



USABILITY IN PRODUCT DEVELOPMENT PRACTICE: AFTER SALES INFORMATION AS FEEDBACK

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ABSTRACT:

To study how companies deal with usability in the development of electronic consumer products and to identify aspects of product development that impact usability positively (enablers) or negatively (barriers), case studies were performed among 5 international product development companies. Within each company development team members that might impact usability were interviewed, with a total of 36 interviewees. The first analysis of the data shows that product developers would like to receive more information about product usage in 'the real world'. After sales feedback seems to offer a large potential for gaining insight in real world product usage and usability issues, through customer service data, customer surveys, monitoring of product use, and field studies.

I. INTRODUCTION

Let's start with a quote from Dennis Wixon: "In my opinion, a case study approach is both the only practical way to produce a body of knowledge for applied usability, and the most effective. First, products get made all the time, and much usability work is applied to them. It makes sense to learn all we can from our own practice. Second, the development of real products is the only context sufficiently rich to produce the kind of nuanced examples that are needed to develop a differentiated and contextualized understanding of methods and techniques needed by practitioners. An accumulation of case studies might even permit meta-analyses to be conducted that would help in suggesting patterns that can be generalized across cases." (Wixon, 2005, p.31)

In the past years, much work has been done on defining usability (Nielsen, 1994; ISO, 1998) and developing a methodological basis (Nielsen and Mack, 1994; Kwahk and Han, 2002). In the meantime many companies have, to some extent, implemented usability engineering in their development process. Despite the increase of knowledge about usability and the increased focus of the industry, the usability of consumer electronics leaves much room for improvement: the number of usage-related problems in consumer electronics has been increasing since the mid-nineties (Den Ouden, 2005), and electronic consumer products can only be expected to become more complex in the future. There seems to be a gap between theories on usability and the effective integration of theories into practice (Norman, 1996; Wixon, 2005).

Most of the current literature about the practice of usability engineering features self-reports (Wiklund, 1994; Böcker and Suwita, 1999) in which usability practitioners present a description of their own practices or a specific case. Very few descriptions of the usability practice provide a comparison of different companies, such as in Madsen (1999). Madsen's study allows the identification of issues that emerge across companies. Studies that do include multiple companies tend to paint a more general picture of the practice through questionnaire-based surveys (Vredenburg *et al.*, 2002b; Gulliksen *et al.*, 2004; Venturi and Troost, 2004).

Although questionnaire-based surveys provide insight into the practice, they might raise a certain bias because of their self-reported nature, as pointed out by Vredenburg *et al.* (2002b). With regard to (self-reported) case descriptions by designers and usability specialists Lindholm *et al.* (2003), working at Nokia, make the following remark: "Reading such material from a Nokia point of view ... creates ambivalence. How can they (colleagues that report the cases, ed.) keep the whole thing on track so well?" In some instances self-reported cases seem a bit 'positive'. As a consequence of aforementioned issues the current literature does not provide a coherent insight into the practice of usability in product development.

To gain an in-depth insight in usability in practice, we performed a case study among five major consumer electronics manufacturers. The goal of the study was to make an inventory of any aspect of product developments that limit (a barrier) or enhances (an enabler) the usability of the products that are developed. The range of issues is very broad, from the key performance indicators of the staff, to the availability of test participants.

As mentioned, a majority of the case studies on usability in practice have been mostly self-reported, and seem somewhat 'positively' biased. This is understandable, as companies presumably would not allow the publishing of a case study that would show their shortcomings in dealing with usability. Therefore, in this case study the companies are presented anonymously. The downside of this is that some contextual descriptions had to be left out, and the story might become a little less vivid. However, this is outweighed by the major upside that positive as well as negative findings – if interviewees are willing to share them – can be presented.

