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AN ENGINEERING APPROACH TO MAPPING MEANINGS IN PRODUCTS AND SERVICES

Waltersdorfer, Gregor (1); Gericke, Kilian (1); Desmet, Pieter (2); Blessing, Lucienne (3)
1: University of Luxembourg, Luxembourg; 2: Delft University of Technology, The Netherlands; 3: Singapore University of Technology and Design, Singapore

Abstract

The aim of this paper is to explore how meanings in products and services can be captured, deconstructed, and finally structured, in order to facilitate the deliberate and intentional creation and conveyance of meanings to users and non-users. These analytical steps for mapping meanings are investigated in an empirical study using a qualitative approach and theoretically grounded in Peirce's triadic model of signs. This new methodology in design research seems promising to obtain a new perspective on meaning in products and services. Through the course of the empirical study, we developed a research method, which is also a design method, called MeaningMap, for organising and structuring meanings. A first exploratory evaluation of the method with students showed its comprehensibility and applicability for analysing and structuring meanings within a limited amount of time. We envision that the MeaningMap as a method for design as communication can support designers during task clarification in analysing the voice of customer, defining user group, specifying the intended meanings, and deriving requirements to the communicative potential of products and services.

Keywords: Design methods, Product-Service Systems (PSS), User centred design, Meaning, Semiotics

Contact:
Gregor Waltersdorfer
University of Luxembourg
Research Unit in Engineering Science
Luxembourg
gregor.waltersdorfer@uni.lu

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1 INTRODUCTION

Since Krippendorff's (1989) famous proposition "form follows meaning", meaning in products and services has received increased attention in design research. Taking the perspective of meaning in design addresses the communicative potential of products and services between designers and users (Crilly et al., 2008). Considering design as communication, the designers' goal is to successfully convey their intended meanings through products and services (Kazmierczak, 2003) in order to make the products and services understood and - hopefully - accepted by potential users. However, it is up to potential users, which meanings they successfully reconstruct. Besides the respective products and services, the reconstruction is also influenced by, for example, personal experiences and preferences, the users' peers, marketers, and culture (Desmet and Hekkert, 2007).

The same product or service can have different meanings, as these are not technologically determined, but created and cultivated by different social groups (Bijker, 2009). In case of conflicting meanings, controversy can arise between social groups, including designers as one group. It is through a process of social construction that meanings in products and services converge (ibid.). Designers can exert influence on this process of social construction through their design decisions. Since the process of social construction revolves around meaning, the concept of meaning lends itself to be taken into account during the design process. By facilitating the convergence of meanings, designers can contribute to a wider acceptance of products and services. This requires to identify conflicting meanings in products and services, and to strengthen or weaken the potential of products and service to communicate intended or not intended meanings.

The role of meanings in the development and acceptance of products and services gives rise to the following research questions:

1. How can meaning be described in a way that supports design efforts?
2. How can aspects of products and services be identified, which refer to conflicting meanings in order to address the communicative potential of products and services?

In addressing the questions above, we specifically aim at exploring how meanings in products and services are captured, deconstructed, and finally structured.

Crilly et al. (2008) identified five complementary perspectives on the communicative potential of products and services: they can be considered as a language; as part of sign systems; as instruments of persuasion; as components of social interaction; and as message or medium of the communication process. The presented research focuses on products and services as part of sign systems, and therefore is informed by theories of signs, namely semiotics. Surprisingly, the application of semiotics in design research for analysing meanings in products and especially in services has made little use of empirical data (Mick et al., 2004) apart from data collected through the semantic differential (Osgood, 1952), a method which has its origin in semiotics (Mick, 1986). We assume that by collecting empirical data, we can gain new insights into "design for meaning". The presented research is embedded in our project on harnessing meanings in products and services to foster eco-sufficient user behaviour.

In this paper, we first outline semiotic theories, the concept of meaning in design, and existing methods that can be used for capturing meanings (Section 2). In the same section, we differentiate empirical studies of meanings in products and services that are informed by semiotics, based on the data collection methods and semiotic theories that were used. This allows us to position our own empirical study. In Section 3, we describe our empirical study. Finally, in Section 4, we describe and discuss the MeaningMap, which is a research and design method that we developed based on our empirical study.

