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Making Services Tangible for Differentiating Between Stakeholder Understandings

Samuli Mäkinen[1], Pia Helminen[2]

[1]*Aalto University, Department of Engineering Design and Production*
samuli.makinen@aalto.fi
[2]*Aalto University, Department of Industrial Engineering and Management*
pia.helminen@aalto.fi

Abstract
For successful service design, it is vital to be aware of the varying and often remarkably different stakeholder understandings of a service. However, the intangible nature of services results in difficulties in making visible these understandings. Existing approaches for gaining a contextual understanding of service use tend to stumble against problems caused by services' nature, or are simply too laborious. After our experimentation in the redesigning of a complex online service, we report on a potentially elegant technique we call collaborative physical modeling (CPM) which appears to make visible the varying stakeholder understandings via tangibilizing a service. The outcome of the technique is a structured understanding of a service achieved in a quick and not resource-intensive way. CPM seems a viable technique for service designers, helping them to have more focused discussions on what issues need to be considered in the design process both in development and use side.

Keywords: user involvement, product and service design, stakeholder understandings, physical modeling, CPM

1 Introduction
Important service innovation activities often take place outside the organized research and development functions of a company (e.g. [1]) and new service development typically involves several stakeholders outside the firm, such as customers (e.g. [2, 3]). Designer's inability to be aware of the varying stakeholder understandings of a service may result in both not recognizing novel design opportunities and a failure to meet even the more trivial needs of different stakeholder groups. Crucial differences in stakeholder understandings may exist, and yet it is still often difficult to convince designers that the differences and what they are exactly are to be taken seriously. Making visible these differences between stakeholder understandings, and even keeping different stakeholders as separate is argued by many to be a vital strategy [4, 5]. However, services' unique characteristics such as intangibility, heterogeneity, perishability and inseparability [6, 7], and varying use contexts related to an individual's own life as opposed to designers' estimation of it result in difficulties for making visible the different stakeholder understandings of the service. This is a thorny and frequently encountered issue also in practice as just the question of what features or characteristics form a complex and intangible service can be hard to answer.

Approaches for user involvement may offer some remedy, and there is a multitude of methods, ethnographic means probably being the best, for gaining a deep contextual understanding of service use. With these methods, such as field observation, interviewing, or more comprehensive approaches such as contextual design [8], the time and occasions needed to map different versions of service in use alone, however, comprises a small research project as the process requires intensive use of time and other resources for both gathering and analyzing the data. Shortcutting this by e.g. group interviewing [9] or focus groups [10, 11] tends to stumble against problems for example in how to effectively and reliably to keep track of the service elements expressed as well as how to keep a stakeholder group aware of what they have already considered. In addition, it is common to apply the one method you know and then hope it fits the purpose. On the other hand, outside expert's systematic analysis could do the job, but according to our experience not too well, as we demonstrate below with the case experience. All in all, existing methods often seem either unsuitable or simply too laborious, thus creating a need for an approach to make visible the stakeholder understandings of a service in a way that is not resource-intensive.

For making visible the differences of any entities, the entities themselves need to be visible first, which is a challenge because of the intangible and complex nature of services. Fortunately, successful experience on dealing with the intangible exists. For example 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. [12, 13]). Design theory points further on towards utilizing physical representations, as according to it, designers solve problems incrementally by creating explicit design representations that "talk back" to the designer [14]. Various physical representations [15] have long been used to support design activities considering physical features, the context of use, socio-technical systems and services [16], experiences [17], social interaction [18], and software [19] to name a few. Prototype is likely the most concrete form of a physical representation, and this type of physical model in its most traditional form is a demonstrative vehicle for sharing and experimenting visions of physical products. While the majority of user involvement with prototypes once concentrated on users evaluating prototypes, Bødker & Grønbæk [20] emphasize on 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 & Kyng [21] mock-ups encourage hands-on experience and are understandable, cheap, and fun to work with.

Moving further on towards collaborative aspects of utilizing physical models, collaborative design features a large family of techniques and methods that take place in workshops and utilize representations of work and technology to translate information and understanding between developers and users (e.g. [22, 23]). In addition to tangible business modeling mentioned above, collaborative design games are another track among collaborative techniques, that have been built for multiple purposes and with notable variation, e.g. in envisioning information system make up and work redesign [24] and design opportunities [25] to name a few.

It is also known that collaboratively working on a physical object can help to bridge the boundaries [26] and for example prototypes and visualizations have their role as thinking and communication tools [27]. As Brandt [27, p. 191] puts 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 addition, 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 [20, 27, 28]. This is yet supported by Stigliani & Ravasi [29] who found in their recent work that “materialization" of cognitive work supports the collective construction of new shared understandings.

