Abstract: Previous research into user involvement in service innovation has found that the effective contribution of users might be minor, since their innovative users’ ideas generally are non-feasible. The paper assumes that this might be due to the way ideas are processed by companies, i.e. the idea selection process. A new way of utilising the users’ ideas, called generative model revision, is proposed and tested. This new approach unveils new potential contributions of user involvement. While previous approaches in user involvement have been directed at gaining rather short-term returns, the new approach advocated in the paper has a longer horizon, and is more focused on reframing the companies’ businesses. The proposed approach is a complement rather than a substitute to the existing ones. It appears as a new technique for “innovative design” in companies.
INTRODUCTION
Most companies are continuously searching for new innovative ideas for new products. To become a commercial product an idea need to be both feasible to realise as well as create some value for its intended users. An advocated way of accomplish products that creates user-value is to involve users in the development process. However, past research has shown that user ideas seldom meet the criteria of being innovative and feasible at the same time. User ideas tend to be either innovative but not feasible, or feasible but not innovative (Magnusson, 2003a; Magnusson, Matthing, & Kristensson, 2003). The results thus indicate that users might not be a source of innovations for the company, since their innovative ideas are likely rejected in the company’s idea screening process.

We, however, argue that it is not the users’ ideas that are faulty. The mistake is to regard the ideas to be input to a product implementation process; innovative user ideas should instead be considered as seeds to a reformation of the company’s mind-set, a process we call generative model revision. In the article we propose a complementary framework for idea handling suited for ideas that are not within the dominant design paradigm; the framework has been deduced from empirical observations and is also grounded in existing design theory. The new framework will unveil totally new contributions from user involvement.

Purpose
The purposes of this paper are, from the scope of mobile telecommunication services, to first present and compare two methods for utilizing user involvement, the traditional idea screening (Wheelwright & Clark, 1992; Cooper, 1993; Crawford & Di Benedetto, 2000) and a new method that we call generative model revision. Second, we propose guidelines for how to implement the new technique into an organization.

Outline
First we make a literature review to position the issue of “innovation field exploration”, in the second part we ground our work on a previous in-depth study of user-involvement in mobile telecommunication services at the Swedish mobile telecom operator Telia Mobile1. Together with designers at the company we have investigated an alternative process for how to handle incoming user ideas. The input to the process is ideas rejected in the traditional idea screening process due to lack of originality or feasibility. The process unveils a need for regenerating the company’s strategy. In the third part, we use a theoretical framework for analysing the data which led to the distinction between two methods for utilizing the users’ ideas. The two different techniques are described; the first aims at directly producing new commercial services, whereas the other results in new generative models, i.e. a model of the service and a model of the users’ wants and needs that can be used in the design of these new services. In the fourth part we compare the both techniques and relate them to other techniques for exploring users needs. When are they appropriate to use? How should their result be evaluated? How can they be improved?

PART 1: POSITIONNING (LITERATURE REVIEW)
To position our paper, we first deal with the issue of “innovation field exploration” in situations where customers values are largely unknown; then we address the issue of

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1 Today a part of the TeliaSonera group.
user involvement in such a situation; last we relate to previous experiments of “user involvement for innovation” to deduce some implications for our work.

**Innovation field exploration**

The paper addresses a new technique for supporting the innovative design activity. It has long been stressed that firms are facing a new issue. Big firms are used to organize for managing stepwise refinement; product specifications are adapted to customer needs based on market analysis; product development involves the technical skills of engineering departments (Chandler, 1989); established dominant designs (Abernathy & Utterback, 1978) structures competition by providing the customer values and the technical skills on which each firm has to compete. Today, in many industrial sectors, the issue consists in challenging the established dominant design, relying on new technologies, new emerging social needs, new types of competition, etc (Henderson & Clark, 1990; d’Aveni & Guenther, 1994; Hamel & Prahalad, 1994; Christensen, 1997; Tushman, Anderson, & O’Reilly, 1997; Leifer, 1998; O’Connor & Rice, 2001). Regarding more specifically the “customer needs” one can identify two issues. First, the trend towards “mass customisation” (Normann & Ramirez, 1989; Lancaster, 1991; Gilmore & Pine II, 2000), which means that designers have to address longer and longer lists of specifications to fulfil the specific needs of each customer. Second, and even worse for market analysis, there is no list of specification at all — there might not even be any market (Christensen, 1997; Van de Ven, Polley, Garud, & Venkataraman, 1999; Ulwick, 2002) so that engineers and product designers do not even have any starting point for the product development. In this context, the management literature seeks for ways of organizing innovation (see Harvard Business Review special issue on innovative enterprises [Harvard Business Review editors, 2002]. The issue consists less in being able to get one single innovation than in organizing for repeated innovation (Hatchuel, Le Masson, & Weil, 2001); to be able to repeatedly open new “innovation streams” (Tushman et al., 1997) or build new “value networks” (Christensen & Rosenbloom, 1995), one needs new ways of organizing, involving “opportunity recognition” (O’Connor & Rice, 2001), “industry foresight” (Hamel & Prahalad, 1994), experimentation and, more generally an ability to collectively explore, design and structure an “innovation field” (Hatchuel et al., 2001). What does “innovation field exploration” mean when it comes to the fuzzy future needs of the users of innovative product or service that do not exist? One can identify two questions; first, is this exploration of needs a random process or can it be performed in a systematic manner? Second, should we really separate customer needs identification and product design or are they so deeply interrelated that one has to elaborate these simultaneously? In the article we will investigate different ways of organizing the exploration of innovation fields where customers’ values are largely unknown.

