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Design for Dynamic Use Situations, First Steps in the Development of a Design Method that Supports Designing for Dynamic Use Situations

M. Brouwer, M.C. van der Voort

University of Twente, Enschede, Netherlands | m.brouwer@utwente.nl

More and more consumer products are used in situations that are characterized by varying users, user characteristics, environments and purposes. This increase of the ‘dynamics’ of use situations is caused by technological developments. The ongoing trend of automation of services results in an increasing number of products that are used by a wide variety of people such as ATM’s, copiers and museum audio guides. Furthermore the growing opportunities of wireless applications result in an increasing number of mobile products that therefore can be used in different kinds of environments. A static environment can be dynamic as well when objects and persons within it are subject to change. In order to support the needs of each individual user in each individual context of use a designer should attune products to this dynamic use situation, thereby achieving a high level of usability. This paper discusses the criteria a design method for dynamic use situations should meet.

Usability Challenge for Dynamic Use Situations

Dynamic use situations are defined as use situations of products with varying user characteristics, varying purposes and varying contexts of use (figure 1). Characteristics of users include skills, knowledge and experiences. The context of use comprises the physical environment as well as objects and persons within this environment. An ATM has a dynamic use situation because many different users try to withdraw cash from the machine. A multifunctional product like a food processor has a dynamic use situation, because it can be used for different purposes. Furthermore the context of use of a product can change because either the product is mobile or the environment itself is subject to change (figure 2).

As stated in the ISO 9241 usability standard, a product’s usability depends on its use situation. Therefore, a product’s usability varies with use situations. The designer has to take these use situations into account. The design process gets complicated when the target use situations are so diverse that requirements from one use



situation conflict with those of others, for example when trying to meet requirements of both expert and novice users.

Current design methods take only one or two use situations as a starting point and develop products that fit those requirements. Although this can result in products that offer a high level of usability for these particular situations, these methods deny the fact that in reality the product will meet many different use situations. In essence every product will meet a more or less dynamic use situation. In this research we focus on those situations that result in conflicting product requirements.

Criteria for Assessing User Centred Design Methods for Dynamic Use Situations

As any design method a method that supports designing for dynamic use situations should include activities aimed at creating solutions, creating a frame of reference and evaluating those solutions. Consequently the criteria the method should meet can be divided in criteria for building a frame of reference and evaluation and criteria for creating solutions.

Building a frame of reference and evaluation

Analysing the dynamic use situation is necessary to build a frame of reference for evaluation. However, with dynamic use situations it is very difficult, if not impossible, to predict the range of use situations a product will meet and what the effect of the product in these situations will be. Therefore the designer can benefit from a method that supports him in dealing with this uncertainty. When investigating this issue in other domains we discovered that in planning strategies one has to deal with similar uncertainty. A valuable method to support people in planning strategies is scenario planning (Heijden, 2005). Therefore we expect that studying scenario planning will reveal useful criteria for this method with regard to evaluation

When an organization needs to make a decision about a strategy for an uncertain future it can benefit from the by now matured method of scenario planning that was pioneered by Herman Kahn (1962). Researchers that advocate scenario planning claim that instead of reacting to uncertainty with denial people should be willing to look ahead and consider uncertainties. In scenario planning this is achieved by creating and reflecting upon scenarios. In this context, scenarios are defined as a tool for ordering one's perceptions about alternative future environments in which one's decisions might be played out (Schwartz, 1991).

Scenario planning is based on focusing on the future, investigating the issues surrounding that future and identifying the forces that drive those issues. The most important predetermined and uncertain driving forces are then used to build integrated scenarios to reflect upon decisions. This can be useful for designing for dynamic use situations as well. In a dynamic use situation the certain factors are factors that count for all use situations, such as usability principles derived from cognitive psychology and factors of which its probability of occurrence can be predicted, such as 8 % of male users is colour blind. The uncertain factors in dynamic use situations are those that are hard to predict such as variation in experience with comparable products or distracting elements in the environment.



Both important certain and uncertain 'driving' factors should be combined to build frames of reference to reflect upon a design. In this way the certain factors are not overlooked while at the same time considering important uncertainties. Uncertain factors should be prioritised on their impact on usability to avoid that the designer gets overwhelmed by a problem representation that is too complex.

Creating Solutions for Dynamic use Situations

What misses in scenario planning with regard to design is the fact that the design itself can have a large influence on the future use situation. The questions a designer frames and the importance of driving factors depend on the solution. Therefore we believe that designers can benefit from a method that supports continuous analysis and synthesis. This requires an approach which integrates both a flexible design representation and a flexible problem representation.

