CULTURAL INFLUENCES ON THE DESIGN PROCESS

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ABSTRACT

Increasing globalisation has led to product manufacturers seeking cooperation with other companies at an international level, not only for production but also for product development. In such cooperation engineering designers from different cultural backgrounds participate in the design process. Their cultures will not only influence the product, but also the development process. A study of the literature has shown that, so far, cultural influences on the development process have not been studied. As a consequence there is a lack of knowledge on how to deal with or exploit various cultures within design processes. The main objective of this research is to support engineering designers working in intercultural design processes, i.e. processes in which engineering designers of different cultures work together. This paper describes the research approach, i.e. how to investigate cultural influences and their effects on the design process. For this, the characteristics to be investigated are derived from the literature on design and on cultural studies. An empirical study will be carried out to identify relevant cultural factors and determine their effects. On the basis of the results, guidelines for engineering designers and project leaders will be developed to deal with cultural influences.

Keywords: Intercultural design, culture, empirical study

1   INTRODUCTION

Globalisation has led to international cooperation among product manufacturers, spanning not only production and assembly but also product development. By becoming active worldwide, companies try to gain benefits from local markets, both in the sense of work force as well as customers. In such cooperations, engineering designers from different cultural background participate in one design process to develop or adapt products under contribution of local engineering designers.

A study of the literature has shown that so far the effects of cultural influences on the process of designing have not been studied. As far as culture is addressed, the focus is on the desired properties of a product for use in different cultures (see section 2.2). It remains unclear how culture influences the approach of engineering designers and how this in turn affects the design processes itself. That culture is likely to have an influence can be deduced from some findings in design literature. Several studies have, e.g. shown that the personal characteristics of engineering designers have an influence on their design process (see section 2.3), culture, however, has not been considered in these studies. Design research also suggests that the ability to work efficiently with others is a key success factor [1]. This too is likely to be influenced by differences in cultural background of the engineering designers. Despite the increase in intercultural design, there is a lack of know-how about how to consider various cultural influences within design processes. In this research, these influences and their effects will be investigated (Figure 1) through comparative, empirical studies in three countries.
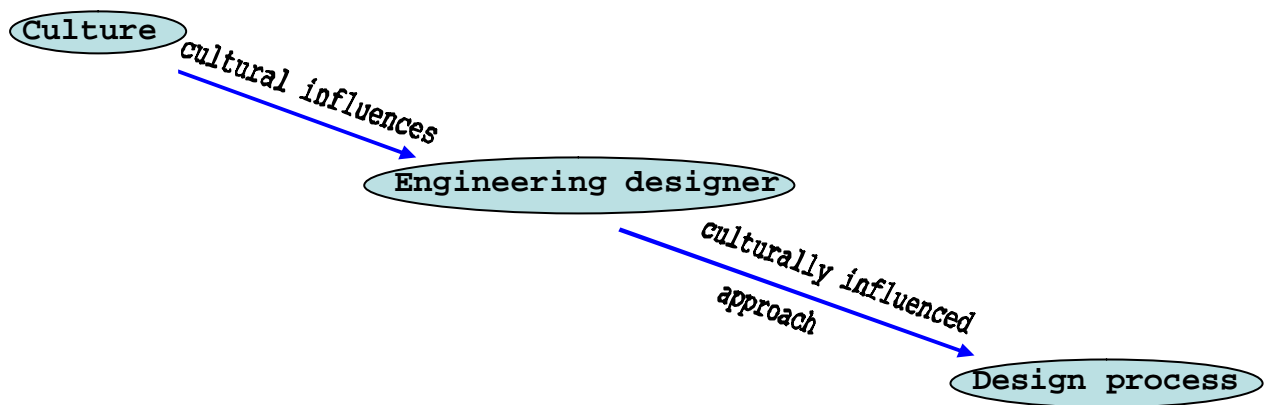
Figure 1: Research topic – cultural influences on engineering designers and their effects on design processes

The main objective of the research project is to assist engineering designers in intercultural design processes by providing them with appropriate support. The key question is how the culture of an engineering designer affects the design process. The results of the empirical study will be used for developing aforementioned support and also for adapting design methodology for intercultural applications.