The focus of the study is on electronic consumer products, as this is a product category that is featuring an increasing number of usability problems (van Kuijk *et al.*, 2006). Den Ouden (2005) points out that in the electronic consumer product industry, products are increasingly complex, the time-to-market pressure is high, the economy is increasingly global and consumers have a decreasing tolerance for quality problems. The latter makes usability an essential product quality.

2. METHOD

To get an insight into usability in the practice of product development, we have chosen a case study approach, which is a suitable methodology to study a current, real life phenomenon in its context (Yin, 1994). Interviews were the primary source of data, and a multiple-case research design was adopted. The combination of several case studies is often considered more compelling, and is regarded as being more robust (Yin, 1994) quoting (Herriott and Firestone, 1983). To be able to include several companies within the available timeframe, interviews – which are relatively time-efficient to conduct – were used as the primary source of data collection. The study was performed among five internationally operating developers of electronic consumer products.

2.1 CONCEPTUAL FRAMEWORK

In order to identify issues and actors that influence usability in product development, a literature survey and exploratory interviews were conducted. In the literature survey the focus was on publications that provide

descriptions of usability in practice: product development cases, descriptions of usability departments, questionnaire-based studies of the usability practice, and usability methodology-issues that arise in practice. To supplement and verify the information found in the literature study, exploratory interviews were held with four usability experts.

The issues and actors that were identified were integrated in a conceptual framework, as described in Van Kuijk *et al.* (2007) The framework reflects a multi-actor, integrated approach towards usability in product development, based on the evidence from the literature and exploratory interviews that the usability of a product can be influenced throughout the product development process, by a multitude of actors. A product manager, who defines the user requirements in an early phase, can define to a large extent what type of product will be developed. An industrial designer influences the usability of the product, because the physical controls of electronic consumer products can have a big impact on usability. And during the implementation phase, the prioritization, the available resources (time and staff), and the attitude towards usability of development engineers may influence whether redesign proposals, that aim to solve usability problems, are implemented.

In the literature survey and exploratory interviews, the following actors were identified as possibly influencing usability in product development.

- Product manager: coordinates product development, sets the priorities for the product;
- Marketing specialist: collects market information, defines marketing strategies;
- Industrial designer: designs the physical appearance of the product;
- Interaction designer: designs the user interface of the product;
- Usability specialist: evaluates and improves the usability of products;
- Development engineer: responsible for technological and production aspects.

It is noted that actors may be found under different names in different companies, or a single person might perform several roles. The working definitions of the roles, as mentioned above, were used to discuss with the primary company contacts whom within the company should be interviewed. In total 36 actors were interviewed.

2.2 CASE SELECTION

Within each case the focus was not on the development of one particular product, but on the product development activities of the business unit or company. To ensure the comparability of the cases a number of selection criteria were established: the study should include companies that performed product development in-house, that had a division of tasks among the development team members, and that have the ambition to improve the usability of their products. This last issue was operationalized by focusing on companies that had a usability or user experience specialist among their staff. Five development groups in Asia and Europe participated in the study, which were active in the following product categories: portable audio and video, mobile telephones, laundry care, home controls (heating, ventilation, security) and mobile navigation systems.

2.3 DATA COLLECTION

The interviews were conducted using the general interview guide (Patton, 1990). In this approach the interviewer uses a list of issues or questions to verify that all the topics are covered during the interview, but the sequence of the questions is not determined in advance, nor are the questions exactly worded in advance. This allowed us to explore the subject freely with our participants. The interview guide contained the following main subjects:

- The product development process (process structure, activities, role of the interviewee, development team organization, communication & documentation)
- The product development context (company culture, department organization & culture, success measures)
- Interviewee definition of, and attitude towards, usability
- Role-specific questions
- Critical incidents for usability (products that had good or poor usability, probing for underlying causes)
- Barriers and enablers for usability in product development (what are conditions, methods and ways of working that positively or negatively impact usability)
- Personal data & background

Since a semi-structured interview approach was used, it is logical that some themes appear more prominently than others, as the interviewees were probed on certain themes such as communication of usability test results, or the feedback they received after use.

