
Hourglass Method: Applying Grounded Theory in Design Research

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Abstract – The purpose of this article is to describe the grounded theory method (GT method) and its suitability for design research. This article examines the general features and principles of the GT method in general and shows the steps that the GT method consists of. This method is not based on theory; rather, it explicitly creates theory based on empirical data obtained through the open, selective, and theoretical coding phases. The GT method is like an hourglass that relies on a large variety of data and a new theory to be formed from it. Because the design research field is multidisciplinary, the GT method can help identify relevant research topics in the future-especially for design research. In design research, new theories based on user experiences are especially necessary and topical. These can be research into the consumption of design products and design processes, along with the human social meanings and interactions at the core of design.

Keywords – Grounded Theory Method, Design, Design Research, Consumption of Design.

I. INTRODUCTION

The grounded theory method (GT method) is a well-known research approach in the social sciences, but it has not yet been established in the field of design research [1]. However, GT has proven to be a useful research method in the field of human-computer interaction (HCI) for developing design products and services in a diverse social reality [2].

The GT method is a qualitative research approach [3]. It is considered to be particularly suitable in the following cases: research on the nature of the social phenomenon of the use of a design product, service or system, or when a research phenomenon is unstructured; the subject of the study is a small number of cases; the analysis aims to elucidate the purposes, meanings, and subjectivity of human activity; the interpretation leans mainly on descriptions and explanations of concrete social, cultural, and physical situations [4, 5].

Grounded theory research is characterized by 1) careful systematic analysis, 2) approaching phenomena with empirical observation, 3) not approaching a study according to predetermined theoretical conceptualizations and coding, meaning that the researcher must be willing to change his/her perceptions as the research progresses, and finally, 4) integrating research results as a new wider theory [6].

In design research, GT requires different choices and solutions from the researcher in terms of how to make sense of the human and social research phenomena, that is, the voice of the people under study (consumers of design and services), in terms of design. The key is to get in and give a realistic picture of the consumer culture, behavior, and wishes being studied [7, 8].

With the GT method, it is possible to find new data and sustainable social service solutions to consumer behavior and mechanisms in design research. What is the GT method and what does it mean for the design researcher? Answers to this question are sought in this article, which aims to introduce the GT method as a valid approach and method of design research. It opens up hitherto unaddressed human factors that have so far been l-

-argely approached through case and action research methods [9].

The article is based on the scientific literature of the field, our previous research [8, 10] and the dissertation work of the first author [7].

II. RESEARCH PROCESS IN THE GROUNDED THEORY METHOD

A Grounded Theory is a research method or approach originally developed by Barney G. Glaser and Anselm Strauss [11]. The GT method aims at conceptual and theoretical generalizability rather than describing phenomena, which distinguishes it, for example, from content analysis [6]. Simply put, the GT method produces a theory that is firmly based on and anchored in empirical data [6].

According to Bohm [12], the GT method is a form of art (kunstlehre, art) whose learning is not schematic nor unambiguously easy. Glaser and Strauss [11] divide the GT method into four phases of analysis: 1) encoding the data into concepts, 2) integrating the concepts into categories of concepts, 3) delineating the theory from the data, and 4) writing the theory. However, Strauss and Corbin [13] elaborate on the implementation of the method. They specify that the implementation of the method requires more steps in the encoding of the data. The result is a formal theory that can be presented as different models or as a theoretical discussion [4, 14].

The GT method is a multi-step method. Next, we briefly describe the steps of the research process of this method, which are formulation of research questions, the collection of data, the analysis of data, and the resulting formal theory.

A. *Research Questions*

When planning research, it is important to consider and select key research questions. What is the aim of the study? To find new solutions or to increase understanding of a phenomenon [15]? It must be made clear from whose point of view the research is being conducted: whether it is designers, consumers of the design product, the design process, or even design education [3]. What kinds of behaviors, activities, feelings, thoughts, opinions, or experiences are we interested in [13]? In addition, attention should also be paid to the form, content, and quality of the data [3, 4].

Many design research questions are complex. Complexity manifests itself in design, especially in the early stages of design, because the definition of problems to be solved is not simple or easily structured. Often it can be a novel situation or otherwise a design situation can be complex, complex, or ambiguous [16]. On the other hand, unclearly formed research questions give room for open, flexible, and creative problem solving and for finding new solutions [17].

