

THE IMPACT OF CULTURAL ASPECTS ON THE DESIGN PROCESS

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1. Introduction

The progression of globalisation, as a result of increasing market pressure and growing linkage of economies, strongly influences design processes [Lindemann 2002]. The development of products in global companies is no longer restricted to one location, it is more and more characterised by distributed design teams, who work in different places, time zones or even cultures [Podsiadlowski 2002]. Especially the intercultural communication faces far more problems than just the diverse languages. Persons from different cultures have different educational backgrounds, value systems, behaviour patterns, etc. Consequently the dissimilar cultures pose a big restraint on effective distributed collaborative design [Strohschneider 2002]. On the other hand the diversity of viewpoints in intercultural teams could support creativity or lead to more innovative products.

In order to cope with the high market pressure and the proceeding globalisation it is important to improve intercultural collaboration. An in depth understanding of the varieties of design processes in different cultures has to be achieved. The aspects and impacts of cultural factors in the development process have to be considered.

2. Aims and Objective

The intention is to systematically identify problem areas for joint collaboration and develop more effective support for such intercultural processes. By analysing intercultural design processes it is possible to identify the major aspects of intercultural cooperation. Based on these aspects, it is possible to propose procedures to support distributed collaborative design and beyond that detect the detailed strengths of multicultural design teams.

In order to find out which of the numerous possible aspects strongly influence intercultural collaboration and how they affect it one has to look into these processes. For this it is reasonable to set up intercultural design experiments and analyse these experiments. To provide an informative basis for the design of such experiments and to find out which factors have to be watched during such experiments, an initial workshop with a cultural mixed group of engineers has been carried out. This workshop included an intercultural design exercise followed by a discussion of the proceedings and the results with the participants

3. Realization of the experiment

The workshop was held at the IISC (Indian Institute of Science) in Bangalore (India) by a group of three German Engineers working together with three Indian Engineers. The design problem used in the exercise was the intercultural development of a sample product to the embodiment stage followed

by the development of a rough mock up prototype. The sample product is a new toy that has novel interesting motions or uses new physical or logical effects and is educational in the sense that it aids in understanding of these motions or effects. The product should be characterized by the following attributes:

- It should educate and entertain.
- It should address creativity and inspiration.
- The effects should be not too easy to understand (fascination).
- It can educate both in mental or physical areas.
- There should be no complex manual necessary to understand the toy.
- It should be easy to carry and hold in hands (size, weight) and be realizable with low costs.
- It should be robust.
- It should be easy to manufacture and should use “simple” materials (wood, metal, etc.).

The design exercise session was divided into task clarification, conceptualisation, embodiment and prototyping phases. During the exercise several steps have been worked out in one big group (three Germans and three Indians altogether) and partly in two separated working smaller groups (group one: two Germans, one Indian; group two: one German, two Indians).

The clarification of the problem was done in two small groups. Every team set up one requirements list, which were united by the big group afterwards. The development of the concept was realized together in the big group: An initial discussion about typical German and Indian toys was followed by a brainstorming based on physical effects for principle solutions and an evaluation of the generated concepts. During the embodiment, the two separated working groups detailed two different concepts. Group one detailed a magnetic tangram, while group two detailed a magnetic gyro (Figure 1). The final prototyping of the two concepts was done in one group again.

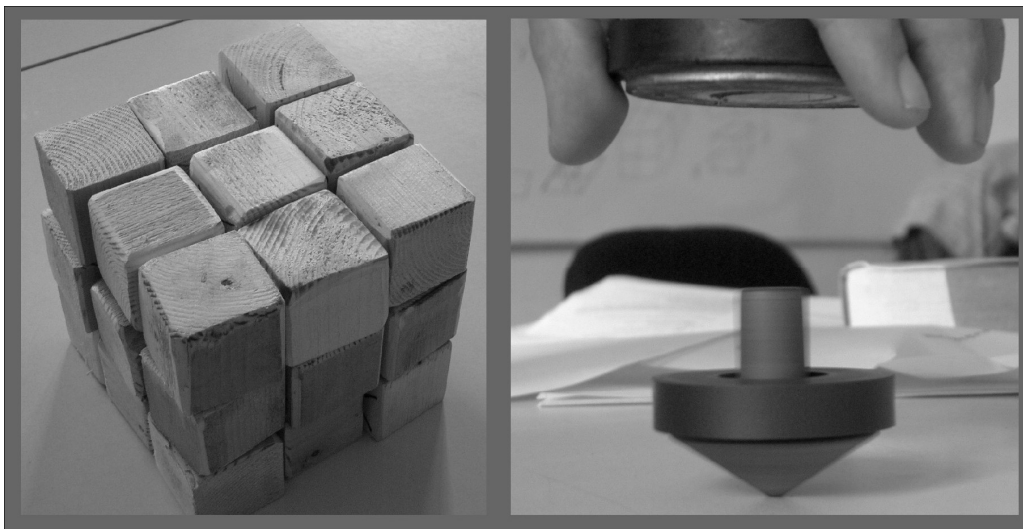


Figure 1. The two developed prototypes (magnetic Tangram and Gyro)