2.4 DATA ANALYSIS

The interviews were recorded with audio equipment, and transcribed literally and in full. Subsequently, relevant sections of the transcripts were identified and encoded (categorized), based on a preliminary coding scheme. In addition, it was indicated whether an issue that was mentioned by the interviewee would have a positive (enabler) or negative influence (barrier) influence on usability or simply was a description of the situation within the company (neutral). See the sample in table 1. Barriers and enablers were identified on product and process level. A process barrier is an aspect of the development process that negatively impacts the usability, such as not performing usability tests at all. A usability enabler on product level is an aspect of the product that positively impacts the usability of the product, such as a reduction of features and options in the product.

Original quote	Interpretation	Barrier
We'll as I said, I think there is a delay, it is slow, and certainly it's just too massive data and the... the data can be analyzed with more, I say more clear, you know, findings.	The data that the usability specialist receives from the customer service center is raw, massive, unanalyzed data, without clear findings.	Poor analysis and presentation/communication of customer service logs.
Original quote	Interpretation	Enabler
It's appreciated if you come up with a solution that is feasible to implement within a relatively short development time.	Other members of the product development team welcome it if solutions that the usability specialists proposes to the usability problems that were found, don't have a long development time.	Proposing solutions (to usability problems) that have a short development time.

Table 1. Examples of a process level barrier and enabler. On the left the original fragment from the transcript, accompanied by the interpretation by a researcher (middle) and the underlying barrier or enabler that was identified (right).

When all the interviews of a company were analyzed, the barriers and enablers brought up by the interviewees were clustered. Thus it was analyzed which issues were identified by multiple actors, which ones

were only were brought up by specific actors, and patterns of emerging issues that were identified. An overview was made, showing issues that were identified by several actors, but also stipulating where actors had made conflicting statements.

3. PRELIMINARY RESULTS: AFTER SALES FEEDBACK

While data analysis is still in progress, a number of themes is surfacing. These themes touch upon a wide range of issues, such as usability being a part of the company strategy, early user involvement, the type and range of product portfolio and the knowledge about the use phase.

We will present preliminary results on dealing with after sales feedback, a prominent theme that is emerging. The results that are presented here, are based on material from three cases. Company A makes navigational devices, Company B develops mobile phones, and Company C portable audio and video equipment.

After sales feedback is the information that a product development team receives once a product is on the market. We expected that after sales feedback might be important for the product developers, because it would allow them to learn from their actions. The question about after-sales feedback spawned an interesting range of issues, beyond the subject of 'learning from your mistakes'. This subject was especially interesting, as in literature the focus usually lies on the development phase of the product, and not on what information can be collected once the product is sold and used (Borgholm and Madsen, 1999; Vredenburg *et al.*, 2002a; Gulliksen *et al.*, 2004). The following issues concerning usability and after sales feedback were identified:

- Limited knowledge about product usage;
- Methods for collecting after-sales feedback on usability:
 - Customer service feedback;
 - Customer surveys;
 - Monitoring product usage;
 - Field studies.

These issues will be discussed in the following section.

3.1 LIMITED KNOWLEDGE ABOUT USAGE

Knowledge about product usage is considered a critical enabler for usability by several interviewees. When probed on what information they would like to have after product launch, interviewees indicate that they have limited insight into how users handle their products in real life, because usability testing cannot reflect real life usage, and usage data cannot be stored in or extracted from the devices.

Usability specialist (B) *You give a task. And by doing that, it's an artificial need. Also, in the real world there are more ways to use a product. If you're on a sole particular task, you could use different combinations. [...] You know, there are lots of different ways of doing it, whilst in a lab, it tends to kind of focus on one application, one way of doing it.*

Requirements manager (A) *...it would be very much that usage information, which I'll be interested in seeing, [...] what will people really use this box [product, ed.] for? [...] The real feedback that we are very interested in, from a design perspective, would be: [...] what do people do with this box the most? At the moment, there really isn't any way to retrieve this kind of information from the products themselves.*

3.2 METHODS FOR COLLECTING AFTER SALES FEEDBACK ON USABILITY

To deal with this desire for knowledge about the usage phase of products, the companies that were studied used the following methods to gain knowledge about product usage once the product was out on the market.