Cross [18] distinguishes five reasons for structuring design research problems:

- (1) There is no definite formulation of the problem. At the initial stage, the problem can only be broadly defined. During the research process, temporary definitions are formed, and the researcher must be open to changes when the data provides new information.
- (2) Any formulation of the research question may embody inconsistencies. Often, the research question involves ambiguity and incoherence, perhaps even contradiction, which becomes clear during the research process.

- (3) Formulations of the research questions are solution dependent. When defining a research question, there may already be ways in which it can be solved.
- (4) Proposing solutions to the research questions is a means of understanding the research question. Many solutions require an understanding of the phenomenon under study in a way that becomes clearer only as the research process and various attempts at solutions progress.
- (5) There is no definite solution to the research question. The solutions may not be universal and cannot be evaluated based on whether they are true or false. Instead, solutions are evaluated based on whether they are appropriate or inappropriate [17].

B. Data Collection

The collection of data most commonly follows the principles of qualitative research. The qualitative data was collected through open interviews, theme interviews, reports, and other textual documents [7].

In GT, researchers must systematically document their own observations, experiences, and ideas at different stages of data acquisition, processing, and of course, analysis. The researcher gradually writes theoretical memos and analyzes them (memo sorting) throughout the analysis process. Writing memos is one of the most important stages of research [7].

C. Data Analysis

The analysis involved in the GT method is time-consuming [15]. The practices of applying the method and analysis vary across different GT studies. In the analysis, the data is encoded, and there are different stages in coding. These include phases and practices of open coding, axial coding, and selective coding [1, 6]. They are followed by theoretical coding, which can also be referred to as theory generation [7, 15]. We present the phases of the data analysis in the form of an hourglass (Figure 1).

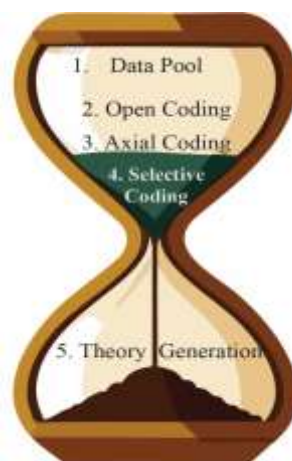


Fig. 1. Hourglass model.

Open coding is the first stage of analysis, in which a researcher analyses and fragments his or her data as empirical expressions [4]. It is an interpretive process in which data are broken up into parts with the intent of gaining new insights about the phenomenon under study. Coding accuracy can be individual words, individual thoughts of interviewees, or sets of thoughts presented by interviewees. Social events, actions, and human interactions are built on concepts and categories based on the similarities they contain [7].

In *Axial coding* the aim is to understand the dynamic relationships among the categories, which form the basis of the emergent theory. The factors that are determined and used include the conditions that give basis to the category building, the context in which it occurs, the interactions that express the context, and the consequences of the interactions. The tentative hypotheses are formed through a deductive process at this stage.

In *Selective coding*, a “core category” is identified, which unifies all the categories and leads to the theory. Sticking to one core category and selective coding based on it is a characteristic of the classic Glaser GT method [5, 15]. Coding is still a little used function in the analysis process of qualitative research. In grounded theory, good codes are “juicy” in the context of the research being carried out and inspire researchers to write memos supporting their own analysis [4]. Memos are the researcher's free-form ideas about anything related to research [4, 15]. The length of a note can range from a few sentences to several pages [4].

The categories and concepts that emerged from the data in the Theory generation phase are organized into functional theory. It is about theoretical modeling [7] or the elaboration of formal theory and metatheory (grand theory). Theoretical coding is also about conceptualizing the substantial codes and the conceptual integration of the theory [15]. The theory is built around a core category found at different coding stages. At this point, memos made by the researcher play a key role [15].

Classical GT research does not intend to use multiple theoretical codes or models in parallel. Theoretical modeling is usually the clearest when only one theoretical model is built from the analysis. The resulting model is usually quite fruitful for describing human behavior. However, there must be a sufficient basis in the data to perceive such a phenomenon [15].

The next step is to take a look at the meaning, benefits, and challenges of the GT method in design research.

III. THE IMPORTANCE AND CHALLENGES OF THE GROUNDED THEORY METHOD

The field of design research is multidisciplinary. The research field is extensive and divided into three categories: 1. research about/in design, 2. research for design, and 3. research through design [18, 19, 20]. For decades, user-centered, participatory, and co-design-oriented design research has sought to understand the needs, activities, and practices of users of design products and services. There has been a desire to respond to and produce better solutions to people's everyday problems [21, 22].

