SEARCHING FOR QUALITY IN DESIGN PRACTICES

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ABSTRACT
In this paper we try to create a context to understand design practices from the quality point of view. Our approach is ethnography based and conceptual. We studied several multimedia production teams to find out how they define quality, how they try to measure and achieve it, and how and why they want to establish sustainable quality in their design practices. First we introduce three dimensions of quality: quality of processes, quality of products and quality of persons. Then we illustrate real work arrangements in web based multimedia production teams and discuss these dimensions in our cases before concluding our paper.

KEYWORDS
Quality, design practice, multimedia design, CSCW, ethnographic case study.

1. INTRODUCTION
Nowadays, everyone – companies, customers, consultants, researchers, journalists, politicians – talks about quality, but it is very difficult and almost not possible to describe the common understanding of quality. Since years researchers try to introduce concepts and models to bridge this gap: Total Quality Management (TQM) (Axlerod, 1993; Zultner, 1993), Quality of Service (QoS) (Braumandl et al., 2003), quality of documentation (Smart, 2002) etc.

These concepts are useful to define standards and norms available for companies and can be used as guidelines and conventions. But they do not enable a better understanding of design processes, influences and reasons for contingencies. We still struggle between standards given by quality assurance systems and realities of complex, unforeseen work processes in design of software systems. Considering a typical web project as a multidisciplinary design process, we claim that there is no common meaning of quality among its stakeholders. E.g. a manager is interested in commercial and financial success, i.e. the less quality of the product is usually acceptable if the calculated costs or the delivery deadline can be kept. A graphic designer wants to create a very unique and innovative object regardless costs and time lines. A customer expects a cheap but very well designed web site, which contributes to his/her financial or strategic success.

Furthermore, the meaning of quality changes over time depending on circumstances like market changes, changes in personnel, technology changes etc. Companies have to know how to deal with modified and revised quality expectations. A precondition for that is again having a clear common understanding of quality.

In this paper we use the concept of quality to analyze work processes in design practices. Our findings are based on ethnographic studies in web based multimedia production companies. The main questions are:
- How can we define quality?
- How can we measure quality?
- How can we achieve quality?
- How can we establish sustainable quality in design practices?

This paper is an attempt to answer some of these questions. First of all, we want to describe briefly our conceptual definition of quality. Then we want to point out the process, product and person related dimensions of quality in our use cases before discussing and concluding our paper.
2. QUALITY AS A CONCEPT

The term quality is used in several software and web engineering scopes. Software quality has been and is still a very attractive field in software development. In software engineering we find standards, methodologies and techniques to improve, measure and assure software quality, but also how to define software development process, how to evaluate and improve it. Here quality is closely connected to cost and schedule (Chulani et al., 2006). We also see how the different views of different stakeholders (Chulani et al., 2001, 2003; Wong, 2004; Boehm et al., 2004), like software design and development teams, customers, partner organizations, are considered in setting quality criteria and measures. The goal is to understand quality from various perspectives. Quality in use is defined as “the perceived quality of software or web applications by actual users in real contexts of use” (Covella & Olsina, 2006, p.1). There are again guidelines and methods for assessing usability and quality in use. Moraga et al. (2006) created a quality model based on software measurement ontologies (Garcia et al., 2005). Their main goal was to evaluate measurable concepts like understandability, learnability, customizability and compliance – all as subcharacteristics of usability.

If information is treated as a product (Wang, 1998) we have to consider the meaning of quality of information. We can measure its quality across multiple dimensions such as accuracy, accessibility, consistency and timeliness (Strong et al., 1997; Wand & Wang, 1996). The other dimensions of information quality are appropriate amount of information, believability, completeness, concise and consistent representation, ease of manipulation, free-of-error, interpretability, objectivity, relevancy, reputation, security, understandability and value-added (Wang & Strong, 1996). “We need to evaluate information products in terms of how well they meet the customers’ needs, how well we produce information products, and how well we manage the life cycle of the data after it is produced” (Pierce, 2004, p.82). To achieve this, e.g. the information product control matrix can be used which is an application of control matrices (ibid).

