ETHNOGRAPHY A RESEARCH METHOD IN SOFTWARE PROCESS IMPROVEMENTS

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ABSTRACT

Software process improvements are required to increase the productivity of software companies. Generally, it is the aim to increase the quality of the produced software and to keep budget and time. Quality models for software process improvements were developed in context of large organisations and multi-national companies. In this study I investigated how software process improvements are done in a small software company using ethnography.

Ethnography was used as research method. It was the aim of this study to build up an understanding of how software process improvements are done and enabled in a small organisation. Based on the field experiences and the analysed fieldnotes, the following results were identified: In the studied small software organisation, software process improvement efforts were pushed by the initiative of single employees. The studied company did not have enough resources to implement a complete quality model. In addition, management was heavily involved in daily work and therefore had not enough time to initiate and lead software process improvement efforts.

Keywords: Quality System, Ethnography, Software Methodology, Process Improvement

INTRODUCTION

The word ethnography consists of the two parts "ethno" and "graph" [24]. The part "ethno" means something like people and "graph" means a picture or image. Based on those two meanings also the idea of ethnography can be understood – to make a picture of a group of people. One of the first ethnographic studies done in anthropology was by Malinowski [12] at the beginning of the 20th century. Later ethnography was also applied in other social

sciences like sociology [22], education research [20], but also in police and crime research [13].

Many ethnographic studies at the beginning presented the researcher's view on the studied culture [7]. This attitude also changed over the time. Today it is the aim of an ethnography to present the view of the studied people and not the way the researcher is seeing the studied culture [7].

ethnography has not to be d one by a social scientist, but can be done by anyone interested in fieldwork instead. This means, today the studied group does not have to be unfamiliar anymore to the researcher [24].
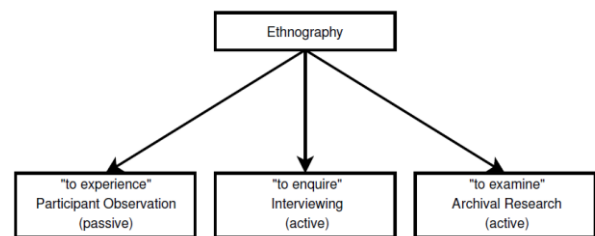
ELEMENTS OF ETHNOGRAPHY

Fig-1: Elements of ethnography discussed by Wolcott [24]

The most often associated work of an ethnographer is *to experience* by participant observation. This means, the ethnographer is living and working with the studied group without any active action to investigate the field. This can also include casual conversations. This means, he is not doing any surveys and is not asking direct questions to examine certain facts or knowledge. In participant observation, the ethnographer participates in the group actions as an ordinary group member would do. In contrast, the ethnographer can take an active role and ask people direct questions. This can be done for example in formal interviews, but it is also possible to ask specific questions in a casual conversation. Therefore, this part of ethnography can be described as *to enquire*.

In addition, each culture is producing artefacts. For example, companies produce many documents while working. It is also an important task to study those artefacts. Since those artefacts are already produced the ethnographer just has to find them for studying. It is an active action, because the ethnographer is directly searching for something. This archival research can be described as *to examine*.

QUANTITATIVE AND QUALITATIVE RESEARCH

There are two strategies of inquiry [3], which can be used in research. One is qualitative research and the other is quantitative research. The difference between both inquiry strategies can be understood from the meaning of both terms. To quantify means to know how much of something exists for example by counting. Qualitative in contrast means to relate something against something else. Therefore, in quantitative research a result is expected, which can be measured. In contrast, qualitative research produces results showing relationships between the studied items. Normally, there is also a philosophical perspective connected to qualitative and quantitative research [3].The basic idea is that the world can be observed and that theories can be created to explain the observations. Furthermore, theories can be proved by generating observations through experiments. If it is possible to observe what is going on, it is also possible to measure and count it – to quantify it [3].

