Three-in-One User Study for Focused Collaboration

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This article introduces a human-centered design approach, the Three-in-One User Study, which applies a set of methods to speed up and focus on the design process. With a Three-in-One, designers' face-to-face contacts with users are concentrated into one collaborative designer-user session where preproduced self-documentation material and early design models enable focused collaborative exploration. Three-in-One combines three different complementary points of view to design: users' subjective interpretations, designers' focused observations, and design interventions with models. Three-in-One was applied in a kick-bike design case, and it led to improvements to the initial concept, as well as justified decisions for further design development.

Keywords - Design Process, Design Methods, User-centered Design.

Relevance to Design Practice - Three-in-One User Study speeds up and focuses human-centered design and is especially suitable for projects with limited resources, where designers collaborate directly with possible future users and where the initial product opportunity identification has already been completed.

Background

Human-centered design can be approached with a wide range of methods, from traditional consumer research approaches to emerging exploratory methods (e.g., Hanington, 2003; Sanders, 2005; Cooper & Evans, 2006). However, it seems that in the present practice a more limited combination of three approaches have been widely taken up: observation based ethnographic methods, exploration with prototypes, and emerging approaches supporting designer and user collaboration.

Users' current behavior in context can be studied with several variations of observation based ethnographic field methods (e.g., Holtzblatt, Wendell, & Wood, 2005; Randall, Harper, & Rouncefield, 2007; Ylirisku & Buur, 2007). When a design team needs to learn about prevalent practices, these methods provide valid and detailed results. However, the results are limited to what can be seen and understood within a very limited time frame and narrow research foci of the observation sessions.

Prototyping either by drawing or creating 3D models is an essential part of designers' reflective problem solving (e.g., Schön, 1984; Gedenryd, 1998). Because prototypes are, in addition to being solution generation and evaluation tools, also vehicles for team collaboration, their importance is revitalized in recent design innovation literature (e.g., Kelley & Littman, 2005; von Stamm, 2003). In human-centered design, the role of prototyping varies from design driven prototyping via interactive testing, such as with paper prototypes (Snyder, 2003), to approaches, such as with Make Tools (Sanders & William, 2001; Vaajakallio & Mattelmäki, 2007), where more initiative is given to the users. Prototype supported explorations can be organized on the field and extended over lengthy periods of time to allow users to innovate new patterns of use, which can provide designers with insight into the domestication processes of radically new concepts (Paulos & Jenkins, 2005; Hutchinson et al., 2003; Routarinne & Redström, 2007).

Emerging human-centered design methods aim at supporting designers' and users' capabilities to reframe design challenges and propose creative interpretations. In particular, so-called generative methods (Sanders & Williams, 2001), experience prototyping (Buchenau & Fulton Suri, 2000), and probing (Gaver, Dunne, & Pacenti, 1999; Mattelmäki, 2005, 2006) have awakened interest in the design community. Probing refers to a set of exploratory tasks given to a group of users to collect personal perceptions and interpretations, among other objectives (Mattelmäki, 2005). Probing focuses on user experiences and trusts user initiatives and interpretations. Probes are often visually rich and put more emphasis on inspiration than information, although there is wide application (Gaver et al., 1999; Mattelmäki, 2006).

Advocates of human-centered design have long emphasized that time and money spent in getting users involved result in higher return in terms of the increased value that the products deliver (Mayhew & Bias, 1994). More recently, human-centered methods, which approach design from the business point of view, have also been recommended in innovation literature (Kim & Mauborgne, 2005). However, collaboration with users does not always lead to immediate business gains (e.g., Bajaj, Kekre, &

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Srinivasan, 2004; Ledwith & Coughlan, 2005), and applying human-centered approaches in consulting practice is not free of challenges. The practitioners' challenges include at least cost, focus and profundity related problems.

In spite of the high expected returns, conducting user studies can require a considerable amount of resources. This is especially true when one of the key principles of user centeredness, continuous user involvement through the project (Gould & Lewis, 1985), is faithfully followed. Practical tasks of arranging appointments, traveling, and recruiting can take a lot of time, in addition to what is needed for immediate user-designer collaboration. New products and services are nowadays often designed for narrowly-focused market segments, like niche consumer groups, or for specialized professional use. Organizing appointments with people who belong to these segments may be laborious. Thus, especially in short design consulting projects, the relative proportion of resources needed for involving users may turn out to be remarkable.

