



The
Cognitive
Condition
of
Design
March
26-27
1987

PROCEEDINGS

Editor:
Brian S. Zaff

A Symposium
organized
by
Dr. Mihai Nadin
Eminent Scholar

CONTENTS

Part I:	<u>The Common Denominator: Is There Such a Thing?</u> Mihai Nadin	1
Part II:	<u>Changing Problems + Changing Capabilities = Changing Design</u> Patrick Whitney	5
Part III:	<u>Design Language</u> John Rheinfrank	28
Part IV:	<u>The Cognitive Style of Design</u> Ronald MacNeil	46
Part V:	<u>Computer Graphics and the Exploration of Design Ideas</u> William Mitchell	83
Part VI:	<u>Design as Knowledge-Based Problem Solving Activity</u> B. Chandrasekaran	117
Appendix:	Directory of Participants	148

PART I

The Common Denominator: Is There Such a Thing?

Introduction by Mihai Nadin

Engineering design, graphic design, genetic design, program or algorithm design, architectural design--I can go on and on--are fields of human activity which seem to share something, since their denotation has "design" as a common denominator. Actually, it looks as though there is no human activity which does not involve a design component. Sure, there is a difference between the design of a business and the design of a computer graphics algorithm, we do not need a symposium to agree on this. What we do not know is how people design and how, in spite of the differences between various forms of design, we are able to distinguish between good and bad design.

In recent months--I can even say in recent days--experts in fields such as artificial intelligence, genetics, linguistics, and mathematics have advanced new hypotheses not in their field of expertise, but in design, acknowledging the importance of design in every form of human creativity. In my preliminary meetings with some of the participants, I was presented with a very challenging definition of design: Design is communication of creativity. I do not take credit for this definition; I expect the person who suggested it to make his own point during the symposium. But I would like to say that the relation between creativity and design seems critical at the level our civilization has reached. It is no longer possible to waste material and energy on poorly designed products. It is no longer possible to substitute quantity for quality, to be competitive while ignoring the contribution of design. It is no longer possible to use scientific developments and new technology without a design concept that integrates science and technology.

One of the contributions made by experts to a better understanding of design comes from Terry Winograd and Fernando Flores (incidentally, Winograd is the author of one of the famous artificial intelligence programs--SHRDLU). The two question our main design concept--representation--and argue that in order to be able to build better computer systems, we need an improved design concept. They

quote from the work of Humberto Maturana, a biologist concerned with understanding how biological processes participate in cognition and language: "Living systems are cognitive systems, and living, as a process, is a process of cognition." (cf. p. 46 in Winograd & Flores, Understanding Computers and Cognition. A New Foundation for Design, 1986.) Indeed, we have to understand that design is not independent of the designer and that design intelligence cannot be reduced to strategies of representation. In another contribution, George Lakoff deals with the role our experience plays. He rejects the idea that reason is some kind of manipulation of abstract symbols and that the realization of meaning is a result of representation. In Lakoff's view, the mind-as-computer metaphor eliminates the role of experience and imagination, the role of metaphors, metonymy, and mental imagery. His book (Women, Fire and Dangerous Things: What Categories Reveal About the Mind, due to appear in May, 1987) takes a look at the mind through the window of the study of language. Let me suggest to you that our symposium is an attempt to look at the mind through the window of design. And I think, due to the nature of design, this window is more intriguing.

I mentioned the two books and alluded to recent articles because in my mind, if we intend to improve the quality of design, we have to better understand what design is. More simply put, we need a theory of design. Enormous amounts of money and much human energy are put into products doomed to fail because of our love affair with technology, we are seduced by the transient, attracted to effects, and transformed into operators. Human creativity deserves better. It is my hope that under the stimulating leadership of Patrick Whitney, Ronald MacNeil, and William Mitchell, you will become active participants in an exchange of ideas, questions, and experiences that might tell us if design is the common denominator of such divergent activities as engineering, programming, architecture, and product development. The rules of this symposium are very simple: No rules apply. Use

every means of expression you are aware of to express yourself. Just don't abuse your colleagues by indulging in the type of lecture we did not want to have in this program in the first place. Talk and listen. Listen and speak. Use the meeting time and the time between meetings to learn from others and so share with others. I would like to thank all of you for being here. And please bear in mind: You will get out of this symposium as much as you are willing and prepared to get.