The electronic design notebook: performing medium and processing medium

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The traditional “Engineer’s Notebook” is a volume of bound paper pages. This archaic system is still the medium of choice for mechanical engineers during the conceptual phase of design. In making this choice, designers are taking a performer’s view, choosing freedom and agility in the initial making of drawings over processing power. The paper notebook allows the designer to quickly write and draw whatever she or he desires. During conceptualization, a designer is functioning as a performer, like a musician. And also like a musician, her instrument must be agile or the performance will be cramped and ideas lost. But the agility of Computer Aided Design systems has been neglected in favor of processing power — the ability to do something with the drawings in addition to just making them. Described in this paper is vmaec, a prototype Electronic Design Notebook which combines the capabilities of performing medium and processing medium.

Key words: Image performance — Computer graphics — Design notebook — Agile interface — Visual language

1 Out from behind the Dim Curtain

In a large Detroit company there is a design room with peculiar interior layout. One half of the room is well-lit, while the other half is very dimly lit. In the well-lit half are the design engineers, sitting at their desks. In the dim half are the Computer Aided Design system operators, sitting at their tubes. The initial concept for a design comes from the design engineers, working in the medium they find most convenient: paper. Usually the paper is in the Engineer’s Notebook, but it may often be the back of an envelope or a cocktail napkin. As the design progresses, it migrates behind the Dim Curtain where it finally gets into the computer. That is, where the design engineer and the computer operator collaborate in fleshing out the details to make the design work and enter it into the appropriate computer tool. Figure 1 shows the geography of the design room as it is split by the Dim Curtain.

For the remainder of this paper, let the description of the room in Detroit serve as a problem definition: the challenge is to design a computer tool which can compete with paper in the well-lit half of the room. Computer support must be brought “out from behind the Dim Curtain” so it can also aid in the initial, conceptual phase of design. The goal is Computer Aided Conceptualization, the necessary precursor and partner to Computer Aided Design.

2 Introduction

The Engineer’s Notebook is a traditional medium for the conceptual phase of mechanical engineering design. This volume of bound paper pages has yet to be replaced by computer tools. How can this be the case considering the ever-increasing processing power of computer design aids? The answer proposed in this paper is that the processing aspect of Computer Aided Design (or CAD) system has been emphasized at the expense of the processing aspect. From the point of view of the designer as performer, the paper notebook is still superior to available computer media. Musical performers demand that their instrument be able to respond immediately in support of their every improvisational whim. Likewise, designers during conceptualization are text-graphic performers and demand similar agility from their instrument. Archaic though it may be, the paper notebook provides that free-
dom and agility: it is a place where the user can quickly and easily write and draw whatever she wants.

We take it as an indication of the superiority of paper as a performing medium that most conceptual design in engineering is still done using paper-based Engineer's Notebooks. Only after the initial design has been finished are CAD tools employed for detailed drawings and analysis. In industry, a "designer" is actually a CAD operator who transcribes already-sketchied-out designs into the computer. This implies that computer-based design tools are at their best when you already know what the design is. And in fact this follows from the traditional techniques employed by computer tools for processing visual objects. If the user wants special processing of written-and-drawn objects, then she must specify in advance what she will be writing and drawing — i.e. whether it is to be a circuit diagram, a page of text, a mechanical linkage, a flowchart or a sketch of a floorplan. Because processing of visual objects is done by special purpose editors, the editor must be selected before the design is started. And likewise, once having selected, for example, a special purpose "linkage editor," the same knowing-in-advance problem arises recursively. The user doesn't get to just draw a part and then later decide that it should be a pivot point; instead that part of a linkage can only be created by selecting in advance the "create a pivot point" menu item in the linkage editor. Thus, because CAD tools seem to require that the user know in advance what the design will be, and because conceptual design is just that stage in the design process when you don't know that yet, computer tools have difficulty in supporting the fluidity of the text-graphic performing that is an important part of conceptual design. Computer Aided Con-

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3 Since this manuscript originated in an even numbered year, all pronouns used in the body of the text are feminine
4 and consequently initial conceptualization has become the "pre-CAD" phase of design

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Fig. 1. The "Dim Curtain" between conceptual design and existing Computer Aided Design.