On the other hand, one might think that the world is just a construction of our own imagination. We can not describe the world, because there is no way to produce evidence. Everything we see, hear or feel must be first interpreted by our own senses and can therefore not be objective [19]. This philosophical view is called constructivism. If all our observations are constructions of our own imagination, it does not make sense to create theories explaining something. Problems arise if for example a qualitative research study is judged based on the positivist world view [19]. Of course there is no randomised selection of studied individuals and also no mathematical model is provided to explain what the qualitative researcher experienced. If one is going to judge the value of a qualitative inquiry, one can not do this from a quantitative view point.

WRITING ETHNOGRAPHY

Writing an ethnography is somehow different. Different authors like Hammersley et al. [7] point out that writing the ethnographic report is an essential part of ethnography. Because of being able to write an idea or thought down means that we have thought about it extensively [5]. Once a teacher gave me the advice that you have only understood those things you are able to teach others. This means, only thoughts you are able to explain in your own words are thoughts you actually understand.
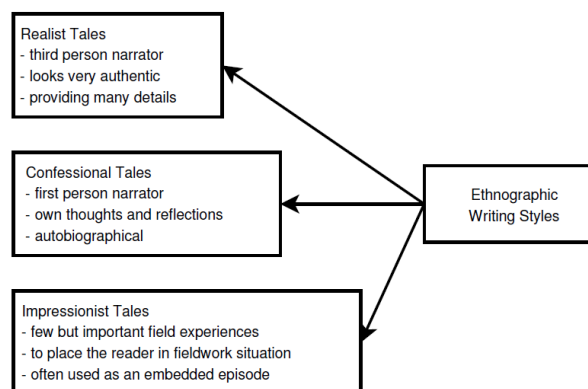

Fig-2: Ethnographic writing styles [21]

Realist tales [21] are written in a third person narrator. This is the style an ordinary movie is done. The reader can see how the different people interact and how they accomplish their tasks.

Another ethnographic writing style are *confessional tales* [21]. These are classical first person narrations. The ethnographer is describing his experiences and how he acted in the field. He does neither try to hide his existence nor his influence on the field. Often he describes his ideas about the studied subject before the study was started and shows how his own ideas and thoughts developed during the study.

Finally, one can also use *impressionist tales* as an ethnographic writing style [21]. This style is often embedded in theoretical discussions to illustrate the theory using a field experience. It helps to place the reader in the fieldwork situation. This means, the reader can understand how fieldwork is done and which problems must be dealt with.

ETHNOGRAPHY IN SOFTWARE ENGINEERING

There are not many examples of ethnography being used in software engineering. One often cited example is [17]. They report on how ethnography can be applied in requirements elicitation.

Ethnography is also used as research method in the closely related research topic Human Computer Interaction (HCI). Here, an ethnography is conducted to identify the best design for a computer interface. [16, p. 380] also points out that ethnography can be applied in interface design.

In their study of designing an image browser interface, [14] used ethnography to understand how photographies are used in private homes. They studied for example in which process and environment photographies are shown to a visitor. They identified that in many cases photographies

are categorised among the dimensions *who*, *what*, *where*, and *when*. This categorisation is reflected in the user interface of the image browser.

Ethnography is also applied in Computer Supported Collaborative Work (CSCW) research. CSCW explores how people work together (collaboration) and how technology like groupware systems and computer networks can support this collaboration [23]. Even though CSCW is not part of software engineering, it is also closely related. A study describing work processes can inform a software engineering effort trying to support the work with a new software [1]. A good example for a CSCW research effort using ethnography is the study by Nardi and Miller [14]. They investigated how spreadsheets are used within work environments. On a first glance it might look like that a spreadsheet is developed by a single person. However, often a single person is missing parts of the necessary knowledge. Nardi and Miller[14] found that developing a spreadsheet requires domain knowledge as well as technical knowledge.

Another classification of ethnography in software engineering is presented [1]. The author talks about three categories:

• ethnography *for* information system development

• ethnography *of* information system development

• ethnography *within* information system development.

