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Comments on Generating Caricatures

Since well before the brothers Carracci drew their caricatures at the turn of the 17th century, exaggerated drawings have captured artists and their audience. Susan Brennan's Caricature Generator can now fire imaginations of computer-literate artists and students of visual perception. As a member of the latter group let me say why this is so.

Brennan (*Leonardo* 18, 170-178 [1985]) suggested that "Caricature... seeks, paradoxically, to be more like a face than the face itself." A caricature captures the essence of its subject better than many other possible representations. But be on guard about this point. Indeed, Ryan and Schwartz [1], Fraisse and Elkin [2] and Dwyer [3] all reported that stylized, accentuated drawings were more easily identified, or aided learning more, than photographs of the same objects. But none studied faces. When Perkins and Hagen [4] compared caricatures and photographs of people, they found no evidence that the former were better than the latter. Yet I have always felt this to be the wrong comparison. As employed by Brennan, bandwidth compression is the key idea for guiding such comparisons. Notice that her caricatures need only 200 points to start with but that even a poor quality photograph needs a million. What is psychologically important, then, is that caricatures seem much better than roto-scoped (traced) line drawings from a photograph. Brennan's is the first available system to allow systematic tests of this idea. As examples, her Fig. 7 tracings of Fay Dunaway, Diane Feinstein, John F. Kennedy and Elizabeth Taylor look less like their subjects than the computer-composed caricatures.

Why caricature works so well is not clear, but it seems related to a phenomenon in ethology known as *supernormality*. For example, a white egg speckled with dark brown spots is preferred by a nesting plover over its own light brown speckled egg [5]. In this case, in many others, and in caricature, some information to which the perceiver is acutely attuned seems enhanced and hence preferred. Following Gibson [6], some authors [7, 8] have supposed that invariants in faces are preserved in photographs, and perhaps even better in caricatures; but since these are unnamed and unmeasured this argument, while it may eventually prove true, is currently little more than explanation by incantation.

What is most exciting about Brennan's system is that it allows exploration of the space of depiction, investigating the preferred amounts of exaggeration, the best norms, and the types of facial information to which we are most sensitive. There is no real need for an expert caricaturist; the theory of caricature has been made sufficiently concrete so that it can be implemented on a machine.

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Comments on "Electronic Thinking Cap: Microcomputer-Enhanced Creative Problem-Solving"

From my vantage point as a psychologist, the Metros article (*Leonardo* 18, 100-104 [1985]) raises a number of provocative questions about the relationships among creative problem-solving, design performance, and the computer as a tool in design. The *Electronic Thinking Cap* is presented as a relatively inexpensive yet powerful aid in helping novice designers (students of graphic design) cope with the large amount of information and ideas typically generated at the beginning of the creative problem-solving process. The computer program accomplishes this by creating a database in which all entered information "can easily be retrieved, organized, manipulated and accessed in a variety of ways". My question is: How does this method of coping with large amounts of information compare with the ways in which experienced (expert) graphic designers traditionally work around the limits of their own human information processing system? Do experts save every idea for later retrieval, organization, combination and reconsideration, or do experts somehow recognize ideas worth pursuing, and discard (forget) those less promising? My point here is not that Metros' system should necessarily emulate expert design problem-solving, but rather to raise the

question of what kinds of designers (in terms of experience) can be best served by this kind of system.

A second general issue has to do with the kinds of problem-solving tasks most appropriately handled by the *Electronic Thinking Cap* approach. My speculation is that there exist a number of qualitatively different tasks that professional graphic designers are faced with, each having widely varying sets of constraints. It is possible that Metros' system could be observed in action to determine empirically what the taxonomy of design tasks is, with discrimination between task types determined by a differential system response to the tasks as set. This line of inquiry has implications for problem-solving theory as well as for curriculum planning in design education.

Finally, while I accept Metros' persuasive argument about the usefulness of the computer as a tool for high-volume information handling, I also hypothesize that the design problem-solver gives something up when he or she moves into this cybernetically assisted process. A relevant limitation of the computer as a storage, retrieval and display device is that, using the cathode ray tube monitor, the user is constrained in the amount and range of information he or she can view or review at any given time. The user sees his or her data base 'one window at a time', in a rather linear fashion. Of course, one could print out everything, but then we're back where we were before computers—in a room full of papers (except that computer printout tends to homogenize surface appearances). In short, I would want to know more about the creativity costs and limitations of *Electronic Thinking Cap* before investing heavily.

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Reply to Professor Clark

In response to Professor Clark's first issue, I feel that the measure of professional expertise should not be a factor in deciding whether a graphic designer chooses to enhance his or her creative problem-solving skills with a program like *Electronic Thinking Cap*. Committing idea options to paper, or disk, for that matter, is good problem-solving form for novice and expert alike. The premise of creative problem solving revolves around the ability to explore fully the many angles of a concept. This 'exploded view' technique is essential in procuring an innovative solution. I cannot speak for all graphic design practitioners, but I do not feel out of line by stating that, in most cases, successful design begins with a list of idea options. A database tool merely provides added flexibility in the ability to interact with that list.

I do agree with Professor Clark's second issue. A psychologist might find *Electronic*