Furthermore creation of solutions is as important as evaluation of that solution. We believe that the application of techniques that stimulate creative thinking can contribute to creating appropriate solutions. However, this is not a criterion that is specific for designing for dynamic use situations. Research has shown that 'immersion' in the use situation can lead to more appropriate solutions (Buur & Bødker, 2000). Therefore we expect that immersion in the dynamics of a use situation will contribute to the creative process as well.

Criteria for a Design Method for Dynamic Use Situations

As for every design method the method aimed at dynamic use situations should deliver design representations that can easily be communicated to other stakeholders. Furthermore the method should be efficient which means it should be easy to learn and should not take much time to apply. Criteria that are specific for the dynamic use domain can be derived from aforementioned arguments and include that the method should support the designer in:

-focusing on possible future use situations. A usable design requires that the designer acknowledges the importance of use situation factors that influence usability.

-exploring issues surrounding future use situations. The designer should frame all relevant questions about the future use situation that need to be answered to be able to predict usability such as 'will people understand where to start?' or 'what will people expect from this product?'. It is important to consider issues concerning effectiveness as well as efficiency and satisfaction.

-exploring the relevant 'driving forces'. The designer should investigate and define all relevant use situation aspects that influence the usability issues. Relevancy is related to the solution which means that in later design phases driving factors will be more solution dependent. For example, to be able to predict recognisability of a text based GUI one will need information about the users' language and eyesight while for a symbol based GUI one might need information about users' experiences with related symbols. Driving factors should include variety in user characteristics, goals and context of use. An analysis of these factors will be necessary to define their importance and certainty.



-ranking driving forces on importance and uncertainty. Based on an analysis of the driving factors the most important (critical) use situation aspects should be defined and ranked on uncertainty. These 'crucial uncertainties' determine the dynamics of a use situation and can be used to consider the most critical or conflicting use situations.

-integrating important predetermined and uncertain aspects in reflection. It should be possible to consider the implications of important interrelated certain and uncertain aspects at the same time.

-reflecting on multiple use situations. The designer should consider implications of a design in multiple use situations.

-applying continuous iteration between problem and solution by using flexible design and problem representations

-immersing in the dynamics of a use situation

Comparison of User Centred Design Methods to Criteria

Above-mentioned criteria will be used in a literature-based assessment of user centred design methods and techniques with regard to their appropriateness for dynamic use situations. As a start we briefly discuss requirements analysis, user tests and scenario based design in this paper. Other methods that will be assessed are among others task analysis, observation, focus groups, participatory design methods, guidelines etc.

Requirements Analysis

Translating a desired use situation into requirements risks losing the grounds of these requirements. A designer might forcedly create solutions that fit the requirements instead of suiting the future use situation. Therefore requirement analysis does not meet the criterion of focus on the future. Furthermore requirements only consider testable and therefore quantitative driving factors such as physical user requirements, thereby ignoring qualitative data such as user experience with comparable products.

User Testing

User tests or usability tests (e.g. Rubin (1994)) score well on a focus on the future use situation, framing questions about this future use situation (the research questions) and providing integrated reflection. However, user tests do not reveal important uncertain, variable use situation factors that influence usability. Furthermore they are limited in reflection on multiple use situations. User tests do not directly support the designer in the creation of solutions. The required prototypes are not flexible and will only be available when detailing the design.

Scenario Based Design

In scenario based design (Rosson and Carroll (2002)) descriptions of people using technology are used in discussing and analysing how technology could be reshaping their activities. Both quantitative and qualitative data are integrated in flexible design and problem representations and therefore the method meets most



evaluation criteria. However, until now these methods are mostly aimed at software engineering. In this application domain the target group is often well known and the context of use is often relatively static. Therefore integration of uncertainty about the future use situation is limited in these methods. Although Rosson and Carroll do point out that sharing and developing scenarios helps to control the uncertainties of design work, they do not explicitly explain how this can be applied when use situations vary. The method as used within software engineering therefore does not meet the criterion of revealing and ranking most important and uncertain, varying driving factors.

Conclusion

To design products for dynamic use situations a method is required that can deal with both certain and uncertain use situation factors. Comparing this issue to planning strategies leads to the conclusion that this method can be achieved by integrating the basics of scenario planning with techniques that support creating solutions. A first review of current design methods shows that a scenario based design method such as proposed by Rosson and Carroll seems promising to serve as a basis for such a method. However, the method should be extended with creativity techniques and the way it deals with uncertainty should be improved to fit dynamic use situations.

Future research includes a further investigation of user centred design methods, a designer survey on practical requirements, the development of the new design method and the application of cases to verify the proposed method.

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