2 THEORETICAL AND METHODOLOGICAL BACKGROUND

2.1 Semiotic Theories

Semiotics is concerned with signs (Chandler, 2007). According to Peirce (CP 2.228) a sign is "something which stands to somebody for something in some respect or capacity". As he (CP 2.308) further noted: "nothing is a sign unless it is interpreted as a sign", i.e. signs come to existence through interpretation. He (CP 5.253) also holds the reverse: "[..] that every thought is a sign." Therefore, signs are a referential way to conceptualise interpretation based on inference (Peirce and Hoopes, 1991).

The two primary sign models were developed independently from each other at about the same time by Saussure, a linguist, and Peirce, a logician: While Saussure advanced a dyadic, or two-part, description

of signs, Peirce argued for a triadic version. According to Saussure (1959), a sign, as "a two-sided psychological entity", is composed of a "signifier", which is a sense impression, and a "signified", also called concept or meaning. Both elements recall each other during the process of signification and are therefore united through association (ibid.). In Peirce's (CP 1.339) triadic model, "[a] sign stands for something to the idea which it produces, or modifies. […] That for which it stands is called its object; that which it conveys, its meaning; and the idea to which it gives rise, its interpretant." Peirce (CP 1.372) described the interpretant as "[..] cognition produced in the mind".
Comparing the two models by Saussure and Peirce, it is obvious to equate "signifier" and Peirce's "sign" on the one hand, and "signified" and the combination of "interpretant" and "object" on the other hand. Peirce's model is preferable for describing meaning in design by deconstructing it into its entities, since it accounts for more details through its triadic nature compared to the dyadic model by Saussure. Specifically, the triadic model additionally considers materiality (Chandler, 2007) and facilitates describing cognitive processes (Nesher, 1984).

2.2 The concept of meaning in design

Scholars in design research agree that meanings can be considered as mental relations (Krippendorff, 1989; Vihma, 2009). Thinking in relations, of which products and services can be a part, provides a distinct perspective on design. Several determinants of relations exist that specify the concept of meaning for design. One determinant answers, for whom the established relations are valid. Depending on the level of agreement, one can distinguish between personal (Heskett, 2002) and socially shared meanings (Kleine and Kernan, 1988). Another determinant is the valence of the meaning relations: pleasant or unpleasant thoughts, events or objects involved in the relations determine if the meaning in a product or service is considered positive or negative (for example see: (Heffner, 2007)). Last, relations of meaning are also determined by the focus of design efforts: is the whole product or service considered or only one aspect, such as the interface (de Souza et al., 2001).
It depends on the methods used for capturing meanings, if these determinants of relations, namely social agreement, valence, and the focus of design efforts, can be taken into account.

2.3 Methods for capturing meanings in products and services

Data collection methods can follow a quantitative approach for measuring "the degree in which phenomena occur", a qualitative approach for investigating "the nature of phenomena", or a combination of both as mixed method (Blessing and Chakrabarti, 2009). The applicability of the methods depends foremost on the research question and the unit of analysis.
Allen and Ng (1999) applied self-developed scales for quantitatively measuring predetermined meaning categories in order to investigate how they impact consumer choices. The semantic differential (SD) by Osgood (1952) is a widely used quantitative method in design research. In a study into design as communication by Khalaj and Pedgley (2014), the SD was applied to compare intended and reconstructed meanings, in order to determine the extent and areas of (in)congruent meanings. As in the SD, the repertory grid (RG) by Kelly (1955) measures meaning by asking participants to position the object of interest on a scale between several bipolar semantic dimensions (in Osgood's terms) or constructs (in Kelly's terms). For SD, the dipoles are defined by the researcher. For the RG, they are elicited from the participants in a qualitative approach, which makes the RG a mixed method. For example, Fallman and Waterworth (2010) used the RG in a study to capture dimensions of meaning that people ascribe to electronic devices after experiencing different styles of human-computer interaction embodied in these devices.
Qualitative research approaches have a long tradition in consumer research for comprehending meaning holistically (Levy, 2005). Instead of quantifying only a few determinants of relations, which necessarily need to be pre-determined to a certain extent, qualitative approaches facilitate an account of all determinants. For researching inferred meanings, Graeff and Olson (1994) recommend personal interviews, since they allow researchers to ask clarifying questions. Interviews have high potential for gaining deep insights into meanings if they are underpinned by interviewing techniques such as probing and deflection: Heffner (2007) reported that deflection, i.e. asking in a way that interviewees need to immerge into a third person, was especially useful for capturing symbolic meanings. Probing, as recommended by Mick (1986), aims at stimulating the interviewee to provide more information by various strategies such as remaining silent or paraphrasing (Bernard, 2006).