In addition to the efficiency challenges, practitioners need to deal with problems concerning the focus and relevance of user information. Obtaining relevant results must be preceded by decisions about the appropriate method(s), because each human-centered design method has its scope: they have their inherent strengths and limitations, and no single method can cater to all information needs. For designs of well-defined problems, the choice of method would be relatively easy on the basis of recognized information needs. However, a design activity unveils new issues and information needs as the work proceeds (e.g., Lawson, 2005; Loch, DeMeyer, & Pich, 2006). Thus, the crucial choice of approach has to be made based on vague expectations of the later information needs. A wrong choice of method can lead to results that are perhaps interesting but irrelevant by being either too generic (only increasing contextual understanding) or

too specific (focusing just on details that the final design may never need) (Fulton Suri & Marsh, 2000; Feyen, Liu, Chaffin, Jimmerson, & Joseph, 2000).

When a human-centered design is outsourced, it is typical that consultants are not involved from the beginning of a new product development process. The customer organization has already recognized an opportunity using whatever methods they have applied and then hires experts to work based on that. Consultants are expected to utilize the work already done and innovate within the set frame. According to Cagan and Vogel (2002), the identification phase of new product development has been done, and the commission starts from understanding the identified opportunity. The methods chosen have to be able to utilize the initial information and build on that.

Users' suspicion of hidden agendas and narrow focus on where they feel completely confident may lead to mundane results in design collaboration. Thus, in addition to appropriate recruitment, a collaborative attitude and confidence with particular design foci are important preconditions for profound creative collaboration. Users, and designers, are better prepared to collaborate after having been sensitized to the design topic, paying conscious attention to it with critically constructive eyes. Sleeswijk Visser and colleagues (2005), for instance, have guided users and designers to design challenges with what they call primes before co-design sessions. Primes make people look closely at their current experiences and routines and consequently make them more focused on the design topic. However, priming participants for collaboration adds another phase into the human centered design process, lengthening the total project time.

Based on the discussion above, we can recognize a set of intertwined problems that design practitioners face in their attempts to apply human-centered methods. First, they need to optimize the result-resource ratio when organizing collaborative sessions with users. Second, while in academic research often any interesting results are welcome, in consulting projects the practitioner has to choose and frame approaches so that they cater well to the limited but not well specified knowledge needs of the project. Third, the practitioner should be able to create an atmosphere of creative design collaboration without affording long separate sensitizing periods.

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Objectives and Approach

The objective of this article is to present and discuss a design process model, a Three-in-One User Study, aimed at solving the above mentioned practitioner's problems. More specifically, the process aims at the following benefits:

- Optimizing the *efficiency* of user studies by maximizing the learning at each point of contact with users
- *Focusing* on project specific relevant information by combining complementary approaches in a flexible manner
- Ensuring the *profound creativity* of collaboration by priming the users and designers without causing delays in product schedules
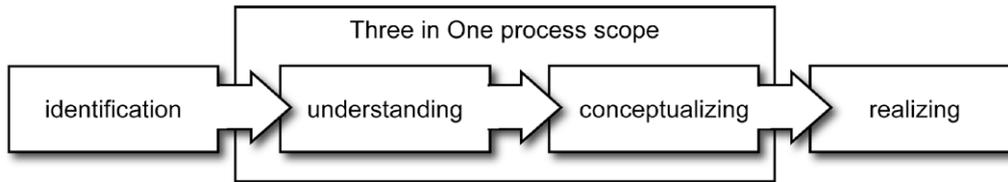
Figure 1: The scope of the Three-in-One User Study process. The Three-in-One User Study can be applied over the product opportunity understanding and conceptualization phases (Cagan & Vogel 2001) of a new product development process.

Due to its contribution to solving these problems, Three-in-One is particularly suitable for projects with limited resources that aim at user-centered innovation, sometimes also called business model innovation (e.g., Davila, Epstein, & Shelton, 2006) in small and medium size enterprise (SME) product development projects, in which designers collaborate directly with possible future users and where the initial product opportunity identification has already been completed. See Figure 1 for the scope of the Three-in-One process. Three-in-One does not introduce new methods to the existing versatile human-centered design method palette, but instead presents an alternative way to combine some of the existing core approaches, namely probing, observations, and prototyping.

