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# Soft Architecture Machines

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# Preface

The position that computer-aided architecture is an issue of machine intelligence is an uncomfortable one. While I sincerely believe that the case is strong, the paradoxes and setbacks are overwhelming to the point of making this position quite self-defeating for the researcher. Nevertheless, the fruits of continuing and the consequences of capitulating are so great that one can easily find incentives to try earnestly to understand the makings of intelligence and the makings of architecture. Without this understanding, I believe, the future of architecture, as aided, augmented, or replicated by computers, will be very gloomy in the technical hands of one-track-minded auto-crats.

In contrast, I believe that computers have the potential for assuring a responsiveness, individuality, and excitement in all aspects of living, to a degree hitherto unseen. For the first time in history, for example, we can see the possibility of everybody having the opportunity to live in a man-made environment that responds to and is "meaningful" for him or her. Ironically, the computer sciences, generally associated with elite and often oppressive authorities, can provide to everyone a quality of architecture most closely approximated in indigenous architecture (architecture without architects). There is no doubt that computers can help in the humdrum activities of making architecture tick: smooth circulation, sound structures, viable financing. But I am not interested in that—I am interested in the rather singular goal of making the built environment responsive to me and to you, individually, a right I consider as important as the right to good education.

It is curious that although the United States government has launched major programs in building technology, particularly in housing, it has had almost no interest in the "design technologies." As a consequence we are on the way to achieving efficient, financially secure, and structurally sound ways of building the same junk cheaper and faster, without devoting an equal measure of time to scrutinizing the design process itself. In this volume I examine the design process in terms of its being conducted (not necessarily by professionals) in concert with computers—in particular, with a class of computers that someday may exhibit intelligent behavior. I consider three potentials of the computer: (1) the computer as a designer, (2) the computer as a partner to the novice with a self-interest, and (3) the computer as a physical environment that knows me.

Each of these themes stems from both specific experimentation and specific acquaintances over the past eight years, most recently during the period of building an "architecture machine." The following chapters will enumerate specific experiments. At this point I would like to acknowledge some important friendships, particularly because I have witnessed and not resolved some deep philosophical schisms between two major, perhaps personal, influences. On the one hand, I listen carefully to Marvin Minsky and Seymour Papert, share their interest in understanding intelligence and learning, but seriously wonder about their emphasis on problem solving, symbol manipulation, and descriptive systems. On the other hand, I listen to Warren Brodey and Avery Johnson, share their interest in soft robots, but see no evidence of progress or even potential. To help

soften the dichotomy, I am very grateful to have as friends and colleagues Steve Coons, Aaron Fleisher, Joseph Licklider, Gordon Pask, and Oliver Selfridge, each of whom has provided many instances of well-seasoned wisdom that can turn contradictory arguments into complementary approaches.

From the “architectural” point of view, Yona Friedman and William Porter are the only two architects with whom I have shared a continuing interest in computer-aided architecture. Otherwise, there is general aloofness and skepticism as to whether any of this really has to do with Architecture. Or are we just playing with expensive toys?

Interesting, though hardly justifying, is the fact that they are not expensive. The Architecture Machine Group has built a multiprocessor mini-computer configuration composed of a family of inexpensive devices, some homemade. This has been achieved through the technical assistance of electrical engineering students and staff at MIT, in particular Randy Rettberg, Mike Titelbaum, and Andrew Lippman, each of whom has borne the burden of being depended upon one hundred and sixty-eight hours a week.

James Taggart and Steven Gregory have been responsible for making things work, developing, respectively, applications and systems software. More recently Mike Miller and Chris Herot have nursed the graphical systems with relentless perseverance. Each of these four gentlemen represents a rare kind of student, one who passes from student to colleague in a matter of months. They deserve special acknowledgment as it is

with them that I spend most of my time on a day-to-day basis, and their ideas are reflected throughout this volume.

Leon Groisser has been a partner in all my ventures, especially in the early days of URBAN5 and *The Architecture Machine*. More recently he has assumed a desperately needed advisory role, providing unreserved criticism, counterbalancing wild fantasies, and bailing us out of trouble in my absence. If a man-machine relationship is possible to the degree suggested in the following chapters, I will consider the acid test to be: Can I have the same relation with a machine that I have with Leon?

Finally and most importantly, it is necessary to acknowledge the individuals and organizations that have supported our work. Most of our contracts and grants have been small but overlapping. As a consequence of some cases of redundant funding, we have been able to support a wide variety of student experiments and have been able to show each sponsor wide-ranging results.

John Entenza must be acknowledged first, because he was the first person to provide outside support to the Architecture Machine Group, thus assuming the risk of sponsoring a new enterprise. Under his directorship, the Graham Foundation made a substantial donation for the fellowships of Huck Rorick and Sean Wellesley-Miller and for a “scholars’ fund” to be used for student projects. Beyond fiscal support, however, John Entenza gave us the recognition and credibility that made further support possible.

The National Science Foundation has supported our sketch recognition work. The Ford Foundation has sponsored the development of a Computer Teaching Laboratory in the School of Architecture and Planning. The Advanced Research Projects Administration has supported experiments in computer graphics through Project MAC and The Cambridge Project, both of which are based at MIT. And, most recently, The Koch Trust has sponsored our studies in computer-aided design, as well as a great deal of the research that went into the making of this book; I thank Bill Koch for this assistance.

Nicholas Negroponte  
Patmos, August 1972

### **Author's Note**

The writing of this book was completed in the summer of 1972. By fall it had advanced to a computer-readable format (paper tape). It is appearing only now, in 1975, for a number of reasons related to its production. The author and the publisher share the embarrassment that most of the delays were caused by the use of automation, in particular, computerized typesetting. The only redeeming aspect of this episode is the shared belief of those involved that, while this is a feature of computerization today, it is not an inherent and everlasting property.