2.4 Positioning our empirical study

Based on the theoretical and methodological considerations discussed above, we can position our empirical study in existing empirical design research into meanings in products and services. To this end, we differentiate empirical studies whether they follow a quantitative or qualitative research approach, and in case of qualitative, whether they apply either the dyadic or triadic semiotic model for describing meaning by deconstructing it into its entities. We prefer a qualitative over a quantitative approach, since our study is explorative in nature. Semi-structured interview is our favoured data collection method, since it can be adapted flexibly. When analysing qualitative studies, we only found one empirical study on semiotics of hybrid vehicles (Heffner, 2007) which makes use of the dyadic model. Surprisingly, we did not find any study into meaning, neither in consumer nor in design research, that applies our preferred choice: a qualitative approach combined with the triadic model.

3 EMPIRICAL EXPLORATION OF MEANINGS IN SERVICES

We strived to answer the following research questions, as discussed in Section 1, through an empirical study: (1) how can meaning be described in a way that supports design efforts? (2) How can aspects of products and services be identified, which refer to conflicting meanings, in order to address the communicative potential of products and services?
Additional research questions pursued through the empirical study, are not discussed in this paper, due to space limitations. These questions are: how do meanings by users and non-users differ to explain (non-)user behaviour? What measures can designers take to facilitate the successful reconstruction of their intended meanings by users and non-users?
Since the aim of our empirical study was to explore the nature of meaning in products and services, in order to inform design as communication, we use a qualitative approach involving semi-structured interviews for data collection. For data analysis, we used Peirce's model of signs for deconstructing meanings and describing the inferential interpretations behind meanings.

3.1 Method

We used services involving shared bicycles and shared washing machines to exemplify our meaning-based approach to design-as-communication. We focused on three types of sharing, which were found for both shared goods: peer-to-peer (P2P), product-service system (PSS), and multiservice (MS). In this paper, we discuss our approach using one example: PSS for washing machines.
Following the ideas by Shostack (1977), every 'market entity', product or service, can be described along a continuum depending on how much weight it puts on intangible and tangible elements. We call our examples services due to the dominance of intangible over tangible elements in the market entities. However, as Secomandi and Snelders (2011) argue, the objects of interest for design remain on the tangible aspects of interface and infrastructure of a service.

3.1.1 Participants

Companies were recruited by contacting the founder or front office via email, LinkedIn or the company website. 42 companies were contacted, 15 were willing to be interviewed. We interviewed four founders, one owner, one consultant, who initiated the venture into sharing, and one store manager of bicycle sharing services, and six founders, one owner, and one director of sales of washing machine sharing services. Each founder was also the designer of the service.
Subsequently, we recruited users of the covered services, and non-users. For recruitment, we used online media such as Facebook, Twitter, and Craigslist and direct contact by the researcher and two companies. In total, we interviewed 41 (non-)users, 19 on all three bicycle sharing services and 22 on all three-washing machine sharing services. 18 respectively 9 participants contributed as user of at least one covered or similar bicycle or washing machine sharing service to our study.