The description of Three-in-One below is based on a kick-bike concept design case (Jääskö & Keinonen, 2006). The case was done in a commercial context by a small design organization for an SME client. The case was not originally planned to be a test bed for the Three-in-One approach; on the contrary, the approach was developed based on specific requirements of the case, and the process and rationale of Three-in-One were identified as worthy of further attention based on the published project documentation (ibid). This article aims to elaborate on the identified potentials of the Three-in-One; however, comprehensive testing of their applicability in practice would require new case studies and further investigation. In the following, we will describe the Three-in-One approach, introduce the kick-bike design project where it was applied, and finally discuss the approach from design process and design knowledge viewpoints.

Three-in-One User Study Process

The Three-in-One User Study combines 1) self-documentation based probes studies, 2) observations, and 3) prototype-based exploration and evaluations into a streamlined two-phase process consisting of a priming phase and a joint session. The name "Three-in-One" refers to the approach that combines three human-centered design approaches into one single joint face-to-face session with the users.

At the beginning of a design project, designers look into the design opportunity, restrictions, and open questions by studying the briefing material, browsing through secondary information sources, isolating potential problems, and creating alternative solution hypotheses. Based on the initial study, they are ready to start with the two activities of the first phase, which is called the priming phase. Contrary to Sleeswijk Visser and colleagues' (2005) version of priming, which is mainly facilitated by researchers and targeted to sensitize the users; with the Three-in-One approach,

the designer plays an important role in implementing the user study and getting primed in his or her design studio.

First, the designers explore the design space by generating solution alternatives. They sketch, make mock-ups and rudimentary functional models, which makes it possible for them to learn about the alternative design directions and anticipate forthcoming design possibilities and challenges in a designerly manner (Cross, 2006). By becoming more familiar with the new project through design exploration, designers can identify project specific information needs, which give a focused agenda to the later process phases, which include meetings with the users.

Second, the designers prepare probes kits (Mattelmäki, 2006). A probes kit contains self-documentation and self-reflection tasks that focus the users' attention towards the interest of the design project. Typically, the kits are customized for each study and include stimulating and visually attractive tasks that are both descriptive and predictive; i.e., they ask participants to report their current experience but also invite them to imagine alternative future possibilities. The tasks can include among other things, diaries to document the everyday life situations and thoughts, photographing tasks to capture situations, and open questions to prompt attitudes and insights. Thus, the probing phase does not focus directly on the product to be designed but instead on the characteristics and lifestyles of the potential users, and broadly on the features, situations, and contexts of the future product.

Once the kits are designed, the designers deliver them to a set of prospective future users. By completing the tasks, the users collect information that might be difficult for the designers to get otherwise, as relevant issues often take place infrequently over longer periods of time, and in environments and situations that are difficult to access for outsiders. Completing the tasks makes users also consciously exposed to experiences related to the design task and sensitized to deal with them during the subsequent phases of the project. After self-documentation, the probes are returned to the designers. The designers then develop and organize the photos, familiarize themselves with the collected data in order to better understand both the users and the topics discussed in the probes. This pre-interpretation enhances the social dynamics of the joint session, because the designers become aware of the situations and challenges presented in the probes. Furthermore, pre-interpretation supports focusing; i.e., the designer is able to pre-select specific situations or pieces of data from probes and thus direct the conversations into topics that seem relevant. (ibid.)

The two activities in the priming phase are described above as separate tasks that prepare the designers and users for the second phase, the joint session. However, the design exploration can contribute to planning the probes for better catering to the
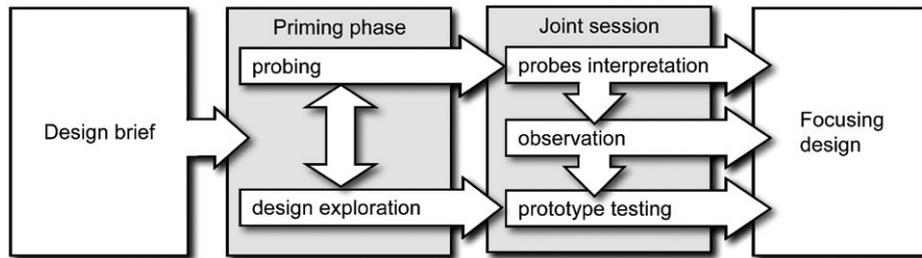
Figure 2: Three-in-One User Study process. The first main phase, priming, includes self-documenting tasks for the users with probes and design exploration for the designers. The second main phase, joint session, includes a collaborative interpretation of the probes, observations in a real context of use, and trials with simulations or interactive prototypes, in this order.

designers' specific information needs. Designers are also able to adjust their solutions before the joint sessions. If the probes are returned early, they may provide designers with ideas that they had not considered in their earlier design exploration. To enable this kind of dialogue between the activities, the priming phase should start and end with design exploration, as was done in our case.