The concept data quality is used to stress the fitness of data for use, i.e. the ability of a data collection to meet user requirements (Cappiello et al., 2004; Yang et al., 2004). Other researchers applied this concept on the Web (Gertz et al., 2004). Caro et al. introduced a portal data quality model (2006), which is based on three elements: a set of data quality web attributes, the data quality expectations of data consumers on the Internet, and the functionalities of a Web portal like data points and integration, taxonomy, search capabilities, help features, content management etc.

In this paper we focus on findings of our ethnographic field studies to identify factors and values related to the quality of processes, persons and products (Figure 1). These different dimensions of quality, which depend on and influence each other, help us to understand the design work in its context. Additionally, we want to relate these to quality concepts introduced in research so far. We use the triangle of quality as an instrument to guide our research. It shows the main dimensions that we have to focus on and – more important – to investigate in real work settings.

![Figure 1. The triangle of quality](image)

First of all, the quality of (design) processes can be investigated by looking for teams’ collaboration practices consisting of communication, coordination and cooperation patterns. Openness, easiness and honesty in working together are crucial for a well functioning of a work group as a team. Documents created and exchanged, the level of details added to common artifacts, defining and maintaining a standard format or conventions e.g. in naming artifacts, temporal and spatial arrangements to organize one’s and team’s work are some factors that we can investigate in a design team. This is the most complex dimension to study.

Second, the quality of the product can be different for different stakeholders. Data included and presented in the product can be measured in terms of quality of information or data quality models mentioned above. Software quality assurance systems and appropriate measurement metrics can be used to evaluate a product’s quality objectively.
Third, perspectives, expectations and motivations of persons involved in a design process can be investigated to find out what their priorities and values are, what they want to achieve in the design process and how flexible and open minded they are to changes and other opinions. Obviously, customers are interested in quality of use of systems, whereas designers might not share the customers’ view.

We claim that total quality can be provided if and only if process, product and person quality are equally important and present in a work setting. The balance of these dimensions is crucial and difficult to achieve.

In the next section, we want to try to look for these notions in our cases in order to ground our conceptual approach in real work practices.

3. QUALITY DIMENSIONS IN OUR CASES

In this section we want to describe quality related issues we could observe in our cases. We have three different design teams:

- **Webcom** – The work processes of Webcom, which is a small commerce-oriented company with eight employees, are organized in a rather straightforward manner. The company’s managing director (MD) puts a lot of effort into standardizing processes in order to keep the costs low. He sets deadlines for his staff and controls the intermediate results. No one in the company is allowed to start a complex process without having his approval. Visualizations play a large role in developing and communicating a design concept, in particular between web and graphic designers. The MD, for example, defines ‘guiding themes’ for a project, which he draws in color on the screen. Most of the design elements (graphic elements used in web pages like colors, logos, fonts, lines etc.) and ideas about structure and navigation of a web site are reused in other projects.

- **Telecom** – The task of Telecom, which is a development team of four designers, called service creation team (SC team), in an international telecommunications company, had been loosely defined as designing and developing innovative products and services by using the very newest technologies with the degree of innovation and the speed of the design and development being considered the main success factors. Being part of a large company, they have to make use of its products in their projects: infrastructural elements they need for presenting their product at a trade fair, such as file servers, networks or a demonstration server on site; or technology solutions developed for very specific mobile devices. This creates sometimes-constraining dependencies.

- **Archcom** – The main product of Archcom is an Internet forum for contemporary architecture. Its manager is an architect with a strong interest and advanced skills in multimedia production and use. He, in parallel, works on small architectural design and building projects. A team of four carries out the Internet project. The Flash animation, which is a part of the product, is designed and implemented by two external graphic designers. The company also outsourced the development of database integration. We characterized the design process in Archcom as best practice. This applies not only to the planning activities, but also to the use of methods and the documentation.

Table 1 shows an overview of the cases by stressing the type, products, employees and a short history of the companies studied.