**User involvement**

On the issue of innovation field, i.e. exploration coping with the exploration of customer value, user involvement appears as an interesting solution to guide company designers towards products that are innovative and appreciated by the customers. Customer\(^2\) or user involvement has long been advocated as a way to improve new product development (Urban & Von Hippel, 1988; Anderson & Crocca, 1993; Cooper, 1993; Kaulio, 1997; Ramirez, 1999; Prahalad & Ramaswamy, 2000). Different kinds of

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\(^2\) Customers and users are often mixed in the research literature. In this paper users are considered the ones that actually use a product, i.e. end-users. Customers on the other hand are the ones paying for the product. In some cases customers are also the users but not always. In this paper though the focus is on consumer products wherefore we can equate customers with users.
contributions have been identified, for instance quality improvement, customization of existing products, refinements and niche-targeted variety, or breakthrough innovative ideas. The contributions depend on the kind of user involvement adopted. There will, for instance, be different results if people are asked to find errors in a software beta-version than if asked for their ideas regarding a future spreadsheet. In practice users are normally not trusted to play a part in the initial generation of new product ideas, they are contacted after the company has developed a new product or service concept to evaluate them, e.g. focus groups (McQuarrie & McIntyre, 1986). Nonetheless, Von Hippel has stated that users can be perceived as sources of new ideas or inventions in innovative design (von Hippel, 1977, 1978, 1982, 1988). Based on these findings von Hippel and colleagues have developed a method, the lead-user method, for involving lead-users early in the innovation process (von Hippel, Thomke, & Sonnack, 1999). The lead-user studies come from the context of business-to-business relations where users and product suppliers have relatively equal knowledge of the technology. It is thus hard to draw conclusions from von Hippel’s results regarding the domain of consumer products or services. Arguments are also raised against the benefits of user involvement, these arguments are mostly build on the assumption that users do not have the sufficient technical knowledge for producing innovations (Christensen, 1996), or that they can not properly articulate their needs (Bennett & Cooper, 1981; Leonard & Rayport, 1997; Ulwick, 2002).

There is thus a debate on the actual benefits of user involvement which focuses on whether the users can contribute with ideas useful for commercialisation. However, the issue of innovation field exploration leads us to set the question differently, namely whether designers can make an alternative use of user involvement endeavours. Our interest is less on the quality of the ideas produced by the users but rather on the assessment of user involvement as a design technique for organizing repeated innovation.

**Experiments on user involvement**

One can notice that there has already been a famous experiment of user involvement for innovation in another area than product development. The users were the workers and the experiment was called “quality circles” and “continuous improvement” or “employee suggestion systems”. These raised big enthusiasm among blue collars and white collars as well (Lawler III & Mohrman, 1985). But they failed on two main pitfalls, unfeasible “good” ideas and costly support systems. Literature on this issue underlines that these systems are not intrinsically good or bad, but that their success is built on a powerful organization that treats the ideas, and above all, channels the idea production on specific subjects (Robinson & Stern, 1997; Monden, 1998; Mukherjee, Lapré, & Wassenhove, 1998; Fairbank & Williams, 2001; Prado, 2001). Several authors have underlined that the problem is less promoting the idea production than supporting the learning processes (Monden, 1998; Prado, 2001) (Mukherjee et al., 1998). This leads us to distinguish two main approaches on how to utilise techniques of user involvement; the first one consists in selecting the “best” ideas proposed by the users and the second approach in using the users’ ideas as a leverage to challenge the existing knowledge and support learning processes and mindset changes among the designers.

**PART 2: EMPIRICAL DATA**

**Method**

We aimed to investigate how user involvement might be a new technique for exploring an innovation field where the customers’ values were largely unknown. Our
methodology relies on three main assumptions, namely the need for an empirical study, the choice of a highly relevant industrial context and the importance of a theoretical framework.

Our reasoning is based on data from an experimental study. User involvement is still rarely used for innovation purposes and when done the practice is often experimental and confidential; a statistical survey would thus have been difficult to perform. Moreover the study was a collaborative research which enabled us to try and compare different techniques of user involvement in the same industrial context.

We chose to rely on an industrial context that would represent all the previously mentioned features of opposing a dominant design, having emerging needs, emerging technologies, emerging actors, etc. The context chosen was service design for mobile telephony. Mobile telephony has been commercially available on a broad market since the mid-eighties. The traditional operation of mobile telephony operators can be described as ‘opening and maintaining connections for verbal communication between two parties’. However, this role is now changing. Mobile telephony has rapidly become much more than voice communication; it has turned into mobile communication. In the digital era a convergence between different networks – such as telephony, television, GPS (positioning system), the Internet has occurred (Kupfer 1993). A variety of information can be combined and accessed through the mobile phone, which has become an access device for different mobile services. An illustrating example of this is the successful Japanese system called I-mode (Curtis 2001). A forthcoming system is the world-wide system, Universal Mobile Telephony System (UMTS), that is mainly designed to provide enhanced data communication (UMTS 2000). It will demand more than merely a technical transition for mobile operators to be successful in designing future mobile services. For instance, when only operating telephony neither the content nor context of a call did matter, only time, since revenues were related to the duration of the call. The novel services will create novel values for the users. The dilemma is though that it is not yet understood what creates user-value in these new mobile services. Telecom operators will need to induct new knowledge concerning the design of these services.

To investigate the issue of involving users in a highly innovative design activity, we will need a strong theory of design reasoning. We will ground our work on the “CK theory” of design (Hatchuel, 2002; Hatchuel & Weil, 2003), which principles will be presented. It will help us to analyse the industrial practices and ground them in a specific firm or industry and underline the more generic features of a new tool for an emerging “engineering of usages”.