3.2.1 CUSTOMER SERVICE FEEDBACK

Most companies that were studied had a customer support helpdesk (telephone), and some also answered questions through a support website. In the majority of the cases customer feedback was considered an important way for product developers to be alerted about usability problems in the product.

Researcher *How do you include the user in your product development process?*

Product Manager (A) *Customer support, that's a very important way of getting input.*

Usability Specialist (B) *We get data from call centers, people phone in and say "Hey, you know, I've got this lovely telephone that can play mp3s, but I can't get any music into it". And we get data and we can see "Look, NOW these products are out in the market, we're getting a lot of calls about these sort of things, maybe we need to do more work there.*

Customer service data seems to provide an indication on what areas of the product need more work. However, within the company A, an interviewee indicated some reservations about usability issues in customer service feedback:

Manager Test Team (A) *You really don't hear that much about it. It's more that users probably are starting to get annoyed, but not so annoyed that they will start reporting about it.*

According to the interviewee, relying on users to call customer service to report usability problems might not be a very good way to assess the level of usability of a product. It just provides an alert if usability issues get out of hand, as users only start reporting problems when these are very serious. Not getting reports of usability issues in customer service calls does not necessarily mean that people do not experience usability problems with the product.

For the information from customer support to be of any use to the product development team, the information needs to be communicated by the customer service department to the development team in an appropriate way. Den Ouden (2005) points out that customer service departments might not be equipped to process usability issues, as their classification system of complaints mostly focuses on technical errors. Even if usage problems are documented correctly, attention needs to be paid to how the information is communicated to product developers. The usability specialist of Company C, who received an unfiltered overview of customer contacts every month, illustrates this:

Usability Specialist (C) *I think it is just too massive, the data. It is just so much that you're just scared away by all this data. [...] I think there is a delay, it is slow. And certainly it's just too massive data and the data can be analyzed with more clear findings.*

Not only does she consider the data hard to understand and analyze, she also indicates that it takes a long time before she gets the data. In Contrast, Company A had a customer support department at the same location where the product development team is housed.

Product Manager (A) *During the lifecycle of the product, there will be a formal contact with customer support at least once every two weeks. Then we review the data and make reports that indicate what product aspects produce a lot of calls. But if there is something important, we just stand at each other's desk. And that's one of the reasons why we don't outsource our support team. They're in this building, a few floors down. I have very regular contact with the people that are getting the qualitative feedback, such as "Hey, my product is not working because... or this and that doesn't work."*

The quality of the information, as well as the informal contact and cooperation between the customer service department and the product development team appears to be stimulated by having an in-house customer support department, and housing it in the same location as product development.

Being housed in the same location allows this company to have a representative from the customer support department as part of the development team:

Product Manager (A) *We have someone from the customer service department in the development team. He will indicate very early-on that a certain choice will lead to a large number of support calls, because the customer will be insecure about this, or doesn't have enough information about that.*

Thus the company uses the information and experience of the customer service department pro-actively in the development process. It is a measure that provides the development team with information that can lead to a better design, without having to perform one single test. This is an example of a way of working that, according to Wixon (2005) is typical for the approach towards usability in an environment where the goal is "to produce, in the quickest time, a successful product that meets specifications with the fewest resources, while minimizing risk" (p.31).