The second main phase of the process, the joint session, starts with the interpretation of the completed probes kits. Joint interpretation is a crucial phase in probing, as the original user generated material can be rather elusive and brief requiring further explications, but at the same time the completed probes kits can provide a good foundation for interactive dialogue, which clarifies the documents and deepens the designers' understanding (Mattelmäki, 2005, 2006).

The second step of the joint session is observation, during which the users show and explain how they interact with the products that they currently have. The observations are conducted following contextual inquiry principles (Beyer & Holtzblatt, 1998; Holtzblatt et al., 2005), i.e., context, partnership, and focus. They are done in the actual physical and social context where the behavior takes place in order to learn about the interplay between the actors, products, and environments. Partnership refers to the trust and respect between the designers and the users: the designers accept an attitude of learning from the users' expertise and experience, and the users trust the designers to apply the lessons learned in an appropriate manner. The principle of focus reminds the designers to pay attention to issues with recognized and emerging design relevance, and by that means it ensures the cost efficiency of the observations. Observations complement the probes with contextual performance data and enable designers to pay attention to issues that users did not consider relevant in their more subjective records or issues that are difficult for the users to report, such as details of ergonomic problems. The set of tasks to be observed can be defined beforehand on the basis of what the designers have learned during the design exploration or adjusted immediately before the observations based on what was identified as relevant while interpreting the probes kits.

At the end of the joint session, the designers present their initial solution as visualizations, mock-ups, or partly functional models. These allow the users to voice their opinions and even though only partly functional, try them out in real environments. The users can utilize the assessment criteria jointly recognized in the previous phases. Thus, the evaluation takes place in an atmosphere of sensitized reflection and contextually embedded

action, which helps the users to be more analytical with their responses.

Instead of starting a project with a user study and ending it with user-based evaluations, the joint session is scheduled into the middle of a project. Before the joint session, there needs to be time for the designers and users to get prepared with their priming tasks, i.e., probes and design exploration. After the joint session, there should be enough project resources to utilize and implement the lessons learned. Obviously, if needed, Three-in-One can be supplemented with other human-centered approaches in the different phases of a project, such as with a more formal evaluation at the end. However, our argument here is that with the suggested combination and scheduling of methods, several benefits – efficiency, focus, and profundity – can be gained and the need for organizing several sessions with users can essentially be reduced. See Figure 2 for a summary of the Three-in-One process.

Kick-bike Case

The kick-bike design case describes the development of a product concept in which a child seat was integrated into a four-wheel kick-bike (see Figure 3) (Jääskö & Keinonen, 2006). The aim of the project was to introduce a new category of muscle-powered, short-distance vehicles for families with small children living in suburbs. The initial idea of the concept came from the client company, which produces similar types of vehicles for elderly and disabled people without the option of carrying a child. Thus, the project addressed a customer segment not well known to the company. The designers' objective was to develop new functionality and structure for the concept and to create an attractive image and appearance for the product. The Three-in-One process aimed to complete the concept design project within the limited budget but still in a human-centered manner.

Figure 3: Starting point for the concept design: A kick bike for the elderly integrated with a child seat from a bicycle.

During the priming phase, the designers explored the structure and appearance alternatives of the new mobility concept with image boards, sketches, 3D modeling, and renderings (see Figure 4). To study how this new vehicle transports users, a working prototype was built (see Figure 8). After design exploration, a probes study was conducted, because the designers felt they needed a more thorough understanding of the short distance mobility needs of parents with small children. Consequently, six families that represent the assumed potential target group were recruited to document their daily travel-related activities with probes, i.e., self-photography tasks and diaries, over a period of four weeks. The objective was to collect material to inspire and inform the designers about the users' experiences in versatile contexts and situations and to prepare the families for the joint sessions.
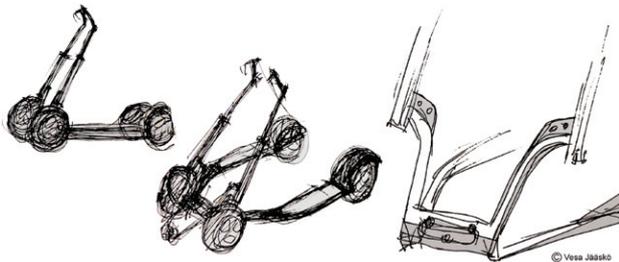

Figure 4: Examples of sketches for the structural frame solution. Drawing by Vesa Jääskö.