Experimental design
The paper builds on empirical data from an experimental study on user involvement, within the so-called CuDIT (Customer Driven IT Development) program (Magnusson, 2003b). Five experimental trials were accomplished, one with a group of professional service developers and the others with different set-ups of users. The participants were instructed to create one, or more, suggestions for a new service outgoing from a given assignment. The results from the idea creation process were supposed to be one, or more, ideas of new services utilising an application platform Unified Services (US), which essentially was a converter between SMS messages in GSM and http-calls on the Internet. From the users’ point of view, US enable access of information on the

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3 SMS is an acronym for short-message-service, and is a technology for sending and receiving text-messages to the mobile phone. SMS is defined within the GSM specification. GSM is a pan-European standard for mobile telephony. The system was introduced in Europe in 1992, but is today spread all over the world.
Internet by sending and receiving SMS-messages. Since the resulting ideas were solutions to a common assignment, they could be compared and ranked against each other thus enabling the determination of the users’ relative contribution when involving them in the idea creation process.

The group of professionals consisted of 12 professional service developers, the remaining participants divided into four groups consisted of 72 users, represented by university students. The main reason for choosing students was that they represent one of the most frequent user groups of SMS services and accordingly a good representative of ordinary users. To provide the participants with a sense of how these services could work and to become inspired, they were given access to a service portfolio consisting of ten implemented services. An example of an end-user service was the ability to access a bus-timetable on the Internet via SMS calls. By sending a pre-codified SMS the users were informed when the next bus to the city-center were scheduled to leave. To use and test these the participants were equipped with a mobile telephone. All participants received hands-on training on how to use the phone by testing some of the services.

The idea creation of the study lasted for 12 days, which resulted in a total of 429 service idea proposals of which 374 came from the users. Six expert judges, experienced in evaluating mobile communications service ideas, evaluated the ideas regarding their originality and feasibility. The evaluation procedure used was the Consensual Assessment Technique (CAT) developed by Amabile and colleagues (Amabile, 1996). When plotting the ideas in a diagram according to their assessed originality and feasibility interesting patterns occurred. The ideas were either feasible or original.

![Figure 1: Scatter plot (originality - feasibility) of user ideas.](image-url)

The first results were thus quite disappointing. Involving users in the idea generation process seems to have a rather limited value; users produce services that are either “me too”, or “totally out of the blue”. Me too in the sense that the ideas do not differ very much from the ones created by professional developers. The ideas considered to be totally out of the blue would most likely be rejected in the company’s idea screening process. The first indication was thus that user involvement for idea generation seemed to be a dead-end. However, there could be an alternative interpretation of the
disappointing results; maybe it is not the ideas that are faulty, instead, it could be the way they are assessed.

**How to make use of the users idea - open the dustbin!**

Together with experts from Telia we analysed the results from the first evaluation. We primarily tried to make use of the original but unfeasible ideas. Could there be any “rough diamonds” (Magnusson, 2003c) among the rejected stones? Take for instance one of the most original (and most unfeasible) idea selected from the CuDIT sample. The creator described his idea as follows: “I had received the wrong Sunday morning paper for the third consecutive week. It suddenly came to my mind that the phone ought to have a function that could enable me to induce an electric shock on the newspaper-boy, so that he would learn to give me the right newspaper”. This idea is considered as extremely original but not at all feasible due to technical, legal and ethical aspects. It would definitely be rejected as a potential valuable innovation. When looking deeper into the idea, the experts reflected on how they could implement something similar to the proposed idea. After reworking a more acceptable service idea was accomplished, however, still barely feasible. Nevertheless, they had produced knowledge to redesign the initial idea. The experts did realize that they could now comprehend the concept of telecommunication services in a new strongly innovative way. A mobile service may not only be a “connection for verbal communication and data exchange” it could also be a way to put two physically separate spaces of action in “close contact”. Hereby suggesting an extension in the main paradigm of “connexion pipe” to include something like “remote control”. Even if neither the initial idea nor its redesigned version directly led to a commercial service, the change in the mindset should have strong business consequences!

From this example, one can conclude that working on the most original ideas would have two main advantages; it can help to understand the experts’ implicit representation of mobile telephone services (the dominant generative model); and it can also help to remodel new representations, i.e. revised generative models. Consequently together with Telia experts we examined the 44 ideas that scored more than 5.0 in originality (on a ten grade scale). The ideas were thus used to produce knowledge on “what is, from the users point of view, a mobile telecommunication service”. We did thus not get any new gems from the rough diamonds, but we learned how we, in a more systematic way, could detect new gems in the future.

We also tried an alternative approach by focusing on how to make use of the heap of non original but feasible ideas. Actually an idea might not have any impact if it is analysed isolated, as normally done in the idea section model. The analysed idea could be a part of a broader cluster of ideas. These ideas might have an impact when analysed all together. These clusters are, however, almost impossible to foresee on beforehand. In our study a cluster did emerge around the bus-timetable service concerning how it could be further refined; these ideas were hardly interesting when analysed one at a time, however taken into account that they could form a cluster of related proposals might lead to “mindset” changes. In this case the role of the designer is like the role of the industrial scientists and chemists as it was exemplified by Stine presenting the nylon at the New York World’s Fair site in 1938: “though wholly fabricated from such common raw materials as coal, water, and air, nylon can be fashioned into filaments as strong as steel, as fine as a spider’s web, yet more elastic than any of the common natural fibers” (cited in Hounshell & Smith, 1988).

The just described can be seen as a design activity based on the given users ideas. We will now explain the main results of this design activity.
Discovering and making the experts’ mindset explicit

First, we unveiled the “mindset” of the experts. Experts have a precise yet implicit model of the services, which could be described as “the establishment of a virtual pipe linking users to a database and providing them with a search tool”. Most of the experts’ services could be defined by specifying some features of a database, i.e. the type of data, update rate, private or public, with or free of charge, access limitations and conditions, (intelligent) search function, etc. This mindset had strong consequences on the type of envisaged new services, the type of research projects engineers were launching (for instance: larger bandwidth, faster signal transmission, type of encryption, smart request tools...), the type of partners (database providers) or the type of mottos (“mobile access to Internet”).