Physical representations have long been used in supporting different design activities, mostly for generative tangible product design efforts, where also the value of customer involvement has been acknowledged for long. Within service design, however, the amount of studies focusing on customer involvement is still limited [2, 30]. It is also noted that designing of services require new perspectives [31]. While several user involvement approaches rooted in new product development may be effortlessly applied in the development of services, services’ unique characteristics mentioned above cause a layer of extra trickiness.

All in all, drawing from designerly practices, physical representations, and approaches enabling user participation, it seems that collaboratively working on a physical boundary object to tangibilize the intangible is a promising approach for differentiating between stakeholder understandings within service design. Building on this notion, and on our successful experimentation with such approach, we report on a simple and potentially elegant way of working we call collaborative physical modeling (CPM) which appears to make visible the varying stakeholder understandings via tangibilizing a service in a quick and inexpensive manner.

2 Collaborative Physical Modeling

The technique is, in short, having representatives of a same stakeholder group, such as users or designers, separately build up their understanding of the service in question from playful tangible materials, then disassembling their built models to service elements and entities in a structured manner, and finally comparing these outcomes with each other.

In addition to sources of inspiration presented in the introduction, some components were brought from reverse engineering (e.g. [32]), and the affinity diagraming (e.g. [33, 32]). In the following, we present the basic idea of the CPM through its process flow. CPM requires 3–5 participants from same stakeholder group for one session that lasts 2–3 hours. We have used two facilitators to ensure the flow and documentation of the process.

2.1 Preparing

Preparing the setting for CPM is ensuring a table and a wall with plain surfaces, chairs, plain paper sheets, and an accessory kit (Figure 1). Recording requires 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" [28, 34].

2.2 Warm-up

CPM begins by introductions and explaining the steps of the process. The first step is warm-up drawing and ideation to get people to loosen up and accustomed to voicing, tangibilizing, 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.

2.3 Model building

After the warm-up, the accessory kit (Figure 1) is brought to the table and divided evenly to allow all 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. 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. Participants may write a name for each element, but this is not required. Modeling lasts from 60 to 90 minutes depending on the nature and complexity of the service in focus. When the model is ready participants are asked to briefly present the newly modeled service and its elements. For examples of finished models, see Figure 2 and Figure 3.

Figure 1 The accessory kit (left) and modeling on the way (right).

2.4 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 color), photograph each element and collect them on the white board in consecutive order. This continues until every element has been labeled and there is nothing left of the model.

2.5 Grouping

The last phase requiring participants is that they group the post it elements on the wall according to affinity into entities and give a name to every entity (Figure 2 and Figure 3). Resulting entities represent the main components of which the whole product consists – as perceived by the participants.

2.6 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.

3 Data and Methodology

Opettaja.tv was a web service developed for school teachers by Finland's national public service broadcasting company Yle, and the authors were engaged in a redesign project of this online service. One of the first challenges of the project was to comprehend what elements constitute the current service. The project later continued into identifying lead users of future online services, collaborative workshop with them, and forming of a preliminary concept of new online service for Yle.

Four different datasets were derived from this particular project: The so called investigator's understanding of the existing web service, the service designers' understanding, and two sets of user understandings (young teachers and experienced teachers). To stay within the length of this paper, we focus on three of the sets here, peeking in the young teachers' view only when further elaborating some of the key issues. The CPM workshops for the designers and for the two user groups were organized separately, the groups did not work together at any point. The CPM workshops lasted 2–4 hours and were documented by audio recordings and still photographs, some parts also recorded on video. For the comparison of the four understandings, we used an approach similar to analyzing free list data by focusing to co-occurrences of items [35].

4 Collaborative physical modeling of teachers' web service

Now we move to presenting the use of CPM in a service redesign project for Finland's national public service broadcasting company's (Yle) teachers' online resource portal Opettaja.tv. We focus here on two physical modeling workshops: one with four designers, and one with four teachers, i.e. users.

4.1 External investigator problems in understanding the Opettaja.tv

The starting point for embarking on the physical modeling exercises arose from our attempt to define what Opettaja.tv was comprised of, to find users that would be versed in its different aspects. The first author browsed the web service systematically listing all features, stakeholders, notions, and such. The list was complemented with information from discussions with designers and teachers, feedback messages stored in the system, a thesis' findings, and first author's own experience as a teacher and growing up in a teacher family. Altogether 52 elements of Opettaja.tv were found and then grouped into 6 entities: Functions and features (such as registering or favorites), Methods/Tools (such as streaming from the web or discussion forum), Essential services (such as programs or ready-made materials), Channels (such as web service and fairs), Concepts (such as learning or navigating), and Goals (such as for Yle to make service more widely known and for teachers to make plans for classes). Despite the first author's own background, systematic exploration and knowledge gathering ambiguity remained as to what really constituted this service for different stakeholders. The "investigator understanding" appeared rather a starting point for more collaborative elaboration and a resource allowing facilitation than a sufficient understanding.