3.1.2 Material

Each service was described on a single A4-page including 3 pictures, which were published by the company online, by using the following ingredients: business model, geographic and timed availability, pricing, payment, prerequisites for use, use process, support by company, and specificities of the shared good. These descriptions were distributed to the interviewees in advance, who were asked to read them as a preparation for the interview. The example discussed in this paper (PSS for washing machines) was

an unattended, self-service laundromat, which runs washing machines and dryers with 10 to 23kg capacity, and accepts payments either via a web app or with coins. The laundromat also provides free Wi-Fi and a moneychanger, and is open 24/7. The price depends on the machine's capacity, but is the same for different temperatures. For paying via the web app, it is required to register with a credit card, and to top up the user's online account. Online payment via the web app requires additional steps for verification compared to payment with coins. Washing machines are owned by the company and have higher capacity and shorter washing cycles than consumer goods.
Three sets of questions were used in the semi-structured interviews: one for the company representatives, one for users, and one for non-users. All sets have a similar base of questions, which capture first impressions, and projective or expressive qualities of services. Examples for these questions are: What comes into your mind, when you think about this service? What is the idea behind this service? What image do you get from a person using the service? In your point of view, what message, if any, does the service convey? By what is the message expressed? When you would use the service, what would people, who know you, think about you? Do you think of any positive or negative social implications that come with this service? All questions were potentially probed by asking why.

3.1.3 Data collection

Interviews were conducted one-on-one in either English or German via VoIP or phone and recorded. The interviews took 30 min for the companies and 30-60 min for (non-)users. All (non-)users were interviewed on all three sharing types for either bicycles or washing machines. In this way, each user or non-user contributed to the discussion of three services; of some they were users, of others they were non-users.

3.1.4 Analysis

Since no empirical studies with comparable methodology had been carried out before, we needed to develop our own analytical procedure for describing meanings. In this section, we discuss the similarities between semiotics and logic, on which we grounded our analysis. This is followed by a description of a two-step procedure of identifying inferences and deconstructing meanings (for examples see Section 3.2).
As stated in Section 2, signs exist through inferential interpretation. In logic, making inferences is about moving from premises to conclusions. The starting point for an inference in logic is the premise; in semiotics by Peirce, it is the sign. Therefore, we can equate sign with premise (cf. Nesher, 1984). The endpoint of an inference is the conclusion in logic, and the meaning in semiotics. Conclusion and meaning can also be equated. The move in logic from premise to conclusion is represented by the interpretant in semiotics. Since the sign stands for the object to which the interpretant refers (CP 1.541), we can equate the object with the reference point of an inference. We highlight that this comparison to logic does not entail that meanings are necessarily based on pure logic, but that logic can support the analysis of meaning.
The transcribed interviews were analysed using content analysis (Mayring, 2015): the analysis aimed at the subject matter of the text, i.e. the meanings in products and services, on the level of clauses stated by individuals. Two forms of textual interpretation were applied: first, reducing the transcripts by identifying inferences that concern the PSS, and second, deconstructing their conclusions (=meanings) into nominal categories, in our case, the entities of Peirce's triadic model of signs.
For identifying inferences in clauses or multiple clauses, we applied indicating words such as, 'because', 'since', 'as', 'follows from', for premises, and words such as 'consequently', 'therefore', 'hence', 'so', for conclusions. Since these indicating words had not always been made explicit in spoken language, they were temporarily added to a sentence to check if an inference became clearer without changing the meaning of the sentence.
During the deconstruction of meaning into its entities based on Peirce's model, we used the more familiar term 'concept', as proposed by Sowa (2000) instead of interpretant. To deconstruct meanings in products and services contained in the clauses, the entities were assigned to parts of the clauses in the following order: meaning (M) as the already identified starting point, object (O), sign (S), concept (C). We call this the 'MOSC-scheme'. Guiding questions were used to identify the object: 'what is the conclusion made about?', the sign: 'what is a premise or an indication for the conclusion?', and the concept: 'what is the inference based on?'. Further questions helped to make the entities distinct from each other: 'is the object more interesting for the person than the sign?' (cf. Anderson, 1933) and 'does the sign have