The revised mindset

The analysis of the “original” ideas and clustering the feasible but non-original provided a challenge of the experts mindset and led to the proposal of a new framework for representing mobile telecommunication services and the users. Mobile telephony services (including phone calls) theoretically constitute an expansion of an action area. Action area describes the space that the users can influence over a limited period of time, i.e. the area where their actions can be executed. Without any communications system, the area is limited to the users’ actual physical action range. Even the traditional phone call can be seen as an extended action area; the user phones someone and makes the other peer to execute an action. The mobile phone can thus be seen as a tool for enabling “user ubiquity”. This implies that the tool must be adapted to a) the user’s own physical action area (e.g., to use the mobile phone in a car) and b) to the area(s) where the action is to be executed (e.g., a phone call intervening in a meeting). Thus, the mobile telephony service can be described as a virtual tool enabling users to expand their action areas.

Based on the service model described above, we could liken the mobile phone with a machine-tool\(^4\), and the mobile services with virtual tools that are plugged in. Consequently, designing a mobile service means simultaneously working on a) the virtual tool and b) the virtual environment to which this tool should be adapted. For instance, the designer of a bus timetable for mobile services has to reflect on the situations where people are supposed to look at a virtual timetable, e.g. in a hurry, during a discussion, etc.

In the new model the “user” is no longer simply a generic representation of all potential users, i.e. not a transparent person. The user must now be defined according to some known dimensions. First, a user will also be a kind of designer, but not the same kind as the professional designers. It will still be true that most designed objects diverge from the initial goals set by the user. This implies that segmentations of users should also be based on their design and learning capabilities, readiness and acceptance. One could contrast between the designer-user (ready and happy to invest time and resources to make use of his toolkit to design his own services) and the user of “ready made” services (waiting for “ready to use” services). Second, there are two main types of users, single users and collective.

\(^4\) A machine tool is a power-driven machine, such as a lathe, miller or grinder, that is used for cutting, shaping and finishing metals or other materials. One machine tool do have several tools. One important quality of a machine tool is a good interface for several tools (e.g. bluetooth compatibility, java engine...); one important quality of a tool is that it can be plugged on the machine-tool and adapted to its (more or less specialized) ends.
This change from a first (implicit) “mindset” to a second one is summarized in the table “revision of the generative model” above.

Table 1: Revision of the generative model

<table>
<thead>
<tr>
<th>Service model</th>
<th>Model 1: old generative model</th>
<th>Model 2: revised generative model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service</td>
<td>Opening and maintaining</td>
<td>Expansion of action area, ubiquity,</td>
</tr>
<tr>
<td>model</td>
<td>connection, database access</td>
<td>machine tool + virtual tools</td>
</tr>
<tr>
<td></td>
<td>and search tool</td>
<td></td>
</tr>
<tr>
<td>User model</td>
<td>Mass market, traditional</td>
<td>single user vs collective user</td>
</tr>
<tr>
<td></td>
<td>segmentation (age, revenue,</td>
<td>design and learning capability,</td>
</tr>
<tr>
<td></td>
<td>profession, geographical</td>
<td>readiness</td>
</tr>
<tr>
<td></td>
<td>location…)</td>
<td>and acceptance</td>
</tr>
</tbody>
</table>

**Impacts of the changes in the mindset**

We have just experienced how the processing of the users ideas not necessarily need to produce a new “service idea” to make a valuable contribution. Its impact must thus be assessed based on other business dimensions. The change in “mindset” could effect the company’s business strategy, business alliances, communication policy, direction of development of applications and research programs. Here are three main impacts.

*First impact, instead of designing only ready-to-use services, think about designing toolkit.*  Previously a service meant, establishing a connection, finding an address, asking for an agreement to connect (ringing), connecting, and disconnecting. It could be defined by a unique protocol. The designer had (only) to specify each of these elements. However, designing a tool is not such a “well-structured” design problem. Using the tool paradigm implies that the users take a much larger part of the production of the service. The users select a ‘tool’ (service choice) and then adapt the ‘machine’ equipped with this tool to their particular need. Consequently, the designers design a toolkit instead of a fixed service. They thus provide the users with a design space. Let us give an example; the designer has discovered the almost infinite variations around the bus timetable service. The users did for instance suggest that it should be possible to specify the approximate time of departure, or to receive the expected time of arrival (scheduled time corrected by using real time traffic information), or to get a notification some minutes before the bus arrives. The designer’s task now is not to design and implement all these variations, instead he or she will provide the users with an opportunity to adapt the tool (service) to their particular need. One simple solution consists in providing a service that the users can configure as a set of predefined parameters (Thomke & Von Hippel, 2002); but it can also consists in a “receipt” for designing new services or in “components” (like java applets) that can be assembled into a personalized service. Designing a toolkit also means that one has to design the learning process for the users. This is thus a new challenge for the designers!

*Second impact, revise the partnership policy.*  As previously stated when designing a tool, one also needs to design the scenarios in accordance with which the tool is to be used. This will inevitably involve additional parties in the design process, e.g. car manufacturers, database access providers, and so on. In the case of designing a database access, it was self evident that the partners had to discuss well identified parameters of the collaboration; access agreement, the access protocol, access maintenance, privacy protection, content update, etc. Even if such a negotiation could be difficult, it was possible to identify ex ante what has to be discussed. In the case of a
tool/environment design, what has to be negotiated is not given in advance, and the identity or the participation of the third party might not even be assured, e.g. should one negotiate with a car maker or an after-sales accessory salesman? As a consequence, the new mindset will imply new forms of partnerships in a more uncertain context.