Bundling probes interpretations, situated interviews, and prototype evaluations into one joint session was seen as a time saving approach. At the beginning of the joint sessions, probes were interpreted and close distance mobility needs discussed (see Figure 5). After the interpretations, close scrutiny of design relevant issues was possible by observing the parents with their children, bags, prams, bicycles, and other mobility equipment in and around their homes (see Figure 6). At the end of the joint sessions, a new kick-bike concept was introduced with illustrations (see Figure 7), scenarios, and a functional prototype for the families to test (see

Figure 6: Observations documented during the joint session: usability issues of collapsible pram structures. Photographs by Vesa Jääskö.

Figure 8). The three-step joint sessions took two to three hours per family. The sessions were photographed, and the conversations were recorded. The voice recordings were annotated the same day to identify potential problems and design opportunities. The designer who was in charge of the design development conducted the user study and assessed the relevance of the findings after all the joint sessions were carried out.

The results of the study were classified into three main information types: features that required improvements, comparison of the kick-bike with existing and competing products, and critical success factors. The basic concept was considered mainly positive: the designed fitness image seemed appropriate; families without a (second) car saw a possibility for extending their daily mobility range; children liked the low sitting position and the feeling of speed; the low centre of gravity was an

Figure 5: Pictures taken during the self-documentation period. Pictures from left to right illustrate preparations when going out with children and prams, alternative means to move with a child, storage space where bicycles and prams are kept, moving with prams into local transportation and public spaces and items carried in prams. Photographs by anonymous study participants with permission.
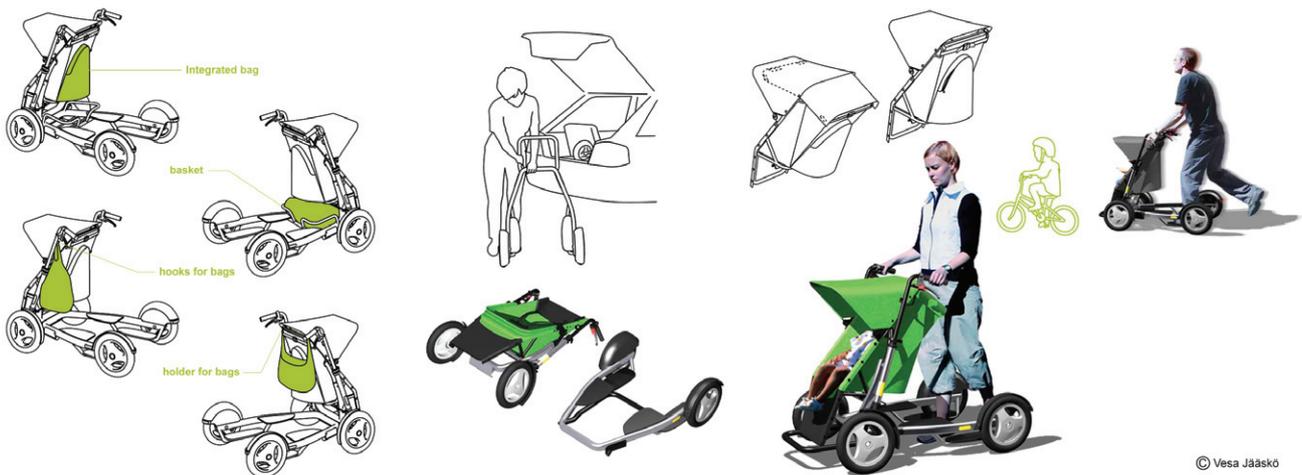
Figure 7: Illustrations and renderings generated for the concept presentation. The figures show alternative solutions of carrying different loads, adjustable seat feature, collapsible structure option, and scenarios of traveling with children of different ages. Drawings and renderings by Vesa Jääskö.

