Summary of Allen Newell's CHI '85 Address, "The Prospects for Science in Human-Computer Interaction"

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The most popular highlight of *CHI '85 Conference* was the Plenary Address by Professor Allen Newell of Carnegie-Mellon University. His address was a frank and opinionated assessment of whether a psychological science of the user can have an impact on the field of human-computer interaction -- not just by packing the CHI conferences with psychologists, but by really contributing a science base that raises the quality of the design of human-computer interfaces.

By "science" Newell means a **hard** (quantitative, technical) science, not the flabby (qualitative, equivocal) science that psychology is usually thought to be. He summarized the competitive situation among sciences and disciplines by proposing an analog of Gresham's Law: *Hard science drives out soft.* If user psychology can't be hardened, then it will be driven out of (actually, not let into) the field of human-computer interaction by the hard engineering disciplines of computer science -- hardware, programming systems, computer graphics, etc.; even AI looks hard next to user psychology.

Newell presented his vision of a hard user psychology having the following elements:

- It focuses on design, not evaluation.
- It has the form of an engineering-style theory based on task analysis, calculation, and approximation.
- It is used by interface designers at design time.

This vision is developed in Card, Moran, and Newell's 1983 book, *The Psychology of Human-Computer Interaction*, which he used as a symbol of a general vision shared by a number of researchers. Newell presented several models from the book as concrete, but partial, realizations of this vision. For example, the Model Human Processor is an architecture for integrating a collection of more specific models of various cognitive functions. The model allows a wide variety of simple approximate calculations of human performance, and it thus provides the designer with an effective way to think about the information-processing structure and behavior of the user.

But this vision (as expressed in the book) has its critics. Newell took a step beyond the critics by succinctly characterizing the problems with realizing the vision:

- The science is too low-level.
- Its scope is too limited.
- It is too slow to keep up with a rapidly developing design field.
- It cannot be applied to real problems.

He then discussed the prospects for dealing with each of these concerns. His message, basically, is that this approach is not the easy road ("the race is between the tortoise of cumulative science and the hare of intuitive design"). For example, the Model Human Processor provides us with a map of the state of the science: and he laid out many of the areas where the model needs to be filled out.

An especially interesting part of Newell's talk was his discussion of the levels issue. He presented a table listing an exponential series of activity timescales, from 10^{-3} seconds (milliseconds) to 10^{9} seconds (decades). He then asserted that the timescale of activity determines the appropriate domain of science. The fastest timescales are governed by physical laws. The laws of human cognitive-symbolic system operate in a limited range of timescales (from tenths to tens of seconds). Larger-scale behaviors (minutes to days to years) are governed by laws of rationality ("common sense") or by laws of social interaction. Thus, it is appropriate for cognitive psychology to focus at the lower levels of user behavior. But the psychology also affects the higher levels of rational behavior by providing the analytic units.

The enthusiastic response that Newell received to the talk at *CHI '85*, along with Stu Card's volunteering to share the authoring load, persuaded him to write it up. Their paper is scheduled to appear as a journal article in the 3rd issue this year of *Human-Computer Interaction.*