4.2 Designers' CPM: designers of Opettaja.tv

The designer session was held with persons from Yle, all responsible for the development of Opettaja.tv in varying ways and familiar with each other. The designers modeled concrete elements, such as skaters (representing pupils), exhibition area as well as abstract elements such as information highway. This, in turn, led to a long discussion of (Internet) network that connects all actors, which in turn led to modeling administration, ministries, bureaucracy and different actors around Opettaja.tv. After 15 minutes of model building, the facilitators reminded the participants of modeling also all the concrete elements, features and the tangible content of service. The participants immediately began listing features of the service while adding abstract elements in between. In the end, designers' model came to comprise 52 elements that were grouped in 8 groups (Figure 2).

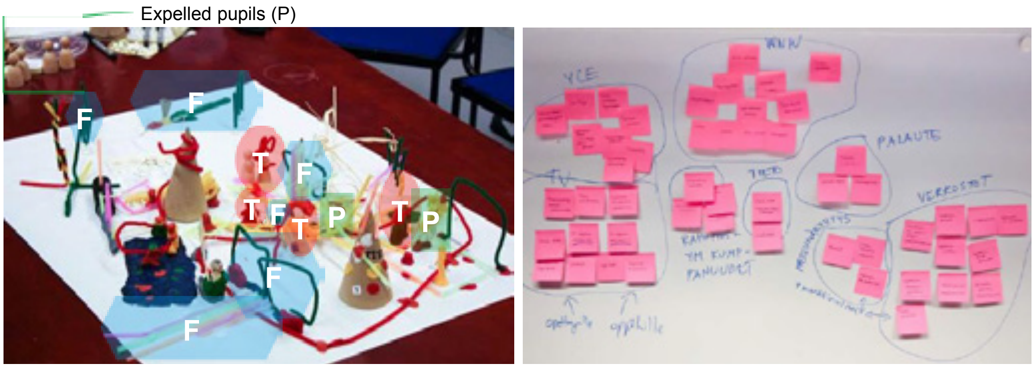


Figure 2 Designers' perception of Opettaja.tv. The finished model (left) and all the elements of the model grouped into entities (right) (F = features, T = teachers, P = pupils).

4.3 Users' CPM: teachers

The second workshop was held with four experienced teachers, using the same instructions as in the previous ones. The participants began their modeling from learners, learner types, teachers, subjects, Opettaja.tv features to adjoining services and network connections. Most attention was paid in how the service related to class situations and preparations. These participants came up with three handy improvements to the technique on the fly, namely using red clay to mark problems, stars to denote improvements and using writing on model elements and sticky notes to record already in the building phase what each feature was. This appeared to foster remembering of what already was in the model and may have contributed to the model ending up with most elements – 69 elements in 8 groups – with modeled interrelations (Figure 3).

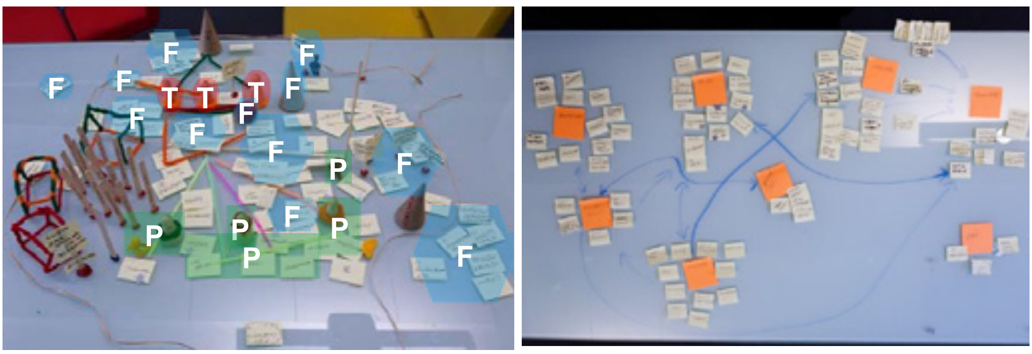
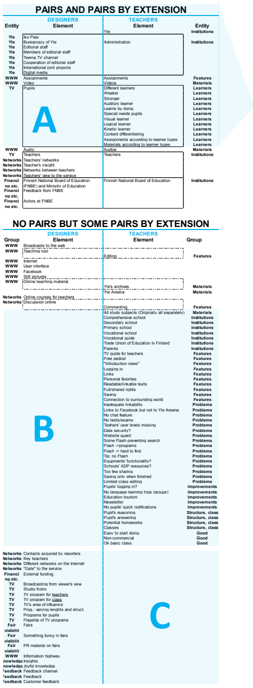


Figure 3 Teachers' (users') perception of Opettaja.tv. The finished model (left) and all the elements of the model grouped into entities (right) (F = features, T = teachers, P = pupils).