Figure 8: Testing the concept prototype: on the move and getting out from the ground floor storage room in a block of flats.
Photographs by Vesa Jääskö.

additional safety feature and the carrying capacity was considered better than those of normal prams. The kick-bike was considered capable of competing with bicycles, because of the ease with which it could be controlled when riding with a child. Based on the results, the earlier assumptions about the user groups were adjusted to cover a wider range of applications. It was realised that the concept should be developed for urban use in addition to the original suburban focus and made compatible for use in public transportation and public spaces like shops. It became obvious that the new concept could not replace existing prams and could be a significant purchase for a young family. Therefore, more emphasis was put on extending the life cycle of the product, including the use before a child can sit upright and after she is no longer transported as a passive passenger. Although the product image itself was regarded appropriate, the design still seemed to have features that resembled aids. The handle bars and pushing position had too much in common with rollator type of products for the elderly. Thus, a major concept redesign was realized after

the user study, including the development of a new mechanical solution for the steering, which made it possible to make the construction simpler, lighter, and cheaper (see Figure 9). Overall handling was improved, and the image of the product changed to a sportier and better balanced design (Jääskö & Keinonen, 2006).

The case study shows that a human-centered design approach could be adapted into a compact design project with a budget of five person weeks of design time. By selecting appropriate approaches and merging the sessions with end-users into one appointment, it took ten person days of designer's time to carry out the user-designer collaboration in order to provide relevant information for design development (see Figure 10 for the project timeline). Through user involvement, it was possible to identify the crucial features of the new product type and make improvements to the final concept design. The results contributed, in addition to the design process, to the communication of the concept solutions within the client company.

Conclusions and Discussion

This article presents a human-centered design process model called the Three-in-One User Study. Three-in-One refers to a user study process where three approaches are bundled into one single face-to-face meeting with users. These approaches are self-documentation with probes, observations, and design trials with prototypes. Three-in-One enables the users' and designers' preparation for the joint co-design meeting by sensitizing them with probes and design exploration. The kick-bike case, based on which Three-in-One has been formalized in this article, gives an encouraging experience and shows the potential of Three-in-One to be applied, especially in short and scarcely resourced projects typical to the SME industry. Two issues related to the theoretical foundations of Three-in-One will be discussed below, namely the role of sensitizing periods in design and the reverse logic of the Three-in-One process. Finally, some challenges and topics for further development will be identified.

With Three-in-One, users become sensitized to the design topics through self-documentation with probes, while designers' priming is mainly based on exploration of the solutions. Both parties are prepared for the joint session by being involved in activities where they can utilize their best knowledge. Users build on their understanding of the practices of which they are directly involved. Probes tasks help them to explicate their knowledge and even challenge users to consider the foundations of their current practices and stimulate suggestions for improvement.

Designers sensitize by activating the arsenal of solutions potentially feasible for solving the design problem. They elaborate from the starting point given by a design brief and aim at identifying more focused information needs. Early references of empathic design point out that one of the reasons why designers should be involved in user research is because they can complement their user observations and solution generation with their understanding of what can be manufactured (Leonard & Rayport, 1997). If the
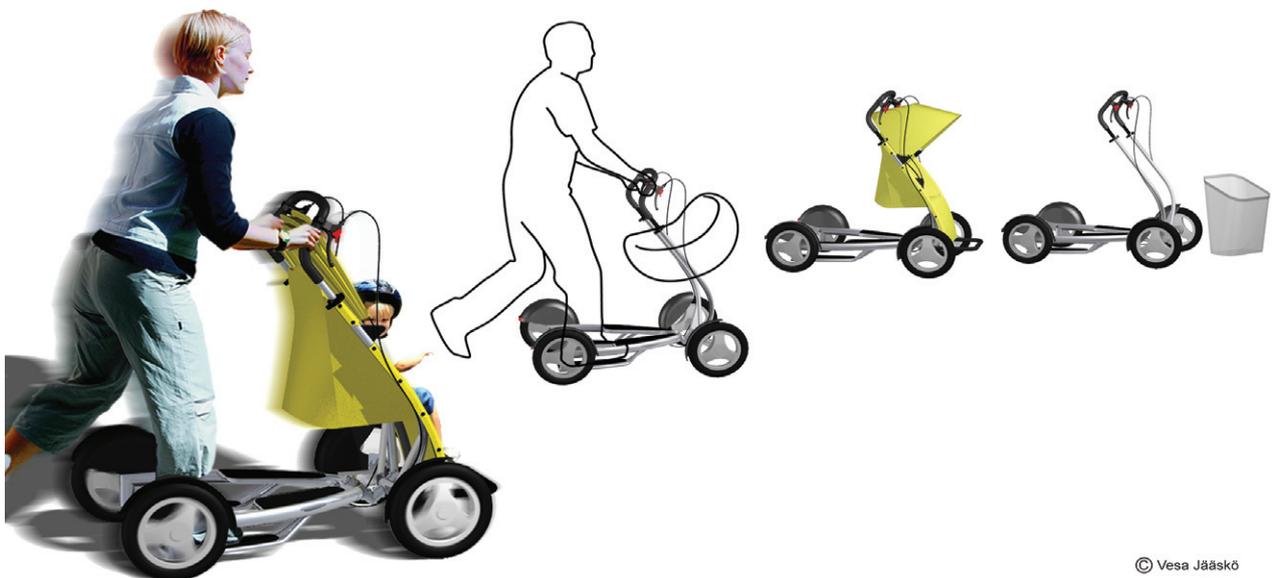

