end result still is clearly structured providing a concrete mediator to be shared with the developer team. This is important especially in preventing developers lapsing back to their existing priorities and inadvertently overriding the lessons learnt from users when user involvement engagements concern only a limited time period in their development, such as concept design (Hasu, 2001; Hyysalo, 2006). Considering the expenses from preparations, CPM requires only preliminary understanding of the service in question for localising the content for a specific service development case, namely the complexity and type of the service to be able to ask clarifying questions ensuring most of the service is covered by the end of the workshop.

The cases illustrate how by modifying the workshop setting (see Figure 3), CPM becomes a method that is extendable to address different types of service development situations from analysing an existing service to generating new service concepts. Moving from analysing to generating, the method was enhanced with a pre-module: a futures module in the case of developers and 'ordinary' users, and a trigger module in the case of lead users. Even though the difference in stakeholder interpretations remained similar through the first two cases, the shift from analysing to generating changed the level of abstraction and caused some loss of detail. When disassembling the physical model into elements, it is the facilitators' job to ask for wordier element labels in order to reveal more detailed meanings of the elements and for the method to remain self-documenting.

Otherwise making sense of the newly generated vocabulary requires going through the audio recordings. When we compare the outcome of the two cases where CPM was used for generating a new concept (see Sections 4.3 and 4.4), we noticed that in the case of lead users collaboration and building on each other's ideas decreased. Unlike in the case of developers and 'ordinary' users, the lead users seemed to keep things more to themselves and pushed more their own agenda. However, this observation supports what is characteristic to lead users as presented in the literature: Their current need not being met by the products and services on the market and the severe nature of this need may have led lead users to create their own solutions to the problem, thus being already content and not interested in others' opinions.

As managerial implications, our proof of concept brings relief to managers who understand the need for involving users in the service development but who are constantly bound by limited resources be it personnel, time, or money. For gaining an understanding of service use through comprehensive approaches, the time needed to map different versions of service in use alone comprises a small research project as the process requires intensive use of time and other resources for both gathering and analysing the data, which likely includes pages of notes and transcripts or hours of audio or video recordings. Here, we encourage managers to take advantage of this low-cost, time-efficient and easy-to-adopt physical modelling approach that can be extended to address differing service development situations before jumping into more complicated and resource-intensive methods. Later on CPM could be easily coupled with service blueprinting, for example. What comes to our follow-up interviews with the provider organisations of the case services, we have seen that the user perspective drawn by the CPM workshops has been found richer and more complete than what has been gained by using more traditional methods such as focus groups and surveys. An anecdote regarding the second case, where the goal was to create next generation health insurance, is illustrative: Some of the vocabulary developed by the user participants is still, after two years, in use in the provider organisation, the health insurance company.

Our proof of concept is a stepping stone for future research that should further explore the possibilities of physical representations in service development. The present-day business environment requires companies to be adaptable and agile, thus creating a need for easy-to-adopt and easy-to-modify approaches such as CPM.

## References

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## Notes

- 1 Jin et al. (2012) show that perceived ease of use and resource commitment positively affect organisational adoption of service development tools.
- 2 Unlike in the work of Buur and Matthews (2008), for example. In their study, each participant in turn placed foam pieces on the map of a plant layout, i.e., the model.
- 3 The identification process of the lead users is described in Hyysalo et al. (2015).