Strangely within Company A, that pays so much attention to the communication between customer support and the development team (through the product manager), the communication from customer support to the usability specialist (who is not in the product development team) appears to get less attention:

Usability Specialist (A) *Actually, not much information is supplied... so if I would not know anything, I would have to gather that information myself. That is one my goals [...] to monitor more what is being said about us.*

Apparently, the usability department is not considered a target group for the information that customer service collects. Company B facilitates the communication of customer service information to people within the company, in this case with the usability specialist, in another way:

Usability Specialist (B) *I sometimes listen in on call-centers I don't know that well. I can just dial a number and I can listen in. It's just interesting to hear what the interaction is like, between someone calling in and agent as they're called.*

3.2.2 CUSTOMER SURVEYS

Maguire (2001) mentions customer surveys as a way to 'capture the subjective impressions formed by users, based on their experiences with a deployed system or new prototype' (p.618). The companies that were studied mostly used (internet-based) questionnaires that are filled out by interested customers who have registered themselves with the company.

Usability Specialist (C) *Basically consumers who bought a product have the right to register online and then we got the data and we can send a questionnaire to them to ask them what they think about the product after you used it. So that sort of thing helps us to understand the real actual experience of the consumer after they bought the product.*

Usability Specialist (B) *[Department name], they also do things they call product satisfaction. So they will, in different ways, contact people who bought or picked the product, a few months after that product was launched. And they will get them to answer a questionnaire. That way we can also compare different products. Look at how well they're doing, how satisfied people are with them.*

The feedback of course is self-reported, and there is some concern, among product developers, that simply asking users what they think of the product might not be a credible source of information.

Requirements Man. (A) *And it's not the kind of thing that you can ask a user [...] I think if you ask a user whether they can use the product they bought, they'll tell you they can, and in their minds tend to overlook the fact that they struggled to find this specific menu option. It makes them feel a little bit stupid, because it didn't work out.*

In the companies we studied, the customer surveys seemed primarily aimed at assessing customer satisfaction in general, rather than at identifying usability issues specifically. In contrast, the satisfaction questionnaires mentioned by Maguire (2001) are almost completely devoted to assessing the quality of the interaction.

3.2.3 MONITORING PRODUCT USAGE

As indicated at the start of this section, product developers of electronic consumer products seem to want to know more about the usage of the products they make. Knowing what functions users access most frequently provides product developers with an indication what functions should receive more attention during product development. With websites (and in some cases with software) there is the possibility to track which functions on the 'product' are used, and which are not. In contrast, in consumer electronics it is usually not possible to track the use of the products remotely. However, Company A offered a number of services

through its product that made use of a server, which caused the development team to be alerted of a usability problem:

Usability Specialist (A) *The reason to perform that user test was the dramatically low uptake of that particular service. People simply did not subscribe to it, and we got a lot of questions in customer support on how to use this service.*

Manager Softw. Dev. (A) *We really only notice that if it's a live service; something that we can measure on the server. There we can see how many people connect to it. And we know how many devices we sell, so you can work out in a percentage whether it is used or not and how it is used.*

By monitoring the server logs it was found that only a limited number of people that paid for a particular service, were actually using it. In addition, the customer service department received a large amount of calls about how to install that particular service, which also triggered the company to investigate the issue.

In the cases we observed, the time pressure on development projects was high, usability departments were often understaffed, and the number of product development projects that needed attention was large. Under these circumstances it was not possible to evaluate the usability of every product or function. The product developers had to prioritize. Thus it becomes important to know which products have urgent usability issues. In the incident described above, the data from the servers and the customer support was what sparked an in-depth usability study of the service.

3.2.4 FIELD STUDIES

Performing field studies can also solve the lack of knowledge about product usage. In surveys of usability practice, field studies are reported to be a popular method (Gulliksen *et al.*, 2004), that is often applied by usability practitioners (Venturi and Troost, 2004). Our data seems to support the fact that usability practitioners appreciate field studies as a method.