The paper describes the key idea behind this research and the findings of the literature review. It further provides details of the research methodology employed to achieve the set goal, how the object of the empirical study is derived and what the results of this are. Finally, a preview of further work is given.

2   EXISTING LITERATURE – A BRIEF REVIEW

2.1   Definition of culture

The definition of culture given in the literature varies widely depending on the context. Here, two definitions of culture are given, that are most suitable for our research.

Hofstede [2] defines culture as a sort of 'software of the mind'. According to him, every person carries patterned ways of thinking, feeling and reacting. These are partly unique and partly shared with others. The unique part belongs to the individual's personality level. The common part belongs to the collective level. Culture is a collective phenomenon and is shared at least partially with other people living in the same social group. Culture can be treated as the collective programming of the mind that distinguishes the members of one group or category of people from another [2].

Thomas [3] defines culture as an orientation to individual perception, thinking and acting of persons belonging to a specific social group. Such an orientation is defined with so-called 'cultural standards'. Cultural standards are values, norms and points of reference, which are shared by persons belonging to a social group or community and seen as binding and normative by its members.

Based on these definitions, it can be inferred that culture affects the way we think and act and classifies people in social groups based on their cultural imprint.

2.2   Culture as an influence

Culture has been a widely studied topic in the disciplines of sociology and psychology. Its importance, however, has been understood also in fields related to the development and use of products, for instance, intercultural product development or intercultural usability engineering. These fields, however, focus on product properties and on user interfaces, not on the design process itself [4], [5], [6].

Culture has also been addressed as an influencing factor in literature on distributed product development and collaborative product development. The study of Gaul [7] recognises the different cultural emphasis of participants as a chance to enhance creativity in a distributed product development environment. This study discusses the context of distributed product development (i.e. cooperation, flow of information and working in teams) and does not go deep into the influence of

culture. The most relevant study we found was an explorative study in which the researchers investigated collaborative design in multicultural teams of PhD Students [8]. This study shed light on aspects pertaining to communication in teams (especially language), knowledge of the culture, requirements on products for targeted markets, planning of the entire process, knowledge of design methods and required media for communication and documentation. However, as the authors of this study state, a more detailed analysis of cultural influences is necessary, so as to understand these properly.

We found in our previous studies on culture that, e.g. an understanding of the cultural backgrounds of the project partners [9] and the cultural competences of participants, in particular of project leaders, are very important for successful collaboration of internationally acting companies [10]. Our focus at the time was to identify important aspects of international projects. The development of support for engineering designers is part of the ongoing project described in this paper.

The literature review and our own previous studies have shown that though culture has been a topic of concern in research, the findings hardly provide insight into how culture may affect the activities and approach of engineering designers in a design process. There is a need for an in-depth study, so as to gain a deeper understanding of the effects of culture and to develop support for engineering designers working in intercultural design processes.

2.3 Individual design approaches

Individual approaches of engineering designers and design students have been investigated in various research projects. Such studies describe how design processes are actually performed and have identified characteristic elements of and influencing factors on the various approaches taken by the engineering designers. The results highlight factors such as individual design strategies, knowledge of design methodology, heuristic competence, personal characteristics and organisational influences. This section focuses on those findings related to the course of a design process, which are considered to be of interest when seen in the light of cultural influences. The findings are based on the studies of Dylla [11], Fricke [12], Blessing [13], Günther [14] and Bender [15]. The participants in each study came from one country only and there were large differences in approaches found with participants from one country. For our study, it is assumed that differences in approaches within one culture are smaller than those among cultures (See also section 4).

One of the main elements of approach observed was breaking down of a problem into subproblems, thereby focusing on the core problem. Another element was the sequence of addressing subproblems and generating solutions for these. A variation among participants was observed here too. Engineering designers addressed subproblems one by one, thereby developing a solution for each subproblem until they reached a concrete level, or attended all subproblems more or less in parallel and developed solutions in the same way.