Third impact, a new communication motto: “the Telia savoir-vivre in mobile telephony”. A tool can become a nuisance. The tool has to be innocuous. This means that both the user’s physical action area and the target action area have to be preserved and protected. This leads to the design of non-disturbing mobile services; this can also lead to exploration of a new value-space (and accordingly new communication messages) around “savoir-vivre” and good manners in mobile telecommunication.

In the following text we will discuss two topics. The first topic concerns how did this “mindset” change occur? The success appeal for further investigation on the detailed process. What was the role played by Telia designers? How should one describe the design process? Is there actually any manageable process or is it simply due to some experts’ creativity? Far from being the result of innovation wizards, this actually relies on a theoretical framework that we will uncover and investigate in the following part. The second topic to be discussed regards the potentials and limits of the technique, how it can be improved and implemented in the organization.

PART 3: THE THEORETICAL FRAMEWORK OF THE EXPERIMENT - UTILIZING USER INVOLVEMENT TO DESIGN THE NEW GENERATIVE MODEL OF SERVICE.

The abovementioned results are actually based on the application of a theoretical framework. To present it, let us first contrast it with a traditional approach of processing users ideas. Normally a user involvement activity is considered as a way to generate ideas that will later pass through the development process as illustrated in Figure 2 (see for instance Leonard & Rayport, 1997).

![Figure 2: Idea screening approach](image)

This development process is considered as a stage-gate process beginning with a funnel (Wheelwright & Clark, 1992). In the case of Telia, it was previously concluded that this approach excluded many ideas as either unfeasible or non-original. Compared to the idea screening approach, our alternative approach has two main differences.

- First, the idea screening approach is based on evaluation and selection made by designers using their existing knowledge. But the expert’s knowledge is not supposed to be affected by the evaluation (the single output are the selected ideas). The alternative approach is a knowledge creating process – a learning
process – where the designer’s knowledge is expanded; the output is thus primarily new design knowledge.

Second, the idea screening approach consists in processing the ideas. But the ideas are often very detailed and narrowly defined and presented as “solutions” to often implicit problems. In the alternative approach, both ideas and knowledge are processed. The users’ ideas are regarded as individualized examples of services that can be reworked into more general concepts.

Consequently the alternative approach appears as a design activity that processes concepts and knowledge hereby producing new concepts and new knowledge. Generally one could define design as a reasoning in which one specifies an abstract concept put in the C-space (space of concept) by using pieces of knowledge in the K-space (space of knowledge, see example below). A systematic way of designing a family of services (or products) consists in having models of these services as pieces of knowledge and generating any service by instantiating some of these models. Each piece of knowledge can be defined as a generative model of the service. For instance “the establishment of a virtual pipe linking users to a database and providing them with a search tool” is a generative model. The model enables the instantiation of a large number of new services. Designing a new service consists in specifying the type of data base, the types of access, the privacy protection levels, the cost of access, etc. In an analogy with object-oriented programming, the service is an instantiation of the object. One can have several classes of generative models, model of the consumer needs (see for instance the famous Maslow typology: physiological needs, safety and security, social and love, esteem, self-realization), model of the typical user (gender, age, profession,…), list of required components (chip, bus, display, connecting slots,…). A generative model is thus always a generative model of something. In our case we speak of generative model of mobile telecommunication services. Moreover we will speak of models that are related to usages, however, we will not address the technical standards such as GSM or UMTS.

Let’s give an example of the use of a generative model in a design process. Suppose that you need to design a mobile service for traffic information retrieval. This is an abstract concept put in the C-space (space of concepts). One will immediately activate in K-space the generative model of a “mobile service”. For instance a mobile service can be defined as a set equal to {a database, a set of possible requests, a price,…}. Based on this model, one instantiates each item step by step in the C-space.

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We can now define a generative model a structured piece of knowledge that supports the design process; given a concept, one activates the generative model by quickly defining attributes to the concept. This accelerates the design process, but it also restricts it and guides into certain directions. For instance, if the design of mobile telecommunication services is based on the “connection pipe” model, one will never try to design a remote control service.

We can now formulate our main hypothesis; the alternative approach of utilising user involvement is a specific design activity that consists in revising (some of) the generative models of the mobile telecommunication service by using the user ideas as a leverage.

We use the representation of the design reasoning to analyse how Telia Mobile’s experts were able to revise their generative model. Initially the designers relied on knowledge about feasibility, marketability, “value” of the services, customer preferences, etc. The mindset was that a new service should be to “open and maintain a connection, database access and search tool” (see number 1 in the illustration below – “revising the generative model of the service, beginning”).

**Figure 3: Revising the generative model of the service, beginning.**

1- Innovation field structured according to pre-defined generative model
2- Ideas of new applications suggested by the users
The incoming user-ideas come into the C-space. They are specialized concepts, i.e. not conceptual but rather “problem solving” oriented. Some of these ideas can be interpreted with the existing generative models but some ideas do not fit, thus falling outside the scope of the generative model. In the Telia case, we intuitively expected the innovative (original) ideas to be the ones to be outside the scope. The designers’ actions begin as soon as they realize the need for a new model that could encompass also the “innovative” ideas, see figure 4 and 5. In the end of the process, the designers rely on a new model of the services. In our case this model includes a new model of the service (from connection pipe to virtual tool) and a revised model of the user itself. We no more speak of an “average” user, instead we introduce new distinctions between the users; the first, regards the user capability and readiness of designing and learning; the second considers whether the user is a ‘single user’ or a part of a collective. For example, in the initial generative model, the service designers did not consider the mobile handset to be a part of the service design. However several ideas manifested that the users do not distinguish between the telecommunication operations and the “equipment”; it is the total offering that matters. The new generative model of the service thus includes design of the handset. This can even imply a renewal of the company’s strategy. The approach for gaining control over the telephone features can be implemented in various ways; manufacturing an own brand, co-operate with some of the established manufactures, etc. The revision of the generative model of the service can indeed have an impact on the service design itself. But, it is also a new piece of knowledge that can be useful in forthcoming design activities such as design of, partnerships, business models, and advertisement messages.