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Figure 9: Refined concept design with the new construction. Renderings by Vesa Jääskö
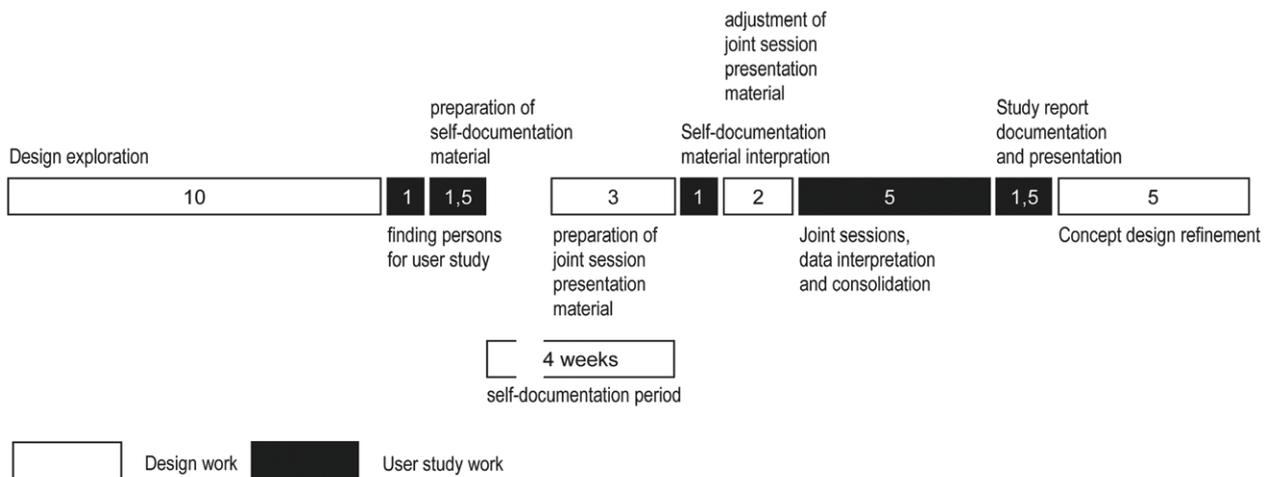

Figure 10: Timeline of the Three-in-One User Study process for the kick bike concept design case.
Estimation of work days spent on each process phase.

specific design challenge is already identified, as in the kick-bike case, its alternative solutions need to be explored to ensure that knowledge about implementation options becomes anchored and the observations focused.

The priming periods help users and designers to contribute from their own point of view as they have positioned themselves in the design space. This means that the users have documented who they are, where they stand, and how they see the topic. Thus, in the joint sessions, they can refer back to their documented experiences and build on them, or alternatively they can criticize the current practices, including their own earlier behavior and attitudes. Similarly, designers are freer to see the topic from the users' point of view after they have expressed their own interpretations, i.e., made design solution proposals. In the joint session, these perspectives meet. The tasks that are completed before the session create a discussion agenda, which can be complemented and adjusted during the session in a flexible manner.

The sensitizing periods can also be interpreted in the light of older creativity literature, which emphasizes the importance of incubation periods during which the problem is approached slowly, letting subconscious processes digest the stimuli (Wallas, 1926). While the pressure to react immediately tends to make us depend on previously known safe solutions, extra time and slack rate allow questioning those and considering alternative interpretations (Claxton, 1997).