The entire exercise was videotaped. On the basis of the tape the participants tried to identify the main aspects in intercultural collaborative design processes by watching certain “interesting” scenes of the videotape together and interviewing the participants regarding those scenes.

Additionally all participants had to answer a questionnaire after the workshop. The questions are clustered and related to the subjects: “general feeling”, “understanding”, “process”, “distribution”, “information”, “team work”, “methods”, “meta review” and “results”.

“General feeling” covers questions regarding the personal impressions of the participants about the process and the results. “Understanding” clusters questions which are related to language and to cultural understanding. Aspects like wording are as much included as administrative parameters. “Process” focuses on the detailed phases of the development process and helps to identify the progression of the workshop from the collaborative point of view. “Distribution” considers cultural and geographic aspects which might influence the distribution of work packages. “Information” looks

at what and by which means information is distributed. “Team work” surveys the quality and the way of interaction between the team members. “Methods” covers which and how methods were used including cultural preferences. The “Meta Review” is a kind of personal feedback. The “Result” at last focuses on the rating of the result which was achieved.

4. Results

The first impression after the development session was that the cultural differences during the workshop in the formal work proceedings were less visible than expected. This impression was shared by all participants. The only obvious cultural factor which influenced the working together was the dialect, which made it sometimes quite difficult to understand what other team members said (especially the Germans having difficulties in understanding the Indian dialect). A deeper analysis of the videotapes combined with the questionnaire and the interview provided further results.

Generally in informal interactions there seem to be more cultural differences than in the formal proceedings. So culture probably affects more strongly these phases in work processes which need more informal interaction than those which are mainly based on formal interaction. Regarding ‘language’ as the most obvious cultural factor it was assumed that the Germans had bigger problems understanding the Indians, because they do not use English in everyday life. On the other hand English was not the mother tongue of the participating Indian engineers too. Beyond the language other aspects of communication e.g. special technical terms, gestures and intonation played an important role.

A cross-cultural team makes participants more conscious of their language and social differences and this affects linguistic and social freedom in interactions. A certain amount of interaction between the team members was necessary before they felt comfortable with each other. That’s why it seems to be more difficult (and more important) to have pre-design interaction in cross-cultural teams than in unicultural teams. This could cause problems when working in distributed cross-cultural teams where it is much more difficult to have informal pre-design interactions. An interesting observation was that even after some days of working together, uni-cultural discussions were more direct than cross-cultural discussions. Maybe this is influenced by the knowledge of what is polite/impolite in a culture.

It was felt that the integration of different viewpoints in cross-cultural teams leads to better understanding and more creative/better products. For example, during brainstorming a variety of ideas were created that exceeded the expected variety in a unicultural team. Different areas of knowledge probably made this happen. Another assumption was that speaking in a foreign language triggers creativity, because one has to think more about what one wants to say.

The knowledge of the culture (in this case especially the target market) does influence notions and emphases about which requirements are important and what product characteristics to focus on (price, physical effects etc.) It seemed to be a good way to make sure that special requirements of that culture are considered. Regarding this it was discussed, that it might be necessary to include people from special cultures in design teams, if the product is to be designed for a special target market (culture).

Generally cultural differences might make processes more time consuming. The task clarification phase in the exercise was much slower than expected. Apart from task clarification it seemed to the participants that the planning which step to do next took more time than in unicultural teams. A quite strict pre-defined planning might have a positive effect on efficiency. Furthermore it would be interesting how the performance of teams could be measured, in which phases there might be advantages or disadvantages and what they might be.

Knowledge and agreement upon design methods is particularly critical in distributed design [Fuchs 2002]. This leads to the assumption that knowledge of design methodology might affect even stronger the intercultural teamwork and the process. This assumption couldn’t be proved, because every team member had basic knowledge of design methodology. Further on the procedure of all team members was more or less orientated on Pahl/Beitz [1993], so that the methods and tools used during the exercise were familiar to all the participants.