expressive qualities?'. Once the entities had been assigned to the parts of clauses, their plausibility were checked based on the following questions: 'is the sign the starting point for the inference?', 'does the sign evoke the concept?', 'does the concept allow making an inference about the object?', 'does the sign relate to the object?', and 'does the meaning refer to the object?'.
Additionally, we analysed meaning from its emotional valence, being positive, negative, neutral, or ambivalent. For that, we looked whether meanings contained keywords with negative or positive connotations, or described positive, negative or neutral effects, or interviewees expressed a positive or negative attitude towards the service elsewhere.
Finally, for structuring the deconstructed meaning, its entities were linked to specific 'layers' of the services. The 'layers' contain aspects of the service, to which the entities refer. The term 'layer' was adopted from the concept of PSS layers of Müller et al. (2009). Aspects of services include processes, people, technical systems, the context of the service, and the business model. The aspects can have different levels of detail, such as interface and infrastructure of the technical system (Secomandi and Snelders, 2011) or the elements of Osterwalder and Pigneur's (2010) business model canvas. A matrix visualised through its two dimensions the links between the entities of the deconstructed meanings, and the layers of the service. We call this matrix the "MeaningMap", which was developed concurrently with the analysis of the transcripts. The links in the matrix were established in two ways: either assigning an entity to one or more layers at particular levels of detail, based on its reference to the layer, or assigning a layer to an entity, based on its contribution to an entity.

3.2 Results and discussion

The analysis, as described above, allowed us to answer the research questions presented in Section 1, which we will illustrate for one service, a PSS for washing machines.

3.2.1 Identification of inferences - content analysis

In the interviews, the designer of an online payment system, and the owner of a laundromat using this payment system, both declared that *"it is a modern concept"*. The designer further explained: *"Being of an industry that is left behind in taking up electronic payments. All over retail are taking electronic payments."* For analysing their intended meaning, we identified the inference by, in this case, temporarily adding the indicating word 'since'. This resulted in: 'since the laundromat is taking up electronic payments, it is a modern concept'. It became clear that the first clause is the premise and the second clause the conclusion.
Non-user 'A' stated after discussing the online payment system: "*For me, the message of this laundromat is like: 'Hello, we are a laundromat. We have arrived in 2010 or 2005 and now we are trying to catch up with technology quickly.*'" Non-user 'A' did not make the premise explicit in this statement, since no part of it could follow an added 'because'. Therefore, the text surrounding the statement was analysed and a possible premise was found: 'the online payment system'. The statement of non-user 'A' was ambivalent, since it contained both, a negative connotation of being late, and a positive connotation of catching up.
Non-user 'B' answered, after being asked, what she thinks that the idea is behind using the laundromat through a smartphone: *"Well, that again everything will be more electronic. I am not a big fan of such a laundromat. […] it requires playing around on the smartphone, instead of just using the washing machine by hand."* By temporarily adding 'since', we identified the premise, which is: 'it requires playing around on the smartphone'. We interpreted the statement as making two conclusions. The first one was 'that everything will be more electronic', which in turn led to the second conclusion that she is not a big fan of it. For non-user 'B' it was obvious that her conclusions (=meanings) had a negative valence.

3.2.2 Deconstructing meaning into its entities - MOSC-scheme

After having identified the inferences, and conclusions (we equate with meanings in products and services), the meanings were deconstructed into their entities through the 'MOSC-scheme'. For that we applied the guiding questions described in Section 3.1.4, which are summarised in row 1 of Table 1, which shows the scheme for the three examples.

Table 1. the MOSC-scheme for deconstructing three exemplary meanings

	Meaning	**Object**	**Sign**	**Concept**
Guiding questions		What is the conclusion made about?	What is an indication for the conclusion?	What is the inference based on?
Intended meaning by designer	It is a modern concept	laundromat	taking up electronic payment	modern
Reconstructed meaning by non-user 'A'	[It] is trying to catch up with technology	laundromat	payment function through the web app	Trying to catch up with technology
Reconstructed meaning by non-user 'B'	Everything will be more electronic	everything	it requires to play around on the smartphone	more electronic

By checking the plausibility of the assigned entities of the 'MOSC-scheme', we saw that the signs had expressive quality, and evoked the concepts, which in turn allowed the interviewees to make inferences about the objects. Regarding the object, we saw that two meanings had the same object, whereas for the third one, it would have been necessary to probe during the interview, if she meant 'everything about the laundromat' or 'everything, as a general development in our culture'. We assume the latter.