We can test the fit between this theoretical interpretation and the experimental data.

*Test 1*: according to this interpretation, generative model revision is based on ideas that are outside the scope of the generative model. Were the “innovative ideas” significantly outside the scope? We can then test whether the relative number of ideas outside the scope among the original ideas (O>5.0) is significantly different from the relative number of ideas outside the scope among all ideas. Table 2 shows a chi-square test that confirms the hypothesis; significantly more ideas than expected of the non-original ideas were inside the existing generative model and vice versa significantly more of the original ideas were outside the existing generative model.
Table 2:  
Relation between originality and the generative model

<table>
<thead>
<tr>
<th></th>
<th>The idea’s relation to existing generative model</th>
<th>Outside</th>
<th>Inside</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-original</strong> (O≤5.0)</td>
<td>Observed</td>
<td>136</td>
<td>249</td>
<td>385</td>
</tr>
<tr>
<td></td>
<td>Expected</td>
<td>156.2</td>
<td>228.8</td>
<td>385</td>
</tr>
<tr>
<td></td>
<td>Adj. R</td>
<td>-6.5*</td>
<td>6.5*</td>
<td></td>
</tr>
<tr>
<td><strong>Original</strong> (O&gt;5.0)</td>
<td>Observed</td>
<td>38</td>
<td>6</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Expected</td>
<td>17.8</td>
<td>26.2</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Adj. R</td>
<td>6.5*</td>
<td>-6.5*</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>174</td>
<td>255</td>
<td>429</td>
</tr>
</tbody>
</table>

*Significant contribution because absolute value of Adj. R greater than 2.00.

Test 2: according to this interpretation, the number of ideas that are generated by the users and fall outside the scope of the initial generative model should be significantly higher than the number of ideas that are generated by the experts and fall outside the scope. Table 3 exhibits a chi-square test that confirms the hypothesis; significantly more ideas than expected from the experts’ were inside the existing generative model and vice versa significantly more of the users’ ideas were outside the generative model.

Table 3:  
Relation between type of developer the generative model

<table>
<thead>
<tr>
<th>Type of developer</th>
<th>The idea’s relation to existing generative model</th>
<th>Outside</th>
<th>Inside</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Professional</strong></td>
<td>Observed</td>
<td>11</td>
<td>44</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Expected</td>
<td>22.3</td>
<td>32.7</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>Adj. R</td>
<td>-3.3*</td>
<td>3.3*</td>
<td></td>
</tr>
<tr>
<td><strong>User</strong></td>
<td>Observed</td>
<td>163</td>
<td>211</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Expected</td>
<td>151.7</td>
<td>222.3</td>
<td>44</td>
</tr>
<tr>
<td></td>
<td>Adj. R</td>
<td>3.3*</td>
<td>-3.3*</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>174</td>
<td>255</td>
<td>429</td>
</tr>
</tbody>
</table>

*Significant contribution because absolute value of Adj. R greater than 2.00.

We underlined that the alternative approach is not only reserved for “innovation wizards” but is based on a design methodology. It appears rather as a technique, with its own process, its own inputs and outputs, its own evaluation criteria, its own actors. We can briefly compare both processes. In idea screening designers process ideas according to predefined selection criteria. They are looking for feasible and marketable services. What is the design process? The design process consists in managing the generation of ideas, managing a portfolio of “ideas” and managing the development of the best ideas (usually as project management). What are the respective role of users and designers in this idea screening approach? The user is a provider of ideas to candidate for a development process; the designer selects and implements the best
ideas. How to evaluate such an activity? A “good” idea screening process is supposed to select good ideas; it can be evaluated according to the ration between the cash flow generated by the ideas and the resources invested in the idea generation and idea screening process. One can underline that the resulting innovation will unavoidably be inside the dominant design, since the selection criteria are precisely defined according to such a dominant design.

In the revision of the generative model, the designers do not process ideas but generative models, they try to formulate the initial model(s) and use the users ideas as leverages for challenging their initial knowledge. The process results in revised generative models (of the service and of the users) and occasionally in new service concepts or even in new services that will support further exploration outside the dominant design. What are the respective roles of the users and the designers? The user provides “catalysts” for the revision process —not necessarily “ideas”; the designer explores and structures innovation fields and produces related pieces of new knowledge. How to evaluate such an activity? One can try to evaluate the ability to structure new generative models and more specifically the ability to generate new concepts. Such an evaluation might be difficult to do. Another, more challenging evaluation consists in considering that new innovation field are supposed to give birth not only to new products but to new service families, new skills and new businesses. One should expect such a process of “generative model revision” to create new lines of business outside the dominant design —or regenerate old dominant design into new one. Evaluation would then consist in balancing inputs by business creation and its dynamic. These features are summarized in the table below “idea selection vs generative model revision”.

Finally we can discuss these two methods regarding our issue on innovation field exploration, as set in our positioning part. We can now give an answer to the two questions previously posed. 1) is the exploration of customer needs a random process or can it be performed in a systematic manner? The screening approach appears as a way of managing a process that is considered as fundamentally random (the more ideas you get, the better your chances to get a good idea); the generative model revision support a design process where this exploration of customer needs is performed in a learning and explorative manner. 2) Can we separate the identification of customer needs and product (or service) design? The technique of generative model revision consists precisely in generating simultaneously a new representation of “what is a service in mobile telecommunications” and a new representation of customer needs; they are strongly connected. It implies that the traditional separation between marketing activity (that formulates functional requirements) and engineering (that translates functional requirements into conceptual models) is impossible when it comes to innovation field exploration.

PART 4: DISCUSSION AND MANAGERIAL IMPLICATIONS - TOWARDS AN ENGINEERING OF EMERGING USAGES.