During the whole exercise the preferred medium for sketching was paper. When working in distributed, paper needs to be substituted because it is not suitable for communication. Furthermore the question by which media to communicate in distributed teams is very important for good teamworking

[Gierhardt 2001] and can not be ignored when working in intercultural (distributed) teams. It was generally assumed that the influence of culture might be stronger in distributed teams than in non distributed teams.

After further discussion of the results with the participants, it was possible to cluster the most important aspects in intercultural teamwork into the following topics: “Culture”, “Distribution”, “Planning” and “Media”. For each of these topics, several research questions were worked out.

The questions related to ‘Culture’ are:

- What linguistic/terminology factors influence success (time, creativity, requirements satisfaction)?
 - Does difference in dialects have an influence?
 - Does knowledge of special terms have an influence?
 - Does understanding of gestures have an influence?
 - Does understanding of intonation have an influence?
- Are there specific aspects regarding the notions and emphases about which requirements are important and what product characteristics to focus on (price, physical effects vs logical effects) that are often / consistently affected by cultural differences (e.g., knowledge of target market / environment)?
- Do cultural differences affect informal interactions more than formal interactions, and does this affect success (use politeness/directness as a criterion for intimacy/trust in interaction)?
- Does cross-cultural teamwork help/force integrate different viewpoints which lead to better/richer understanding and help develop a greater variety of ideas, which helps develop more creative/better products?
- Does interaction in cross-cultural teams makes participants more conscious/reflective of their thoughts/ideas/speaking (especially language) and does this affect linguistic and social freedom in interactions? (could help with creativity by having to think in alternative ways to express, thereby hitting new ideas; also may hinder creativity since one may not express one’s ideas lest one is misunderstood)?

The questions related to ‘Distribution’ are:

- Does culture have a more pronounced affect when working distributed?
- How does distribution affect success?
 - Within one culture?
 - Between two cultures?
 - Between uni- and cross-culture?

The questions related to ‘Planning’ are:

- How do pre-design interaction and experience affect success?
 - What should a pre-design interaction constitute (in uni vs cross)?
 - Do informal interactions have a bigger influence on design success than formal interactions (for cross vs uni-cultural teams)?
 - Is pre-design interaction more important in cross-cultural teams than in uni-cultural teams?
 - Is it easier to do pre-design interaction in cross-cultural teams than in uni-cultural teams?
- How does methodical structuring of the proceeding affect success?
 - Is it more important to state explicitly the overall plan at the beginning, and to state what the next step to be followed in the plan is (making sure everyone understands the proceedings and what the next steps are) in cross-cultural teams than in uni-cultural teams?

The questions related to ‘Media’ are:

- What information is important to distribute?
- What media is useful for information exchange?
- Which steps (activities) of the process are hindered by the used media?
- What should be the preferred media for documentation?

5. Designed Future Experiments

To develop a better understanding of the effects of culture in intercultural teams and to define measures to support such processes, a more detailed analysis of intercultural teams is needed. The research questions lead to an experiment set up, which looks at the differences between uni- and cross-cultural teams, between teams working in the same place and teams that are spatially separated, between the culture itself, the influence of the problem (target market from another culture) and at the effect of pre-design interaction (Figure 2). Further aspects which will be regarded during the experiments are related to media and information. The experiments last one week each. The teams should consist of 2+2 people who have to solve a specific problem. One of the four people will be the coordinator. A rough proceeding will be provided. The Experiments will be videotaped and analyzed. The Participants will be questioned on the basis of these videotapes. Participants will be recruited from Masters Level Design Students with a certain amount of design methodology education.