3.2.3 Structuring meanings - MeaningMap

In the next step, the meanings were structured in the MeaningMap by linking their entities to the layers of the service, which we illustrate in Table 2. We detailed the layers of the service up to two levels, which are still quite generic. Additional levels can be added either by deriving them from the empirical data, based on whatever might come up, or by having them filled by a designer, who has experience in developing the same or a similar service.

Table 2. The MeaningMap for three exemplary meanings of the service 'PSS with washing machines' ((-): indicating a negative valence)

Layers \ **Meanings**		**It is a modern concept**	**[It] is trying to catch up with technology**	**Everything will be more electronic**
Level 1	**Level 2**			
Service	As a whole bundle	O: laundromat	O: laundromat	
	One particular service			
Processes	General principles			
	Customer journey	S: electronic payment	S: payment function	S: playing around on smartphone (-)
	Support processes			
People	Involved			
	Affected			
Technical system	Interface		S: web app	
	Infrastructure			
Context of service	Directly influenceable	C: modern		
	Not or only indirectly influenceable		C: trying to catch up w/ technology	C: more electronic O: everything
Business model	e.g. key resources			

We assigned 'electronic payment' to the layer 'customer journey' in Table 2, since this is when the payment option takes effect for communication. Of course, providing electronic payment also requires a technical infrastructure and interface. But these aspects remain of minor importance for the researcher, unless these aspects are made explicit by the participant, implying that they are relevant for the participant in relation to the service. The MeaningMap can be read in several ways: to highlight to which layers of services the entities refer, and to highlight which entities contribute to which meanings. Additionally, it allows researchers and designers to compare meanings.

3.2.4 Evaluation

We evaluated the method with seven students with different backgrounds in a master's course on product development, in order to see if the method can be comprehended and applied within a limited amount of time. The evaluation took two hours and consisted of: 30 min method introduction, 15 min pre-test with one meaning example, 30 min Q&A, 45 min working on seven meaning examples. The students were given a six-page manual (as incorporated into Section 3.1.4) including the indicating words for premises and conclusions, the MOSC-scheme, the guiding questions, the MeaningMap and examples for illustration, and five pages of worksheets guiding them through the steps of identifying inferences, and deconstructing and structuring meanings.

From the seven meaning examples, on which the students worked independently, they analysed on average three meaning examples in the given time of 45 min and achieved a success rate of 88% for identifying the inferences, 60% for deconstructing the meanings, and 50% for filling the MeaningMap. Despite the limited time for training, the results showed that the method can be learnt and applied within a few hours, delivering acceptable results. The evaluation also provided insights in how the manual and worksheets can be improved.

3.2.5 RQ1 How can meaning be described in a way that supports design efforts?

Now we can answer our first research question. To support design efforts, our engineering approach to mapping meaning distinguishes two steps: deconstructing meaning and structuring meaning. For the former we developed the MOSC-scheme describing meaning based on Peirce's triadic model; for the latter we developed the MeaningMap based on Müller et al.'s PSS layers to link the MOSC entities to aspects of products and services. Specifically, the MOSC entities 'sign', having an expressive quality, and 'concept', as the cognitive move from premise to conclusion, are the two cornerstones of our approach. This has two reasons: first, through the MOSC-scheme, these entities enable a new way to analyse the voice of customer, and by that inform the definition of the target user group; and second, they allow designers to specify the intended meanings. In our examples in Table 2, the customer preference of manual use over 'playing around on the smartphone' could be one indication for defining a non-user group. Regarding the specification of the intended meaning in our example, we see that modernity, as a concept, refers to the culture, which the designer can directly influence. Furthermore, the intended meaning is expressed by electronic payment during use. Through the MeaningMap, these thoughts are made explicit and the entities' links to layers of the service are visualised, which in turn can inform the analysis and design of the communicative potential of this service. We call it an engineering approach, since meanings can be broken down to sub-systems in the MeaningMap, which covers processes, people, technical systems, context of the services and business models.