The GT method has been used to develop formal theory structures based on unique empirical data. There are some examples of the application of the GT method to design research, but its wider use, especially in “new-creative” and solution-oriented design research, could be more widely applied than it is at present. There are likely many reasons for the limited application of the GT method in design research. Perhaps the use of the method has been curbed by the method's original way of producing new theory in a data-driven way [4, 15], which is not typical of traditional design. Design is typically seen as a pragmatic endeavor. Creating new theories may seem inappropriate, as well as laborious. However, by developing theory, practice can be promoted [23]. To that end, the goal of producing new information for the needs of design is most valuable in terms of design research. The goal of the GT method to go beyond the usual description of observations; however, identifying and constructing the concepts that belong to the phenomenon under study and the relationships between them is demanding [7]. The method is not easy, and in general, its presentation is not effortless.

The merits of the GT method for design research are significant and the method deserves to have time and att-

-ention devoted to it. We live in a consumer society characterized by ever-increasing consumer and service needs. Developing them through research, generating new knowledge, and creating theories of design should play a more central role in design research [24]. The aim of design research is to produce new sustainable designs (products, services, and systems) for human problems. To achieve these goals, it is important to create a conceptual and theoretical basis of those human social processes and mechanisms that are interesting and profitable in design terms [7].

The most challenging part of the GT method is to produce as clear a description of the progress of the analysis as possible, which follows the principle of continuous comparison. Chronologically advanced description of the different stages of analysis is a typical way to explain the progress of the qualitative research and analysis process [25]. At the same time, the chronological description of analysis may be combined without question and self-evidently with various techniques of thematization and classification of the data, by which massive textual “human speech” is summarized and renamed, encoded, and the categories and relations of the interpreted qualitative data are finally constructed by funneling [3]. However, the GT method, especially its classic version in terms of analysis, does not mean this. This also allows us to demonstrate the merits and differences of the GT method in relation to the mainstream understanding of the techniques of qualitative analysis in design research [26].

When the GT method is used to study design, productization, users of design and services, and the whole range of complex systems related to design, the question of whether the researcher's presence and social interaction affect the information he or she forms is raised. The researcher's freedom from his/her own interpretations is significant, and therefore the GT researcher must disclose his/her own starting points in relation to the phenomenon being studied. The GT method requires the researcher to be able to describe the phenomenon under study as objectively as possible. It has been questioned whether the identity of a design researcher influences interpretations too much and inhibits discovery of new results [14].

The GT research process is time-consuming and involves several steps. Applying the constructivist approach can produce too many classifications, concepts, and categories. It is important to be able to summarize the results without drowning out different voices [7]. Glaser, who developed the method, has himself stated, “The tenth paper you write is already all right”, meaning that a researcher’s understanding of the GT method develops as they write papers based on use of the method [4].

Skill, art, and technology are at the center of design research [27]. These are also key elements of research using the GT method, where the goal is to discover, clarify, and model the fundamental, often-wicked process of (design) thinking [8]. In accordance with the user-centered model of design [8], it can be asked whether it is interesting to examine the behavior of design consumers from the perspective of how they, as “non-designers” or “non-visualists” but experts in different fields of leisure and consumption, implement design thinking. In other words, how does a design experience arise for a non-designer in a so-called layman context/framework and what does it mean for ordinary people?

Design is a very hands-on practice. Design research has also identified that all people are able to formulate cognitive problem-solving strategies, utilize abductive reasoning, and use non-linguistic modeling media. In designers, therefore, these abilities are particularly advanced, but the same fundamental skills are inherent in all people [18].

In design research, the collection and analysis of the research data requires, on the one hand, sensitization to the practical expressions of design experiences, empathy for the ideas and opinions of the research subjects and, on the other hand, the ability to form a new description or theory of the qualitative data. Constant comparison of the empirical data and an abstract network of theoretical concepts requires abductive reasoning typical of the GT method. As an approach positioned in the field of qualitative research, the reliability of the GT method should be assessed from the point of view of credibility [2]. Each qualitative study can be viewed as a case study related to its context, in which it is important for the researcher to have the ability to produce as transparent a report of the research process as possible with its different stages [28].

In accordance with qualitative studies, special attention must be paid to ethical aspects in the GT method. The researcher must be particularly careful both in the collection of the data and in the analysis of the data. Subjects must be carefully informed before collecting the data, their anonymity must be protected, and they must also be prevented from causing physical, psychological, or other harm to subjects [29]. Confidentiality is important when analyzing and reporting results. In these stages, researchers must consider the potential consequences of the research publication for the research subjects, interviewees, and groups they represent [29].