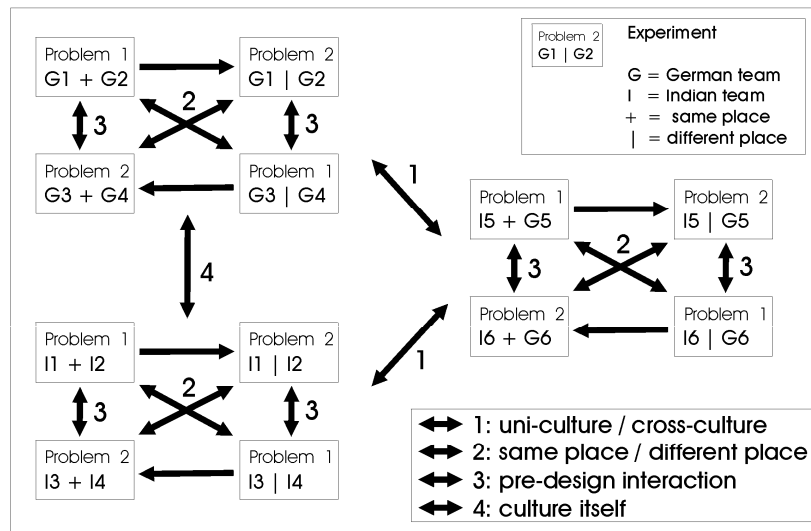


Figure 2. Designed Future Experiments

Due to the very high number of research questions, the experiment is very time consuming. Another problem is that the several aspects can't be related exactly to one research question and so it is difficult to analyse them separately. To reduce the number of research questions, a detailed analysis is in progress, so that only the most important questions and aspects are considered during the experiment set up. Additionally there will be no distribution of tasks in the first experiment setting. Research on distribution of tasks is planned to be analyzed in later experiments.

6. Outlook

The experiments should reveal the strengths and problems of intercultural teams and work out guidelines for effective work in intercultural teams. This includes aspects like which tasks are useful to work out in intercultural teams and which tasks are not suitable for intercultural teams. It is believed, that the results of this research will provide a better and deeper understanding of where intercultural distributed teams are helpful, and clarify resulting requirements for communication media. Furthermore, it might be possible to work out guidelines when to work in cross-cultural distributed teams.

7. Summary

In order to identify the major aspects of international cooperation, a three day workshop was held at the Indian Institute of Science in Bangalore. A group of three Indian and three German engineers took part in an exercise with the goal to develop a new toy. The comparison of Indian and German

distinctions has shown differences in economic, infrastructure facilities and cultural aspects like religion, language, costs of living, etc. The impressions during the first days of the journey raised the expectation that the workshop would be influenced by culture; the workshop did not confirm these expectations. During the workshop teamwork was appropriate, misunderstandings occurred mainly due to language problems and peculiar gestures. The procedure of all team members was more or less orientated on Pahl/Beitz [1993], so that the methods and tools used during the exercise were familiar to all the participants. A deeper analysis of videotape recordings combined with a questionnaire and an interview provided further aspects, which led to 32 research questions. In order to define measures to support intercultural design processes a more detailed analysis of the cultural influences is necessary. The setting of the experiments will be very challenging due to the high number of factors and the impact of individual human behaviour during the workshop. The evaluation will be time consuming too, because several aspects can not be related exactly to one research question. Furthermore the transfer of the results to the industrial environment needs to be done carefully, because some of the boundary conditions, e.g. the pressure to succeed, are different to the research environment. This report does not claim to state complete scientific results. Rather it is a step to see which areas of cross-cultural teamworking need further research in order to detect the strength and weaknesses of intercultural teamwork and to define measures to support such processes.

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References

- Fuchs, D.-K.; Lindemann, U.; Jokele, B.; Anderl, R.; Kleiner, S.; Fadel, G.; Greenstein, J.: "Sensitization to the Distributed Development Process." In: Horvath (Hrsg.): 4th Tools and Methods of Competitive Engineering, Wuhan (P. R. China), 22.-26. April 2002. Huazhong University of Science and Technology Press 2002, S. 601-612.*
- Gierhardt, H.: „Globalverteilte Produktentwicklungsprojekte“, München: TU, Dissertation 2001. (Produktentwicklung München, Bd 46)*
- Lindemann, U.; Pulm, U.; Stetter, R.: "Effective Strategies for Distributed Product Development", In: Ehrig, H.; Krämer, B. J.; Ertas, A. (Eds.): Proceedings of the Sixth Biennial World Conference on Integrated Design and Process Technology (IDPT-2002), Pasadena, CA (USA), 23.-28.06.2002. Pasadena, CA(USA): Society for Design and Process Science 2002, CD-ROM.*
- Pahl G., Beitz W.: "Konstruktionslehre, Methoden und Anwendungen", Springer Verlag Berlin, Heidelberg, New York, 1993*
- Podsiadlowski, A.: "Multikulturelle Arbeitsgruppen im Unternehmen", Waxmann Verlag Münster, 2002*
- Strohschneider, S. (2002): "Cultural Factors in Complex Decision Making". In: Lonner, W. J.; Dinnel, D. L.; Hayes, S. A. & Sattler, D. N. (Eds.), OnLine Readings in Psychology and Culture, Western Washington University, Department of Psychology, Center for Cross-Cultural Research.(2002) <http://www.wvu.edu/~culture>*

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