3.2.6 RQ2 How can aspects of products and services be identified, which refer to conflicting meanings in order to address the communicative potential of products and services?

We identify conflicting meanings by making comparisons between meanings in the MeaningMap. Conflicts can exist either between the designer and (non-)user or between (non-)users. Specifically, identifying conflicts is about comparing thoughts behind 'signs' and 'concepts' that refer to the same layer of the service, but describe meanings with different emotional valence, or which imply the opposite. The examples in Table 2 show that all three 'signs' refer to the same layer 'customer journey', but one is part of a meaning with negative valence. The meaning reconstructed by non-user 'A' applies a more uncertain concept: 'trying to catch up' compared to 'modern'. It is possible to derive requirements from these discrepancies between meanings, such as expressing modernity in another way, and evoking a stronger concept such as 'outpacing' technology instead of 'catching up'.

4 MEANING MAP AS A DESIGN METHOD

As indicated in the previous section, we propose that the research method for deconstructing and structuring meanings, which consists of the MOSC-scheme, its guiding questions, and the visualisation tool MeaningMap, can also be applied as a method in design as communication during the analysis and evaluation phases of the basic design cycle (Roozenburg and Eekels, 1995) for addressing the communicative potential of products and services.

The main contribution of the MeaningMap is to show discrepancies between meanings. When redesigning products and services the MeaningMap can be used during task clarification, according to

the terminology by Pahl et al. (2007), to highlight areas of improvements in the communicative potential by comparing intended and reconstructed meanings. For original designs, the MeaningMap can also be used in the task clarification stage to compare meanings in competing products and services in order to inform the new design, or to compare meanings of potential users in order to define target user groups. In any of the stages, the MeaningMap can be used to compare intended meanings to meanings in customer feedback for evaluation.

Meanings do not necessarily have to be captured through interviews. Other data sources, such as online reviews, focus group discussions and recorded complaints, are applicable as long as they contain inferences. The MeaningMap should be applied by a designer, a marketing manager, a product manager, or an entrepreneur, since setting up its more detailed levels requires product- or service-specific knowledge. We do not recommend deriving these levels from empirical data, since it eliminates another way of reading the map: looking for 'blind spots', which were never or only a few times addressed by meanings. This way of analysis requires more data and clustering algorithms. Apart from looking for empty spots, of course, clustering also allows designers to look for 'crowded spots', which, as we envision, will tell more about products and services and hopefully also inform design decisions. But in order to make it an efficient analysis, quantitative data collection methods for the triadic model of sign, and a tool for computational processing of meaning deconstruction need to be developed.

5 GENERAL DISCUSSION AND CONCLUSION

In this paper we described our engineering approach to mapping meaning, which is based on deconstructing and structuring meaning in a research and design method. The method is centred on the MeaningMap and involves a procedure for deconstructing meaning called the MOSC-scheme, as well as guiding questions.

The method was developed concurrently with an empirical study, whose methodology was never applied before in consumer and design research and also provided us the desired new perspective on meaning. We contribute to design research by having developed and described this research method for meanings in products and services. In order to evaluate the contribution of the method to design practice, a benchmark with a comparable approach is required.

Regarding our empirical study, we faced the following limitations: first, the descriptions of the services (see Section 3.1.2) are already an interpretation and representation of the actual service and therefore influence the inferences made by participants. Second, the applied data collection method and our set of interview questions may have concealed specific meanings, which would have required other techniques for uncovering them. Third, identifying inferences, deconstructing meanings, and structuring meanings involve much interpretation, which - despite being guided by questions and a plausibility check - can always lead to different results by different interpreters. The third limitation also applies to the design method in general.

To address these limitations, the inter-coder reliability of the current study is required, and at least a further empirical study using different representations of the service examples and different data collection methods. It is also worthwhile considering analysing the MeaningMap using clustering.

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