4.4 Comparing the models of Opettajat.tv

The differences in investigator, designer and user constructions of Opettaja.tv can be approximated by comparing in ordered pairs the overlaps and level of detail in elements of the models (Figure 4). We used an approach similar to analyzing free list data by focusing to co-occurrences of items [35]. 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 (the national broadcasting company) as an element while designers listed detailed elements comprising a group they called Yle. Experienced teachers had one more detailed element about Yle, administration, which was paired with designers' element bureaucracy of Yle as a direct overlap and all designers' detailed Yle elements were included when counting extended overlaps for experienced teachers' Yle element. Another example of elements paired by extension is designers' online teaching material which did not have an explicit counterpart but experienced teachers' Yle's archives basically means the same thing. Also, audio for example came up in both workshops and is a clear pair, i.e. a direct overlap.



A

PAIRS AND PAIRS BY EXTENSION

Entity	DESIGNERS Element	TEACHERS Element	Entity
		Yle	Institutions
Yle	Iso Paja		
Yle	Bureaucracy 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	Learners
		Weaker	Learners
		Stronger	Learners
		Auditory learner	Learners
		Learns by doing	Learners
		Special needs pupils	Learners
		Visual learner	Learners
		Logical learner	Learners
		Kinetic learner	Learners
		Content differentiering	Learners
		Assignments according to learner types	Learners
		Materials according to learner types	Learners

Figure 4 An overview illustrating magnitudal differences in paired comparison (pairs in section A and no pairs in sections B and C) of designers' and teachers' perceptions (left) and the section A magnified as an accurate example of the content (right).

In terms of numbers Table 1 lists the amounts of elements and groups found in each physical model and the investigator analysis of Opettaja.tv and then compares the results in regards to direct overlap and overlaps when element extensions are allowed. The differences between how designers, users and investigator construct a service based on their experience are noteworthy. When comparing roughly similar size models by teachers, designers and investigator analysis, direct overlaps remain 7–21% and extension allowed overlaps 32–62%. Lowest overlaps are found in comparisons to user model. While the outcome of the pairing may depend somewhat on the person or team doing it, the magnitudes of the differences are correct and notable.

Qualitative examination of the ordered pairs in Figure 4 offer us a further view into these differences and overlaps. For example, in paired elements (Figure 4, section A) designers list 8 elements for Yle, glossed over as "administration" by teachers. Respectively, the object of teacher's work, the learners, is represented by twelve elements by teachers and by only one gloss by designers. Sections B and C (Figure 4, designers on the left column and teachers on the right) provide the contours of non-paired issues in these two models of Opettaja.tv. There teachers are very detailed and full of nuance in regard to key features of the technology-in-class and its problems and points for improvement – entirely missing in designers' view (Figure 4, section B). Designers in turn have more contextual issues such as the importance of fairs and the connection between web service and Yle TV programs (Figure 4, section C). Remarkable perception differences exist also in regards to categorizations. For example, what is perceived as "WWW" by designers is glossed as "materials" by teachers.

Table 1 Amounts of elements and groups in all perceptions (top) and overlaps of different stakeholders' perceptions (bottom) (*12% of teachers' elements are found in designers' elements).

	Designers		**Teachers**		**Investigator**	
	Amount		Amount		Amount	
Elements	52		69		52	
Groups	8		8		6	
	Coverage	Extensions allowed	Coverage	Extensions allowed	Coverage	Extensions allowed
Designers	-	-	14 %	45 %	21 %	62 %
Teachers	12 %*	32 %	-	-	7 %	42 %
Investigator	21 %	40 %	10 %	54 %	-	-

To further unfold the differences between service-as-designed and service-in-use we add detail to paired comparisons with transcript based analysis. In the length of the present paper we illustrate one such line of development and we focus on the role of pupils in Opettaja.tv. In designer workshop's building phase designers grab wooden pawns amongst the available materials at 2:30 min from the start. Designers decide that the small ones would represent teachers and the big ones would represent pupils. They quickly conclude that the students should be excluded altogether, removed them outside the model: "Pupils have no role in Opettaja.tv. They are not part of it." (see Figure 2, expelled pupils). However, as the workshop progressed, pupils re-emerge in the model in two peripheral locations made out of play dough. The teachers remain as wooden pawns and hold their central location closely linked to features. In contrast, young teachers placed pupils in the very center. Both teacher modeling sessions also begin with them. Experienced teachers' model (Figure 3) then grows from learners (note, not pupils) and their connections to teachers. Soon different types of learners were identified including e.g. visual, vocal and logical learners that were matched to teaching and presentation modes.