In particular studies [12] and [15] showed the occurrence of forward and backward jumps both within and between design stages. It was also found that personal characteristics, like motivation [12] and [13] and emotional stress and regression (behaviour of escape when facing difficult problems) [14] have an impact on the design process. Studies [12] and [15] showed that knowledge of design methodology has an influence on the results of a design process.

The next section deals with the question how these findings can be linked to the findings on culture.

2.4 Characteristics of culture

Empirical studies on culture have revealed many dimensions, some of which can be related to the characteristics of individual approaches and some are interesting in the context of a design process in general. This section summarizes the findings.

Nisbett [16] and Kühnen [17] showed in their study that in different cultures there are basic differences in viewing things - in western cultures by dissecting objects into components (i.e. Westerners pay more attention to the objects and see the environment in terms of unconnected entities) and in Asian cultures viewing objects in holistic terms (i.e. Asians focus on the relationships of the objects and see the environment in terms of inter-connected entities). Time is also conceived differently in different cultures and as a result, the sequence of carrying out activities is also different – sequential or synchronous according to Trompenaars and Hampden-Turner [18] and monochromic (one thing at a time) or polychromic (many things at once) according to Hall and Hall [19]. Another cultural characteristic observed by Nisbett and also by Kühnen is informational context. Depending on

the culture, information is considered and processed independent from the context in which it has appeared or information is considered and processed in the context, in which it has appeared. The difference in the freedom to take decisions has been pointed out by Hofstede [2], which he explains by the social-hierarchical structures within societies.

There are few other culture-bound characteristics revealed by related studies, however not considered for close investigation within the scope of this research because these have no identifiable link to the acting and approach of engineering designers in a design process.

3   RESEARCH APPROACH AND METHODS EMPLOYED

Design literature has shown that individual approaches of engineering designers significantly affect their design processes. At the same time, literature on culture has revealed that culture is an essential influence on how a person acts. For this research, the cultural influences on the design process are of importance. The assumption is that if the design processes of engineering designers in various cultures are studied and compared, this will provide knowledge that can be used to support intercultural design processes. The overall research approach used is based on the Design Research Methodology (DRM) proposed in [20]. DRM has highlighted the need of a proper understanding of designing for the development of guidelines. Complying with the framework of DRM, the issue of systematic approach has been addressed in this research.

Cultural influences are non-verbal in character and are reflected in a person's activity. Therefore, engineering designers will be observed while solving a given problem in a laboratory setting and then subsequently interviewed. The laboratory situation is chosen to be able to control the conditions under which the design process takes place, hence to allow comparison. Hofstede [2] has pointed out that in culture-related studies a method based on observation of activities alone is not sufficient. In this research, the observation is complemented with the half-structured interviews, which permits participants to express their views, in particular on cultural aspects.