Usability Specialist (A) *Last year I went to the US to see how people use the device and experience it; whether that was different than in Europe. The interaction in itself wasn't that different, it's just that the [behaviour of consumers] was different, which does affect our products.*

Usability Specialist (B) *...sometimes to do field studies, where we actually take products or prototypes and give them to people and they have them for a while. [...] You can get passed learnability and look at other things [...] That's quite a nice one, where you can have them, doing their stuff in the real world [...]*

Although field studies are considered worthwhile, because they generate valuable insights, they are also considered time-consuming, complex and expensive, which seems to limit how often they are applied.

Usability Specialist (B) *As soon as you go out of the lab, it's much harder, and costly to observe exactly what people are doing.*

Usability Specialist (A) *What's a pity is that it is a pretty tough procedure. You'll be with them for days. But I think we're not doing these studies often enough.*

The usability departments we studied quite often suffered from a lack of staff and the time pressure that was on the projects they were engaged in:

Usability Specialist (A) *We're trying to do it regularly, but performing tests is quite labor intensive; preparing and executing a test can take two weeks, easily. We really don't have that time at the moment.*

We observed that because of high time pressure and shortage on staff, usability specialists seemed resort to methods that are easier to execute and cost less time. One usability department routinely used expert reviews as the main method of usability evaluation. This contrasts with the findings of Venturi and Troost (2004), where usability practitioners indicated that they used a wide range of usability methods. However, their survey of the user-centered design practice was primarily aimed at the field of Human Computer Interaction.

4. CONCLUSION

Product developers of electronic consumer products seem to have a limited insight into the real-world use of their products. After sales feedback can provide the product development team with an indication of the level of usability of the product involved and they may get an indication of usability problems that users encounter in the product. These problems can then be investigated further, and fixed in the current or a next version of the product. In our case study product developers got after sales feedback on product use from a variety of sources, such as the customer service department, service server logs, field studies, product reviews on websites and in the media, and customer surveys. From our study it becomes evident that collecting knowledge about the usability and usage of a product can go well beyond the product launch date. However, attention must be paid to the fact that some after sales feedback methods, such as customer service calls provide more of an indication that there are problems, than what the problems are exactly. The company that was alerted by monitoring server logs and customer service calls of the presence of a usability problem

subsequently had to execute usability tests to study the nature of the problem. The fact that most after sales feedback is based on self-reports by the users might reduce the quality of the information.

5. DISCUSSION

Literature pays relatively little attention to methods for collecting usability-related information from after sales feedback. The present study shows that, from a usability point of view, this phase can be a very valuable source of information in the development process. In literature, evaluating the outcome of activities is considered an integral part of the design process (Roozenburg and Eekels, 1995), as well as the learning process in general (Kolb, 1994).

There is a number of advantages of collecting usability information through after sales feedback. Firstly, as after sales feedback is collected when the product is already on the market, it does not take precious development time. In addition, the collection of after sales information is part of the normal procedure for many companies, so no special studies need to be set up. However, attention needs to be paid that the information on usability issues is collected, stored and communicated in an appropriate way. Finally, after sales feedback seems especially valuable in the field of electronic consumer products, as development cycles in this sector are very short (Brombacher, 2005). So, much of the information that is collected can be re-used in a next version of the product. For example, in overviews of user-centered design methods, field studies are usually classified as a method to be used as a start of a product development project. But, because of the fast and cyclic nature of the electronic consumer products industry, evaluative field studies into one product can become the informative field study for the next product generation.

6. NEXT STEPS

Within each of the participating companies a workshop will be held with the interviewees, in order to perform a member check of the descriptions and conclusions in the case analysis. But still. One of our interviewees indicated that if you ask users whether they are able to use a product they bought, they might tell you something different than what is actually happening; maybe not even consciously. And we have to admit, the same goes for this study: it is based on what people say, not on what people do. Even though there were good reasons to do so – in a relatively short time we were able to sample a considerable number of companies and actors – in subsequent studies we will aim for supplementary sources of information, such as observation or documentation, to triangulate information from the interviews with other sources of data.

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