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1 Our study was conducted as part of the research project “Systemic Integration of Production and Services. Case Studies in the Software and Multimedia Industries”, in cooperation with the Brandenburg University of Technology Cottbus and DJI Munich (2001-2003). The descriptions of the use cases included in this paper are partly based on Tellioglu & Wagner (2005).
Table 1. Overview of the cases

<table>
<thead>
<tr>
<th></th>
<th>WEBCOM</th>
<th>TELECOM</th>
<th>ARCHCOM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Commerce-oriented web design company</td>
<td>Function-oriented service creation team</td>
<td>Best practice company</td>
</tr>
<tr>
<td>Products</td>
<td>Communication-design-solutions for the Internet, CD-ROM &amp; print</td>
<td>Innovative telecommunication services</td>
<td>Web applications with database integration for contemporary architecture, Architectural design</td>
</tr>
<tr>
<td>Employees</td>
<td>8 persons including 4 free lancers</td>
<td>Team of 4 persons</td>
<td>4 persons, including 2 free lancers, 1 external programmer, 1 external graphic designer</td>
</tr>
<tr>
<td>History</td>
<td>Founded in 1994, In 2002 bought by another company</td>
<td>Part of a large, international telecommunications company, In 2002 the team was dissolved</td>
<td>Founded in 1996</td>
</tr>
</tbody>
</table>

3.1 Webcom: Controlled process and product quality

In Webcom, the main focus is on process quality. The standardized procedures with strict deadlines and controls of intermediate results dominate the design process and are seen as important factors to assure quality in processes. How does this standardized process look like? At the beginning of each project, in a very first meeting the main requirements of the customer are communicated in detail. As a next step the Internet is used for getting more information about the customer, his/her products and strategies on the market etc. The customer’s current web site is used as an important reference for understanding his visual preferences but also to identify limitations of the old web site and possibilities for improvement. In addition, the web sites of the customers’ competitors are studied. Then, an offer is created including graphic design. If the customer agrees with the graphic design and other aspects included in the offer, the creative director, the customer support and the graphic designer arrange a meeting in which they together define the next steps in the project. With this meeting the creative phase can be started. The result is the final graphic design of the web site in the form of images, either handmade or created in Adobe Photoshop. At the end of this phase the design can be implemented. The web sites and multimedia products can be produced. The first prototypes are accessible for the customer, as soon as they can be executed. The customer tests the work-in-progress continuously and communicates changes or enhancements directly with the designers.

Many of the conventions that are used in Webcom are typical of graphic design companies. For example, the person in charge of documentation puts all relevant project documents into a physical folder, labels it appropriately and updates the ongoing design changes by creating print-outs of the last version of a design and filing it in the corresponding folder. This is a convention used in a paper-based graphic design process, but not necessarily in web design.

Some values of Webcom are related to process and product quality at the same time. For MD discussing the graphic design with the customer is the most difficult activity within a web design project. A strategy is to show the customer one single graphic design, based on the argument: “We try to formulate this in a quite explicit and arrogant way, saying, the customer has the right to say ‘no’ to a design and ask for something completely different … But as regards our design of concept or layout or corporate identity or interface of a website, here we insist that we are the ones to define the optimal solution for a customer” (MD).

The writing up of an offer follows a standardized format: with a cover page (1 page), a description of the project team which can also include partners working together in the current project (1 page), an introduction part showing the status quo of the customer’s needs and brief description of the problem domain (1 page), goals and requirements (1 page), contents planned to be presented in the web site (1 page), branding (1 page), home page (1 page), detail view (1 page) etc. All offers look the same; they all have the same structure and length. They all also include an on line presentation (with Microsoft Power Point), with links to the already developed web pages. The customer can access these pages before the design concept has been discussed and approved. This format is used to define and communicate the product quality within the team and with the customers.

MD has a problem in maintaining high quality of his personnel. He means, that there is a difference between the skills required to design a graphic interface and those required to design a web page. This is why
graphic designers need to know how their design is going to be implemented technically, using HTTP, XHTML or CSS, if they want to be involved in web design projects. According to MD, this combination of skills is scarce.

3.2 Telecom: Not appreciated process and product quality

When we had the opportunity for fieldwork, the SC team had established a work process of iterative cycles. They have seen it as the main reason for the process quality. The iterative process starts with an idea for new products or services, mostly in the context of an upcoming trade fair. First the team performs research about standards, technical challenges, possibilities for implementation, offers of competitors, market demands and possible cooperation partners, using the Internet, professional magazines and searching for relevant published studies. Based on this research and their own experiences, the SC team focuses on products that are new for the market, are supposedly highly interesting for potential customers and challenging for design and development. After having substantiated the design idea, a very simple user interface is produced and the team’s main focus is on the development of the system’s functionality. One of the open issues is if the new products (applications, services) they want to use in the new application will actually be available and work. During the design process the original product idea gets revised and enhanced. Unexpected problems, e.g. a partner company cannot deliver the promised product at the right time or in the agreed configuration, make it necessary to explore alternative technical solutions. The time line for design is always set very tight.

