

STRUCTURING DESIGN SPACES

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ABSTRACT

The paper outlines the coarse structure, called CO-SITUE, of the design space in which designer reasoning takes place. It appears that any account of design rationale or of the logic of design reasoning will have to assume a CO-SITUE-like framework. As a frame notation, CO-SITUE has been applied in analysing and recording a medium-scale design project.

KEYWORDS

Design space, usability, designer reasoning.

INTRODUCTION

In order to investigate novel means of providing principled support for usable artifact design, many HCI scientists are turning towards analysing full-scale design processes (e.g., [5]). Results are intended to be fed back into requirements for new developments of the HCI science base, new ways of representing the knowledge in the science base in order to support design and, ultimately, operational support tools [1]. This is the overall context of Esprit Basic Research project AMODEUS II [2]. This paper outlines work in AMODEUS II on a top-down framework for characterising design spaces. The framework, called CO-SITUE, provides a coarse-grained analysis of the problem space within which artifact design takes place. CO-SITUE has been applied to a medium-scale design process with promising results [3], [4].

WHAT IS BEING DESIGNED?

Let us call what is being designed an artifact. In addressing the question of what is an artifact, let us look at CO-SITUE first. CO-SITUE stands for the following aspects of the artifact:

C = Collaborative aspects.

O = Organisational aspects.

S = System aspects.

I = Interface (or more generally: system Image) aspects.

T = Task aspects including task domain aspects.

U = User aspects.

E = User experience aspects.

User performance on the resulting artifact will be the function: $UPERF = f(C,O,S,I,T,U,E)$

Put an artifact designed for one organisational setting into a different organisation and the artifact may not be used any more; or change the user population from occasional users into professionals and they may become frustrated using the artifact. The claim behind CO-SITUE, therefore, is that in designing a "system" what is actually being designed is something much more complex. What is being designed is an artifact and artifacts are CO-SITUE complexes.

CO-SITUE AND THE DESIGN SPACE

During design, designers have to consider and actually do consider to some extent and at various levels of detail the types of aspect included in CO-SITUE. The artifact is designed the way it is in order to satisfy multiple criteria and constraints derived from a consideration of its CO-SITUE aspects. The claim here is not that designers do consider all possible CO-SITUE aspects of the artifact, or all relevant aspects, at appropriate levels of detail, or that they consider the aspects which they do consider in any systematic fashion to make sure that nothing relevant has been left unanalysed. Designers today have no way of making sure that this happens. They work instead with personalised stopping rules and evaluation functions [6]. The point is rather that designers actually work within the conception of an artifact designated by CO-SITUE: CO-SITUE describes the structure of the design space around an artifact during design.

The claim that what is being designed is a (CO-SITUE) *complex* involves two main points. Firstly, during design the aspects of CO-SITUE constantly interact. Neither normatively nor in actual design practice is there such a thing as first specifying a system and then looking at user requirements, or user tasks, or interface specification (or vice versa). In design reasoning, multiple constraints derived from very different aspects of the evolving artifact are continuously brought to bear within the design space.

The resulting physical artifact is an embodiment of a specific CO-SITUE complex. Secondly, there is an important sense in which designers design, not only systems and their interfaces but also collaborative and organisational work schemes, tasks, users and their degree of experience. Usable artifact design is not a one-way traffic of optimising the way constraints from those domains influence the usability of the resulting artifact. Computer artifacts change users' tasks [8]. However, this point about change is more general. As viewed *from within* the design process, all or most aspects of CO-SITUE are potentially subject to change as a result of design decisions. Thus, computer artifacts often change work conditions, i.e. collaborative and organisational schemes of work. And artifacts "change" users in the sense that the types of target users and the requirements on their knowledge and experience for operating the artifact are themselves to some extent variable design options.

In other words, during design one constantly has to identify and select between options concerning the way the system is to be built, the way the interface is to be built, the possible ways to change the organisational and collaborative work schemes of users, the ways to change their tasks, and the ways to select the types of end-users and the knowledge and experience they will need.

If CO-SITUE provides an approximate, coarse-grained characterisation of the design space around an artifact, design can be turned into a process of making explicit a number of generic constraints on the artifact to be designed and applying, through a process of interpretation, discovery, justification, trade-off and decision-making, those constraints to all aspects of the evolving artifact. Each general constraint or criterion, and each result of applying these to the artifact adds an additional constraint on subsequent specifications. This process can be incrementally described in a numbered series of CO-SITUE frames. Below is shown the frame which was used in analysing and recording the initial specification phase of a spoken language dialogue system prototype [3], [4].

CO-SITUE No. (0)

A. General constraints and criteria

- Overall design goal:
- General feasibility constraints:
- Scientific and technological feasibility constraints:
- Designer preferences:
- Realism criteria:
- Usability criteria:
- Naturalness criteria:

B. Application of constraints and criteria to the artifact within the design space

- C =
- O =
- S =
- I =

- T(S) =
- T(U) =
- U =
- E =

C. Hypothetical issues:

D. DR/QOC arguments:

E. Conventions:

- T(S) = System Task aspects including task domain aspects.
- T(U) = User Task aspects including task domain aspects.
- CO-SITUE No. () indicates the number of the current CO-SITUE specification.

Using this notation, four successive frames allowed a succinct representation of the initial design specification phase from the point of view of usability engineering, capturing all the main design criteria and constraints used, their interpretation with respect to the overall design goal and their justification in terms of user characteristics.

CONCLUSION AND ONGOING WORK

The merits of CO-SITUE in its present form are:

- CO-SITUE makes explicit the general aspects of the design space around computer artifacts and hence enforces a consideration, during design, of each aspect from the point of view of usability engineering;
- even in substantial design efforts, the CO-SITUE notation compactly represents the design decisions relevant to usability and the constraints and criteria on which they are based;
- maintaining a numbered series of CO-SITUE frames can be useful in recording designer consensus and the reasoning behind it.

Ongoing work aims at combining CO-SITUE with the DR/Questions, Options, Criteria approach to Design Rationale [7] and investigating the possibility of developing a taxonomy of CO-SITUE complexes.

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