Presenting the analysis process in chronological order makes it easier for the reader to follow the progress of the research toward the results, but at the same time, it can give an unreal picture of the progress of the analysis toward the final theory. Research carried out according to the GT method is often not presented as a chronological analysis process. The open coding phase is a rewarding part of research, in which the material is allowed to tell what it has to say, and the researcher's preliminary understanding of the topic can change very significantly at this stage.

Applying the GT method requires familiarity with the constructivist trend represented by Strauss and Gorbunov [13] and the so-called classical Glaserian trend, which represents a realistic perspective [5]. Yet, each new study develops an application, maybe even a trend [30]. Design research can produce novel applications.

IV. CONCLUSION

The use of the GT method is a challenging research method. In addition, its application to design research is challenging and brings its own characteristics to the research because there are not many previous models to follow. The GT method has been used to develop formal theory structures based on unique empirical data. There are some examples of the application of the GT method to design research, but its wider use, especially in “new-creative” and solution-oriented design research, could be more widely applied than it is at present. There are likely many reasons for the limited application of the GT method in design research. Perhaps the use of the method has been curbed by the method's original way of producing new theory in a data-driven way, which is not typical of traditional design research which favours more functional and solution-oriented approach to research. Design is typically seen as a pragmatic endeavor. Creating new theories may seem inappropriate, as well as laborious. In addition, the field of design research is multidisciplinary which makes the establishment of general principles of design research complex.

However, the application of the GT method in design research may little by little set the goal of producing new research models that serve the practice of design. The GT method is not based on theory, but explicitly creates theory based on the empirical data obtained into a field that does not yet have a well-established

scientific base. In this way, the GT method has interesting opportunities to be involved in creating research objects for design research that it has not previously found relevant to this newly established field of research. For example, in design research, new theories based on user experiences are especially necessary and topical.

The use of the GT method has its place in design research, but it is still in its early stages. However, by developing theory, practice can be promoted. The application of the GT method in design research may set the goal of producing new research models that serve the practice of design. We live in a consumer society characterized by ever-increasing consumer and service needs. Developing them through research, generating new knowledge, and creating theories of design should play a more central role in design research. The aim of design research is to produce new sustainable solutions (products, services, and systems) for human problems. To achieve these goals, it is important to create a conceptual and theoretical basis of those human social processes and mechanisms that are interesting and profitable in design terms.

V. DISCUSSION

The application of the GT method in design research may set the goal of producing new research models that serve the practice of design. Data collection can be used to open up the world of the experiences of users, customers, and stakeholders of design products and services, as well as concerns and problems these groups confront in everyday life. The GT method can be used to find new interpretive design models, explanations, and design solutions to understand and promote design practice. Genuine human-and user-driven design is all about starting to produce solutions to the real concerns of the people being studied, which they themselves unconsciously reveal in the empirical data but can only be found through systematic data-driven analysis [7]. The application of the GT method is complicated by its rich philosophical and theoretical basis, which can also be interpreted and implemented in different ways. There is also some conflicting information about the application of the method, as its scientific roots can be placed either in the constructive Straussian and Corbinian tradition or in the realistic Glaserian tradition. The development of the method has been disturbed by the fact that the creators of the method, Anselm Strauss and Barney Glaser [13], drifted off on different paths and came to very different perceptions of the data analysis practices, among other things. The method develops when it is applied extensively and to various research questions. There are many scientifically significant gaps in design research and the GT method could be very helpful for bridging these gaps.

The use of the GT method has its place in design research, but it is still in its early stages. With the GT method, it is possible to open up the design process, clarify its starting points and alternatives, and find solutions that affect the development of the field. The GT method could promote the practice of design and strengthen its own theory [31, 32]. The GT method overlaps with other design methodologies, such as design thinking, participation design, and human-centered orientation [33], thus contributing to the identification and progress of key elements of the design process. Like design thinking, the GT method can well signify these key issues of design research [34]: 1) the process of creating a plan or action for the advancement of design activity, 2) the skill of incorporating a new social situational awareness of design in the production of ideas for different users and stakeholders, 3) a tool that utilizes both analytical and creative thinking to solve problems of design consumption and design process, 4) inspiring research mindset, in which preliminary ideas are extracted from diverse, even conflicting solutions and refined into new better solutions, or 5) novel understanding of design and the creation of new ideas and their submission to critical feedback, which again provides the basis for new desi-

-gn modification [17].

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