Figure 2 shows the research approach and use of its results (see also section 5).
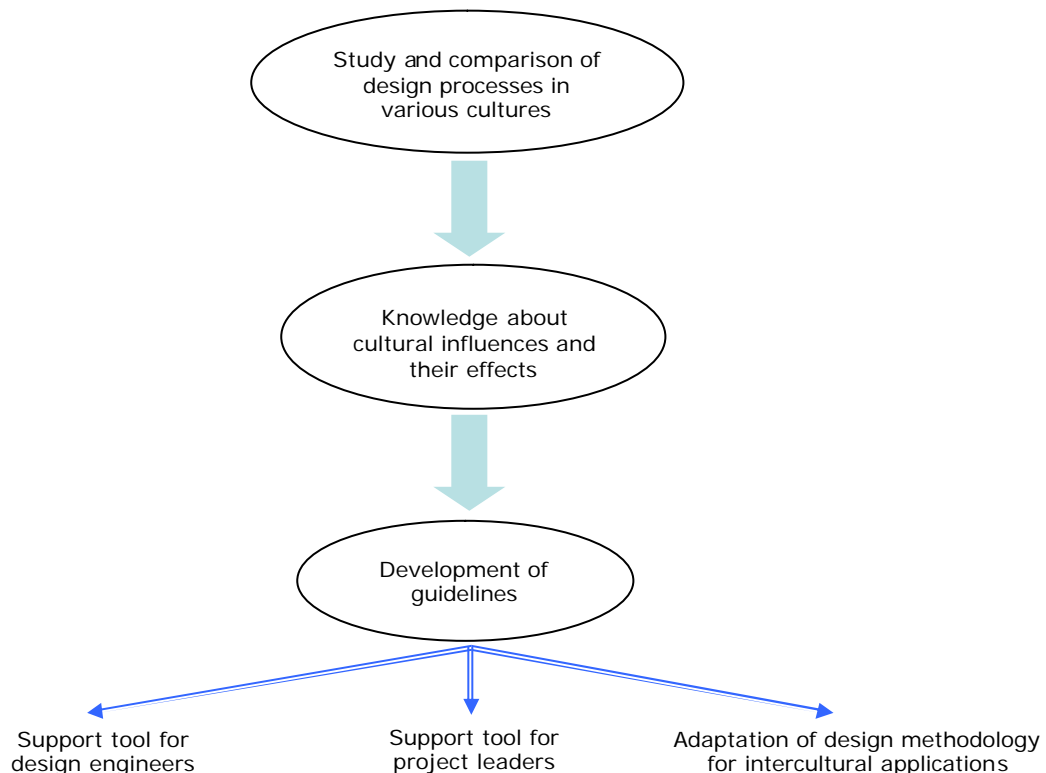

Figure 2: Research approach

The empirical study is designed to employ think-aloud. The participants are asked to voice their thoughts while designing [21]. The processes are recorded on audio and video for a detailed analysis. The study will be conducted in 3 countries – Germany, India and China - and consists of 5 settings in each country. In each setting, a team of 2 engineering designers will be given a design problem, asked

to develop a solution together and document the entire process. The solution process covered will be from task clarification till rough embodiment design. The design activities focussed on in the experiment are: analysing the requirements, generating solutions, evaluating and selecting.

4   OBJECT OF EMPIRICAL STUDY

As explained in section 3, culturally influenced design processes are the subject of study. Therefore, the characteristics have to be determined, which define these processes.

We are interested in finding out the course of a design process in a culture. For this, as a base line, the characteristic features of the design process described in the Systematic Engineering Design approach from Pahl and Beitz were identified [22]. The design approach according to Pahl and Beitz is widely known and its terminology is generally accepted, hence serves here as a reference point. It is necessary to locate a reference point in case of an intercultural research topic like here, so as to assure a common understanding of used terms and definitions within the scope of this research.