The small SC team works in isolation from the rest of the department, not only locally. They talk about themselves as a “garage company”. Their work is not accepted and appreciated by the large software engineering team within the company from which they split off. One reason for this is the difference in style and working culture of both teams. Their methods and priorities are different. Whereas the SC team is capable of creating, in a very short period of time, innovative products and services by means of improvisation and bricolage, the large technical team is a fan of traditional software design methods: of creating several specification documents, of modeling parts of the system in detail, of designing the system on paper before starting with its implementation etc. They also have different ideas about how to do research or how to install a technical system. They prefer different programming languages. No coding styles or standardized programming conventions are established. All team members are self-trained. The SC team is more interested in ready-to-use products and cannot be creative and productive with written specifications of the technical team. This results in the clash of working cultures between both teams and in the technical team refusing to acknowledge importance of the contributions of the SC team and the quality of their work.

Figure 2. Isolated dense cooperation of the SC team (Telecom)

Ad-hoc design of problem solutions dominates the work practices of the SC team. It may happen that an important function, for example the payment server for music-video-charts, is not ready at the expected time for the team to integrate the software in the final product. Then an immediate solution to the problem needs to be found, in face of the approaching deadline of an exhibition event. We for example observed the SC team improvise in order to be able to present certain functionalities like streaming or downloading in their product. This is an example for person quality. They also create some graphic elements customarily based on random access to magazines or web sites, e.g. to design the payment interface, they bought a wallet, took a picture of it and used the image in the graphic design of the payment service.

This exploratory and intensely cooperative process (Figure 2) results in a fully developed executable (mostly with a provisional user interface), which the SC team presents at a large trade fair event, using the feedback from visitors for further enhancements and adaptations so as to make their product more customer-
oriented. This is a very crucial step to achieve an accepted and appreciated product quality. The modified and improved product is then located as a sample on the company’s demonstration server, which can be accessed by all interested customers with a user name and password. These samples are usually simple in use, layout and functionality.

3.3 Archcom: Best practice for high process and product quality

We found very high process quality in Archcom and therefore characterized the design process as best practice. The project manager (the architect) uses a project plan in form of a spreadsheet for the management of deadlines, responsibilities and workflows, which he updates regularly. During the weekly project meetings detailed to-do-lists are generated which afterwards are used to organize the cooperative work within the team. These to-do-lists are essential for continuous project work. With regard to important issues, for example concerning the design of the search function of the forum, thorough research is conducted in order to prepare a solid base for decision-making. Detailed sketches of navigation and graphic layout of the pages are produced. Equally detailed and thorough are the descriptions of the data for the persistence layer of the system, which are discussed before integrating the database components (Figure 3).

Figure 3. To-do-lists (on the left), sketches of persistent layer of the system (in the middle), navigation and graphic layout (on the right) (Archcom)

The best practice orientation can also be observed in the product quality: the structure of the delivered end product comprises a short history of the company, requirement analysis (use cases, a tool kit as a commercial product), technical description, description of deployment and use, flash animation, prototype (shows the functionality of the system, contains only static pages and is used to illustrate the design), storyboard (in form of a presentation) and glossary (as part of the technical documentation). UML is used for modeling the system and to describe the use cases. The team considers representations of the system-in-development with UML particularly useful in convincing the customer of the technical design and of its quality. The team member responsible for the technical concept tries to follow a best practice example in software engineering. He applies coding conventions and tries to keep the code simple, readable, understandable, and easy to maintain. Design representations are prepared in different media: sketches on paper, computer-based drawings and lists, storyboards, HTML prototypes. In meetings these are used to communicate the design-in-progress, considering constraints, such as deadlines, available resources, and user requirements. For the presentation of the whole system to the customer a HTML prototype is built together with a video movie illustrating the use of the system.