Traditional human-centered design process models, e.g., ISO 13407 standard for human-centered design, assume that framing a design challenge has been completed before studying user requirements and that requirements should be defined before solutions can be designed. And finally, the evaluation phase can only be done after enough knowledge has been gathered for specifying and building a prototype. Consequently, several contacts with the users are required if, as is suggested, all these phases are conducted in a human-centered manner. Three-in-One challenges this traditional thinking by combining the framing of a design challenge, learning detailed information, elaborating new ideas, and evaluating the solutions into a process with only two phases: the priming phase and the joint session. In spite of the seemingly reverse order of logic, we claim that the Three-in-One process actually follows well the logic of design problem solving and design knowledge presented by Brian Lawson (2005) and Nigel Cross (2006), for example.

First, Three-in-One allows the designers to elaborate the design problem the way that is most natural to them, i.e., by exploring various solutions and concretizing them into prototypes. The design brief and designers' own experience give them good enough prerequisites to *start* thinking about the possible solutions, even though they do not have enough knowledge to *complete* the design. Based on the reflective design exploration (Schön, 1983), they create an image describing the scope of possible solutions and identify a set of key problems. Thus, in addition to creating a prototype to be tested, they learn about the key design challenges, get to understand what they do not know, and are well prepared to meet the users.

Second, the Three-in-One process encourages designers to use prototypes as tools for learning and communicating and

as platforms for developing the concept. It also pushes designers towards the iterative use of prototypes, as they know that the prototypes will be discussed with a group of users and most likely modified. The prototypes presented in the session are not yet design results, but should be considered as professional guesses, which work as shared platforms for discussion as the probes and the real environments do during the first two steps of the joint session. We can say that Three-in-One rides on three parallel avenues using three alternative grounds of reference, or types of boundary objects (e.g., Henderson, 1999; Lee, 2007), to link the users' and designers' realities: the self-documentation material, the actual environment, and the design models.

Third, decision-making in design is seldom a linear process that begins with the analysis of user needs and ends by responding to those with design solutions. Instead, design solutions evolve through a dialogue of both. Iteration, well acknowledged in many design process models, is an inherent feature of design. Thus, saying that design should start from framing the problem and continue via information gathering and solution generation to evaluation is in many cases idealizing and oversimplifying reality. Any phase within the iterative loop can trigger the winning solution and thus be the actual start of the work that will eventually lead to the final design solution.

We regard the Three-in-One User Study as a promising approach for the purposes specified above. However, this conclusion is based only on one design case and theoretical discussions. The kick-bike case began with a rather well-specified concept, which made the focusing of consecutive design activities relatively straight forward. A future challenge for the applicability of the Three-in-One process would be to test it in a process setting with a more open brief, allowing a broader exploration of product functions and alternative solutions.

The description of the process is relatively open to interpretations, partly because of the lack of cases, but also because we do not believe in over formalized process descriptions, which do not trust the designers' capabilities to apply examples and generic guidelines. Consequently, we do not propose the process be further specified but rather applied and adjusted. However, we acknowledge the need for collecting and sharing more experiences of the Three-in-One process to better understand the feasible scope of products and situations where it is applicable. The kick-bike was a relatively simple product functionally, though not an atypical industrial design challenge. However, if a project involves interactive digital products or complicated product and service systems, the challenges with organizing user involvement change. For instance, comprehensive observations of operating large-scale interactive systems in social context are nearly impossible to combine with other parts of the joint session because of the practical time constraints. The applicability is probably also limited by several project specific issues not well covered in our pioneering case, such as the demands it may put on users' schedules and motivations to collaborate, as well as the extra cost for user based knowledge and confidence. Three-in-One is also relatively challenging for the designers not only because they need to master several human-centered design approaches, but also because they have to maintain their welcoming attitude

towards user initiated design changes even though they have already proposed their solutions.

From a more fundamental human-centered design point of view, perhaps the main challenge of the process is that it may lose some of the users' innovation potential. The users are involved in a relative long and intensive process, including the priming period and a joint session with several steps. Even though the users are contributing in a variety of ways, they almost exclusively respond to designers' proposals without actively and directly contributing to solution generation, for instance by participating in prototyping (compare e.g., Sanders & William, 2001; Vaajakallio & Mattelmäki, 2007). Furthermore, the approach forces designers to wait until the end of design exploration for contributions from users. These are compromises necessary to respond to the practical project challenges, but also a motivating goal for the further development of the approach.

Acknowledgements

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