As a technique the “generative model revision” approach addresses four main questions. When should it be used? How can it be compared to similar existing ones? Can it be improved? How can it be used in the organization?

When should the generative model revision be used?

One must insist on the fact that the “generative model revision approach” is not “the only way” of utilizing user involvement. There are situations where one should rely on the idea screening approach and other situations where one would favour the generative model revision approach. If the generative models are stable, the idea
screening approach is preferable. In this case one knows market needs, product (or service) functionalities, technical feasibility, i.e. the evaluation criteria (feasibility, value added for the customer, etc) are well identified and can be easily assessed. It also implies that the business is within a stabilized dominant design (Abernathy & Utterback, 1978).

In contrast, the generative model revision approach is suited for business situation where there is no established dominant design, e.g. the context of mobile telecommunication services. One can notice that this might also be valid for an audit of any “generative model” in an apparently established dominant design; this “revision of the generative model” can be considered as a process that helps to control regularly the validity and stability of a dominant design.

Comparison with other tools for supporting innovation without dominant design.

Regarding the generative model revision approach as a technique to support innovative design, it can be compared to others tools and techniques in the same area, e.g. marketing, empathic design, employee suggestion systems (creativity enhancement), customer ethnography and netnography, can be considered as other innovative design tools. In this section we compare user involvement for the revision of generative models with other techniques for investigating users needs in a situation of innovative design.

We can distinguish techniques that are essentially adapted to situations where a dominant design exists. Techniques based on providing ideas (see for instance suggestions systems in van Dijk & Ende, 2002) fall into this category; we have already underlined that existing techniques are well adapted to situation where the assessment of the ideas is possible, based on known functionalities, known market structure and known technical concepts. Traditional quantitative marketing tools are also well adapted for situations with a dominant design; it is possible to structure the customer samples (according to the rules of stratified or cluster sampling) and to formulate questions in marketing questionnaires (based on existing products). In this situation one can avoid the strong (and costly) interaction with the customer and rely on quantitative tools as an efficient way to focus on market niches and well identified needs (see also the description of the newly funded marketing department of the Winchester Repeating Arms Co in Freeland, 1920; see the place of marketing in the development process in Wheelwright & Clark, 1992).

Besides techniques that are based on an existing dominant design, there are techniques that aim at providing knowledge for supporting innovative design activities. Since Maslow hierarchy of needs in the 1950s (Maslow, 1987), several authors have insisted on the necessity to rely directly on the customers opinion in case of strong innovation (see for instance Berthon, Hulbert, & Pitt, 1999). New qualitative marketing techniques have been developed such as focus groups (Calder, 1977), analysis of consumer consumption stories (Thompson, 1997), socio style and sociological analysis (Mermet, 1999; Brooks, 2000), ethnographic studies (Arnould & Wallendorf, 1994) or netnography (Kozinets, 2002). These techniques aim at proposing revised and enriched models of the customers and their values. Even Maslow (whose pyramid of needs is today strongly criticised as useless for new needs), in his time, aimed at enriching the too mechanistic behaviourism. These are actually techniques to investigate what are the customers needs and what are the main values of products and concepts; in our framework, they appear as techniques to revise the generative models of users and service usages. Nevertheless there are two main differences between those techniques and the generative model revision through user involvement.
1- The above mentioned techniques consist in observing, analysing and diagnosing customer needs or values while limiting the interaction with the customer. Contrary to these “non-intervening” techniques, user involvement consists in asking the customer directly. Would it mean that it is less reliable? We don’t think so, for two reasons:

a. From an epistemological point of view, it should be noticed that any “observation” technique (be in ethnology, in physics or in biology..) implies a mutual conditioning between the observer and the observed. The user involvement technique aims rather at controlling the mutual conditioning (particularly by explicating the different mindsets).

b. If one interacts with the user, then what for? We already underlined that the main contribution of the user does not consist in “innovative ideas” but in pieces of new knowledge useful for revising the generative models. This is the major issue one has to find the right way to “activate” knowledge production. The advantage of this method is precisely in this way of “activating” knowledge production instead of waiting for “observations”. From the designer’s point of view, “user involvement for generative model revision” is not only a description of new life styles, the designer being supposed to use it on his own; here knowledge is produced in strong connection with the design process since the designer “asks” the user to challenge his own generative model.

2- Traditional techniques are essentially independent of the design process, i.e. the designers are absent. What is the disadvantage of separating the marketing knowledge production from the design process? It is actually an advantage as long as one is inside a dominant design; it avoids too many backward loops and changes in the specifications given to the designers. However, when the process aims at building a new generative model, it is useful to involve marketing in the design process. At Telia, the designers directly participated and led the revision of the generative models.

How to improve user involvement experiments in the perspective of the generative model revision approach?
We have described a first experiment of using the technique of “generative model revision”. The theoretical perspective has helped us to understand the logic of this user involvement based design process. It can also support the improvement of it. Three main issues can be identified; the role of the users sample, the role of the initial generative model, and the role of the tools given to the users.

User sample. When employing the idea screening approach, it is essential to have a rather big and representative sample. The sample size and composition is, however, less crucial in the generative model revision approach. As stressed by the theoretical perspective, the latter consists in challenging the initial generative model. One single idea can be enough, as long as it is original. For instance, the newspaper boy punishment idea was enough to induce a shift from “database access” to “remote control”. It is actually possible to speed up the process and reduce the cost by involving fewer users and engage them for a shorter time period.