Next, the characteristics and influencing factors on approaches of engineering designers were identified from empirical design research [11], [12], [13], [14], [15] and from empirical studies on culture [2], [16], [17], [18], [19] . All involved characteristics and influencing factors were analysed, compared and classified. From a cultural point of view, such characteristics were identified which could be relevant to the approach of an engineering designer in a design process. From a design point of view, such characteristics of design processes were identified which could be influenced by culture. Figure 3 shows the approach taken to determine the object of empirical study and result of this process.
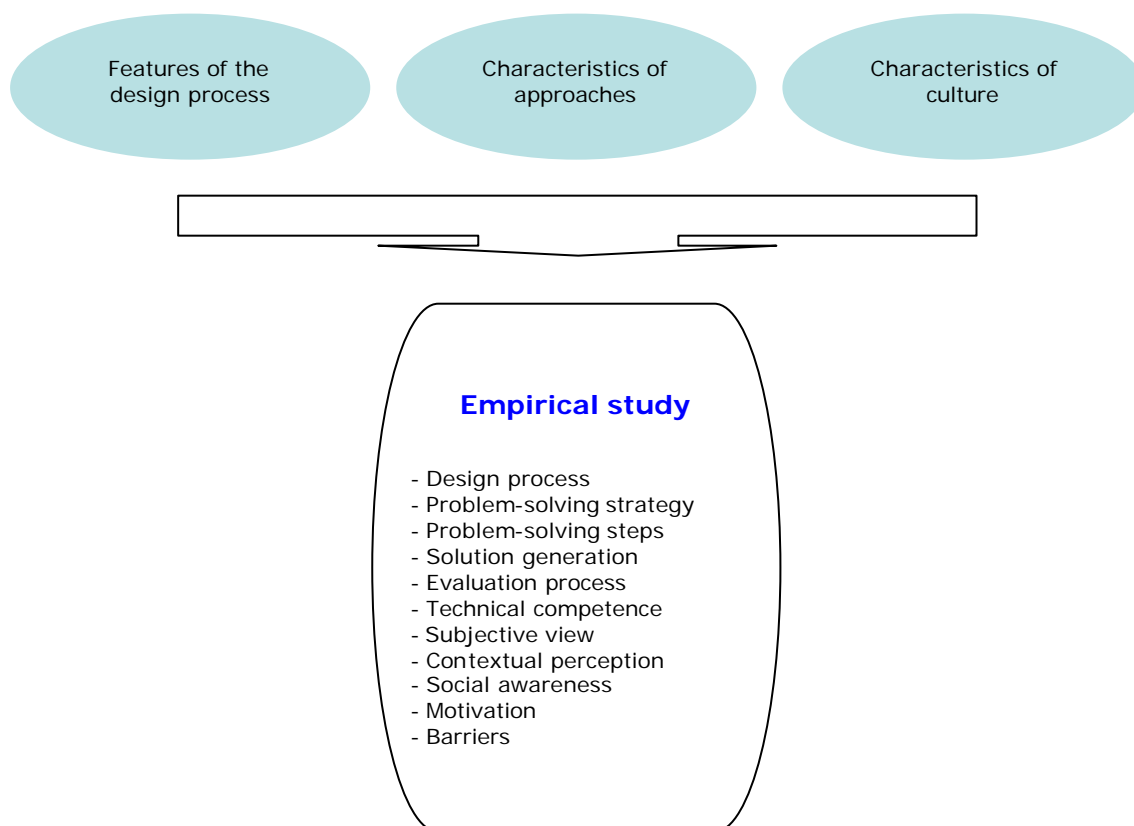

Figure 3: Focus of the empirical study

Below a few examples are given, to illustrate the object of empirical study:
- Design process: which course(s) is (are) taken in different cultures, for example, the order in which the steps in a design process are carried out
- Problem-solving strategy: does an engineering designer approach the design problem by dividing it into subproblems or rather considers the problem as a whole
- Problem-solving steps: are different steps of problem-solving carried out one by one or rather in

parallel
- Subjective view: how does this affect the approach of an engineering designer, for example, in case of interpreting the problem or preferring particular criteria over others while selecting a solution
- Contextual perception: is the information, which is used for making decisions, directly linked to the problem (i.e. seen in close context to the problem) or does it relates to the broader context of the problem (i.e. not only the problem but its surrounding also)
- Social awareness: how are aspects like safety or environment considered
- Barriers: what hindrances appear during an activity and block its progress, for example, difficulties in taking a decision

Figure 4 provides an example of how cultural influences of engineering designers could show up in their design processes. This example is based on [6] and [23], which state that problem solving behaviour in different cultures is shaped around a 'western method' or an 'Asian-Confucianist method' (see above), i.e. focusing on problem division and sequential execution of working steps, or focusing on a holistic approach and parallel execution of working steps. Considering these behavioural patterns in the context of a design process would mean that depending on their cultural background, the processes of engineering designers would be different.