The quality of the team members can not only be observed in their results but also in their habits in communication during the weekly jour fix meetings. These meetings are both used for communicating and for intense cooperation. In these meetings it may occur that no one talks for a relatively long period of time because all are busy with thinking about a problem or working on a part of the system or taking notes. Meetings are there for solving problems together, for making design decisions and for planning the next steps. The project manager has a crucial role in these meetings. It is him who moderates the decision process. This includes in-depth discussion of the benefits and disadvantages of a suggested solution for a technical problem. As an architect he also represents a typical user of the system and he often voices the user perspective in the decision process. He insists on understanding the technical issues systems designers bring up, asking them to translate these for him so that he can write down the appropriate use cases. He sees his
role in confronting the system designers with user requirements all the time.

The central role of the jour fix meetings is mirrored in the highly detailed and thorough meeting minutes that are produced. They allow team members follow all decisions taken about the functionality and user interface of the system, about changes and enhancements of the underlying database model, about modifications of the web pages, about the business logic, about open questions and the responsibilities of team members for different tasks.

4. DISCUSSION

There are several quality issues that we observed in our cases. Routine work must be optimized to make use of former projects and products and to establish and maintain organizational learning. To achieve this, standardized procedures with clear time and work plans can be used. The MD in Webcom found this as the best way to assure quality in processes. For him the development of process and temporal structures is crucial for being able to manage the progress and quality of the work. He tries to set and closely monitor deadlines, not only within his internal team but also with external professionals. He frequently carries out reviews, checking the status, quality and quantity of the work. He prefers to have his co-workers present in the office in order to be able to communicate with them personally. He e.g. checks the work-in-progress directly on people’s screen. Feedback or instructions for modifications are preferably communicated face to face. The SC team in Telecom named its structured and standardized activities “iterative cycles” to communicate their success and competence with the rest of the company. To establish structured work practices, the project manager in Archcom uses artifacts like spreadsheets for project planning and managing to-do-lists and workflows. The detailed to-do-lists created in weekly meetings are connected to the project plan and enable an overview of work progress, open issues, priorities and responsibilities.

In each project Webcom and Archcom invest a lot of time for research about the current customer and his/her background, motivations, requirements and expectations. This is a method to find out what the customer means with quality. Furthermore, the MD tries to define criteria to achieve this expected quality, uses “guiding themes” and evaluates their own effort. This shows how important it is to focus on customers’ needs. Another way of integrating customers’ ideas into the product design and using this for the improvement of product quality is observed in Telecom. Customers’ feedback at trade fair events resulted in modifications and improvement of products evaluated.

Decision-making in a design team is very crucial and can be supported by effective and accessible meeting minutes (Archcom). To avoid unnecessary loops and deadlocks in design and development some kind of organizational memory needs to be created and kept active all the time. Easy and continuous documentation of relevant information is the base for a clear communication of technical, organizational and financial circumstances of a web project. It is also necessary to shorten up the decision making process with customers with respect to graphical components and layout issues. Webcom tries to avoid long discussions about the graphical design of web sites by showing the customer only one single design. This way they try to make clear what competencies they have and what they know better than the customers themselves. In this sense, representations of the system-in-development and design ideas internally, and of the whole system to the customer need to be created appropriately (as in Archcom).

5. CONCLUSION

In this paper we tried to create the context for answering the questions how to define, measure, achieve and establish quality in design practices. We illustrated real work arrangements in web based multimedia production teams and discussed the three dimensions of quality: quality of processes, products and persons.

In Archcom, process, product and persons’ quality are equally important. This is a necessity for a well-organized, thoroughly prepared, professionally developed and appropriately communicated results. In Webcom, process quality is the dominating dimension and is maintained mainly by the manager (MD). This is not enough to keep a work group motivated enough to create innovative products. We could investigate all web sites Webcom created looked the same. Only the colors or some graphic elements were different.

It is very important to let the customer participate in the design process just from the beginning. This type
of prototyping and iterative detailing enables an ongoing evaluation of the product by its users and guarantees their acceptance.

Finally, commercial success of a web project might depend on qualifications of team members, on structures, time lines, project management skills (at least one person in the team), on innovation e.g. by using media like music, real artifacts etc., on adaptation e.g. in case of technology changes, on improvisation capabilities e.g. if partners do not deliver the promised software application which is an integral part of the product-in-development the team has to improvise, on graphic and web design skills of team members, nevertheless, on market situations (demands, products of competitors, pricing etc.) and on standards and conventions applied in processes and products.

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