The role of the initial generative model. When using idea screening the ideal is to get as many ideas as possible to pass the selection filters, i.e. ideas that conforms to the existing generative model. This is quite the opposite to the generative model approach where a good idea is an idea that does not fit the existing generative model. Here the users are instead asked to be hackers of the initial generative model! “Be creative” means actually: “surprise the experts” i.e. “find the flaws in their mindset”. In the Telia experiment, the initial generative model was not explicitly presented to the users and
they were only told to be “creative”. Some of them were even taught to be creative and it is no surprise that they proposed a much higher proportion of original ideas than the other groups did. Can the “hacking process” be supported? One possibility would be to try to make explicit the initial mindset and propose it to the hacking users. To explicit the model is actually part of the generative model revision, it is consequently not the main obstacle. Nevertheless it might be easier to work on the initial model when original ideas have already been identified. Moreover, one can wonder whether a designer that is able to explicit his generative models is not also able to hack it! Why does one bother with users in this case? Another issue is that the initial model could be quite abstract and not really easy to understand for common users. This question remains consequently rather open and speculative; what is the role of the initial generative model and how does it orient further knowledge production? Even if this question should be addressed in further research, one can notice that the issue is not only to orient knowledge production but also in which direction. All “hacking” is not fruitful; the question is how to support a “haching” process that enhance the “user-value”?

Tools given to the users. In the Telia experiment, one element supported the “hacking process”, i.e. a portfolio of ten implemented services that was proposed to the students. Should one think that this predefined portfolio in some way might have prevented the “hacking” process? One the one hand, one could assume that it supported a first “hacking” process; it supported the search for strongly different ideas. We can call this process an “external” hacking, since the hacker refuses to follow the implemented examples, i.e. abandoning the dominant design and proposing new ideas. However, there is a second process; the hacker remains inside the dominant design and only plays variations around the already known services. This “zealous” user also discovers the limits of the implicit generative model. This is an “internal” hacker, he plays inside the dominant design and is looking for internal contradictions. Both directions were ways to find flaws in the design reasoning; the “external” one aimed at being immediately “original”; the “internal” one rather put it through the test of “real situations”. One can notice that the second direction might appear as less “original”. But with respect to the fruitfulness of the hacking process, one can underline that the “internal” hacker has the advantage to stick to some aspects of the dominant design and is only playing with variations, so that he can suggest trajectories for shifting from the dominant design without too much disturbing the users’ or engineers’ knowledge. .

Organizational perspective - how to implement “generative model revision” into the organisation?

One main issue when applying the “generative model revision” approach is; “how can the quality of the new generative model be assessed?” One can first underline that the new one can only be larger than the initial one since it is supposed to encompass the old. In practice the new revised model could become too broad and in fact slow down the design process. Therefore, in practice, in order to speed up the exploration process the company should decide to explore only a limited area of the new revised model. This limited area can, however, be very different from the previous generative model and there can then be a risk to be trapped into a too limited area. For instance, the new revised generative model would here imply that several designers in the telecommunication industry, focus on image treatment (movies,…) and exchanges and neglect database access. Neither broadness nor narrowness appears as a satisfactory criteria.

Should a good generative model be valid for a long time? There is then a risk that the generative model becomes obsolete, e.g. due to changes in customers behaviour and values. However, a too frequent revision would demean the function of a “generative
model”, i.e. to be a model valid for a family of products-services. In some contexts these changes might be very slow; one could rely on a newly established dominant design for decades. In other business context, the need for revision will be much more pressing.

Broadness, narrowness or longevity, all appear as contingent criteria. It thus seems difficult to decide whether the intrinsic quality in a generative model can be assessed. We think that the question cannot be answered independently of the organizational context. The generative model will be good as long as it can support collective action for repeated innovation. One can then reverse the question; the issue is not “what is the best technique for a given organization” but rather; what is the organization that can make use of such a technique?

We already concluded that generative revision is not a development process where functions and competences are well identified. However, the new generative models created will later on support and be utilised by development processes. It is neither a “research” technique, since it does not rely on well-established disciplines and questions. It rather aims at identifying new research questions. It appears rather as a tool of what Hatchuel et al. call an I-function (I for innovation) (Hatchuel et al., 2001). This technique helps to structure innovation by supporting the revision of development and the investigations made by research. It is a technique for the “research2” and “marketing2” of Miller et al. (Miller & Morris, 1999) or the creation of innovation stream as described in Tushman & O’Reilly III (1996).

The technique could be consider a “marketing tool”; in a perspective where marketing are aware of not having any relevant consumer segmentation and not having a valid set of “functions asked by the consumer”. It would thus be an innovative marketing technique, suited to redefine ad hoc consumer segmentation and product functions.

As a technique for innovative design, this technique aims more specifically at revising the generative models of a service and its users. This technique is not in itself a complete “I-function”; it appears rather as one of its potential tools. In the perspective of an I-function we would make the hypothesis that this technique is more precisely a tool for the engineering of emerging usages (around mobile telecommunication services); it helps to redefine the main functionalities of a product (and the main features of its users) on the basis of the action context of the user; it is not an observation or an analysis of existing usages; it is a way to design new usage. In this sense it is an “engineering tool”.

CONCLUSION

We have investigated a new way of utilizing user involvement. Far from being the result of “innovation wizards”, i.e. extraordinary genius people, this appeared as a technique well grounded in the most recent design theories. The technique uses users ideas as leverages for revising the generative models. It has been first developed and tested for mobile telecommunication services with their users. The theory helped to extract the main features and principles of this new technique so as to make it useable and useful in other industries. It is well adapted to situations where there are no established dominant designs and where product-services functionalities and customer segmentations are not yet stabilized. It can be compared to other techniques aiming at investigating emerging customer usages and needs but it differs from them by directly involving the users in the innovative idea creation and by deeply involving the designers. The technique is mainly based on orienting the user to be a “hacker” of expert knowledge; it can support this process by providing the users with demonstrators that can be used either to create conformant services, or services that
differentiate.. The technique appears as an efficient tool for an “innovation function”, it supports an engineering of emerging usages.

REFERENCES