All identified factors were operationalised, i.e. translated into indicators that can be observed in the study using the available means.
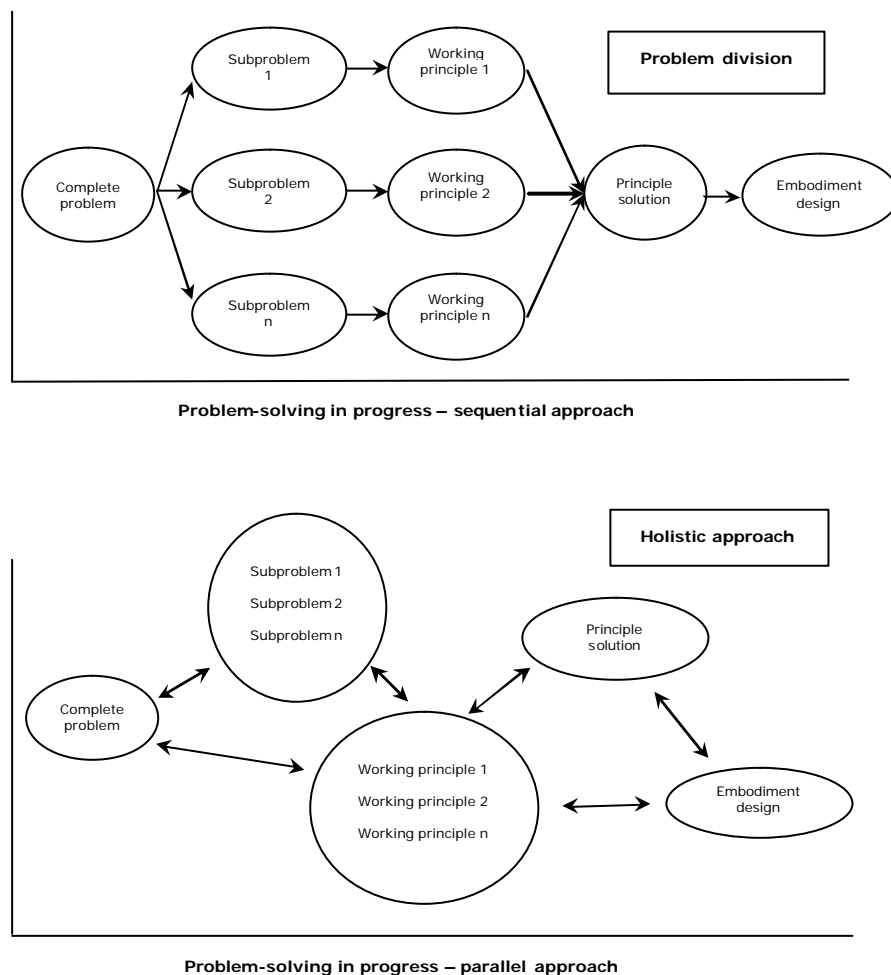

Problem-solving in progress – sequential approach

Problem-solving in progress – parallel approach

Figure 4: Characteristic approach of engineering designers in different culture'

Obviously, the options listed above for the factors to be studied are the ends of a scale. Engineering designers use a variety of approaches within one process depending on the situation at hand and there are large differences among engineering designers even within one culture. The aim is to investigate which of the factors show a larger between-culture difference than a within-culture difference. The

results are expected to show tendencies, e.g. in case of problem-solving behaviour, the approach is more towards sequential or rather towards parallel.

5   CONCLUSIONS AND FURTHER WORK

Based on findings from literature, this paper highlighted that there can be different approaches undertaken by engineering designers from different cultures in a design process. The characteristics that could influence the design process were theoretically determined. The verification is subject of a laboratory study that is currently in progress. In addition to the empirical study, interviews will be held with people involved in intercultural design projects in several countries. The results of the laboratory study and the interviews will be used to develop guidelines to support engineering designers and project leaders who are working in an intercultural environment. The results will also be analysed as to how design methodology has to be adapted for intercultural applications.

Remarks

The term 'culture' in this research denotes the culture of a country. It is not differentiated here at the level of regional cultures. Other existing forms, like corporate culture or project culture are not considered either.

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