5 Conclusions

Our experiences with CPM point to three main directions. First, the use of such collaborative physical modeling technique appears to bring to the fore substantial differences in how different stakeholder groups perceive and understand a service, in particular the richness in each group's primary orientation and concern. Designers spelled out richly the features and organizational issues surrounding the service, but glossed over as "pupils" what appeared to them as at best secondary users of their service. Users i.e. teachers, in contrast, described in rich detail "learners" and organized their models around learner–teacher relations, but in turn glossed only thinly over the more technical and administrative sides of the service. Also, the sense of depth of the actual use context maybe seen in only users mentioning service features especially for pupils and the linkage to parents, completely lacking in designers' perspective. In our analysis, we compared the CPM results also to the view of the (very technology and user domain knowledgeable) external investigator, and there it was salient that such external view had difficulty in delineating what other aspects in designers' as well as users' contexts are or are not relevant for the service. Due to remarkable differences between stakeholder understandings evident in our study, making visible the differences seems indeed a vital strategy for service design as different stakeholder groups likely provide insights and perceived importance of service elements that would otherwise go unnoticed by designers. Comprehending the differences in understandings may help design teams to have more focused discussions on what issues need to be considered in the design process both in development and use side.

Second, the presented approach of physical modeling can yield understandings of an intangible and complex service in a quick and not resource-intensive way with the final result being clearly structured and thus easy to process further or to present. Just 2–3 separate workshops of a few hours with low-cost material support, and equally short analysis time was enough for us to render richly visible the remarkably different constitutions of the relevant characteristics of Opettaja.tv web service. While the same job can be done 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 in groups and even if facilitated, would have to rely on analysis of transcripts or some very advanced note taking technique. Naturally, the depth of the final results is not as deep as with those more laborious techniques elaborated earlier, for instance structured elements of CPM vs. a fully analyzed transcript of a focus group session. However, it is up to the CPM facilitators, if they wish to conduct the analysis on similar level with CPM transcripts and the novelty here lies in the possibility to acquire the main results with ease. 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 in that it remains participants', not investigators' categories that are captured. Considering the expenses from preparations, CPM requires only preliminary understanding of the service in question for localizing the content for a specific service design 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.

Third, the material nature of the technique – tangibilizing the intangible – seems to have several benefits. In comparison to just free listing of service elements, the physical model helps participants to see connections and be reminded of elements and prior considerations. This we found important when modeling a more complex service and/or domain in a group. The 3D character of the model also appears to facilitate getting at multiple layers of the service as well as to the complex relations it may have to other adjoining systems and practices. Physically modeling a service from scratch inevitably takes some time but it just may give the necessary excuse to take the time and ponder on the service and its surrounding world thoroughly. Escaping the narrative allows for multilevel work and reconsidering and building on the emerging collective set of elements and their interrelations. Also, 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 seems to lower the barrier to start modeling and probably also helps to move away from "office mentality" that might chain one's imagination and creativity.

To conclude, collaborative physical modeling provides means to clarify different stakeholder understandings of intangible services. As our case with Finland's national public service broadcasting company illustrates, the differences can be substantial even when parties are seemingly well educated of each other's concerns. To us this indicates that such technique would be a viable addition to a service designer's toolkit, also answering to the need for new perspectives and techniques for service design noted earlier [31]. Using physical modeling helps clarifying the varying ways in which the features and functions of complex services can be grouped, mapping where areas needing improvement in the its adjoining systems reside, and clarifying how users and designers understandings of the service differ. The key differences and benefits of the technique are open exploratory early phase with low-cost material support, easy documentation and clear participant driven clarification and grouping towards the end of the workshop resulting in an outcome easy to comprehend, process further and/or present, making it affordable for practitioners' use. Tangibilizing an intangible service and externalizing cognitive processes to material format in addition to plain narrative creates a vessel for a collective memory and further collaborative processing. While there are several similar methods for generative and envisioning purposes, the novelty here lies in using CPM for capturing fairly comprehensive stakeholder understandings and their differences in a not resource-intensive way in an easy to process format.

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