Ethnography for information system development means to do ethnographic research to provide useful insights to developers and other practitioners. Those insights will help them to understand the way they work better. The author for example cites different studies, which revealed the importance of tacit knowledge within information system development [1]. Other studies cited by the author show that the end user must be involved in system development.

Ethnography of information system development means to study how software engineering is performed by practitioners. The author illustrates this with a study about how developers share development tasks among each other [1]. Other studies cited by the author investigated how communication is used during requirements elicitation [1].

The final application is ***ethnography within*** information development. Here, ethnography is used as a tool like development environments. An example presented by the author is requirements elicitation [1]. Here, ethnography can be used to create a domain description. Also software engineers can be sensitised for the domain by letting them do ethnographic work in the domain for some time before the actual software project is started [1].

ETHNOGRAPHY APPLIED

There are many ways to do an ethnography For example ethnography for requirements elicitation done by [17] sociologists conducted the ethnography in the air-traffic control room. It was not the software engineers collecting the field data directly. Instead, the software engineers just used the data collected. A recent study done by [15] can be seen as an ethno methodological informed ethnography. The authors observed a group of software engineers through interviews, hanging around in the office, focus groups, casual conversations and analysing work artefacts. They used the gathered data to investigate how plans are used in software projects. The chosen way of doing ethnography depends heavily on the ethnographer's personality.

1. **Ethnographic Question**

Lethbridge et al. [11] present in their paper different data collection methods for field studies. They explain that based on the research question, data required to answer this question must be identified. Therefore, designing research follows different steps according [11]:

(i) Define the research question.
(ii) Identify data needed to answer the research question.
(iii) Evaluate which data collection method is best suited to collect the necessary data.

Based on this definition I decided to do an ethnography, which combines different data collection methods. Taking a look at the different data collection methods described [11] it can be seen that some of them are part of ethnography (as described by [6]:

• Interviews

• Work Diaries

• Participant Observation

• Fly on the Wall (observation without active participation)

• Analysis of produced artefacts and used tools

2. **Collecting Fieldnotes**

427

The fieldnotes look like a long list of notes. The notes are in most cases not longer than one or two lines. we took the field notes on paper for several reasons. Pencil and paper is available everywhere and it can be used in almost every situation.

3. Data Analysis

At the end I ended up with several thousand words of field notes, with about 20 important email threads, and several electronically documents which all needed to be analysed.

By reviewing the literature I decided to do something like a template analysis as described [10]. The basic idea is to develop a hierarchy of codes. These codes summarise issues, which occurred in the study. This code network is called template. In a second step the fieldnotes are coded with the template. That means, passages in the fieldnotes are marked and a code is assigned to the marked section.

4. Self Reflection

I often reflected on what I was doing and what I was observing to identify problems in the way I was doing ethnography and also to enhance my understanding of the studied organisation. Continuous reflection is seen as an important part within software engineering [8], because it is a way to become aware of the complexity involved but also of the important role communication plays. A software engineer may for example think about his basic assumptions, about how decisions are made, about how problems are solved and how models are used [8].

CONCLUSION

This paper was done using ethnography as a research method. The study provides insight on how process improvements are done in a small company. This study eventually has contributed to the body of knowledge, even though the contribution might be small. In general, this means that ethnography applied in

software engineering research can contribute new insights. This is also one result of the workshop done by Sim et al. [18]. However, they stress the point that the contribution must be well formulated. Also one must be aware of the disadvantages of qualitative research.

Judging from my own experience doing an ethnography as a software engineer is a very good way to get aware of the subject's nature. Using a qualitative research method helps to understand that software engineering is more than models, technologies, and formal methods. For example, the need to create enough pressure for change is not a technical problem but a social one. Social interaction is a very important part of software engineering, something which was already pointed out by many different authors many years ago [9].

However, to get the most out of applying a qualitative research method training in front is needed. I had to learn almost from scratch how to do ethnography. A possible solution would be to include qualitative work in the education of software engineers.

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