Commentary on High-Performance Computing and Its Promises for the Behavioral Sciences

LYNNE K. EDWARDS

University of Minnesota, Minneapolis, Minnesota

Even with the advent of magnetic resonance imaging and other sophisticated physiological research, we have not made a great leap forward in creating a physiological map relating each neuron to its activity involved in simple day-to-day psychological processes. In contrast to notable progress in human vision research, we have yet to model the simplest of our daily memory processes in memory research.

The symposium was concluded by Patrick Suppes of Stanford University. Suppes (1997) commented that a research area that awaits further development is that of brain magnetic resonance imaging (MRI), which involves the measurement and visualization of electromagnetic activities in the brain. He pointed out that there is not yet a meaningful correlation made between the underlying psychological processes and specific electromagnetic activities in the brain. He challenged researchers in neural/physiological processes that even with the advent of sophisticated physiological research such as MRI, we have not yet created a physiological map relating each neuron to its specific activity involved in a simple mental arithmetic operation.

In the discussion that followed Suppes's remarks, Samuel Williamson, whose research is focused on MRI (Gençer & Williamson, 1997), offered his hope that from localization of brain function we can at least determine the degrees to which we are processing a cognitive task by memory. He also suggested that pattern recognition may offer a way to discriminate one type of cognitive process from another in real time. However, the participants in the symposium generally agreed that the specificity in terms of a one-to-one mapping of a neuron to its particular activity in a higher order psychological task will not occur in the foreseeable future.

Suppes's comment that it is important to understand the cognitive process at the cognitive level is well taken. A physical or mechanical level alone may not be sufficiently powerful to decipher the psychological process in our brain. Another challenge by Suppes was directed to researchers in psychological modeling. Suppes compared the computational loads involved in the human vision system with those of analyzing turbulence in physics. He

also pointed out that while human vision in naturally rich contexts is now simulated and analyzed, the work on human memory is still limited to an artificial laboratory context. There is a great need for the research on human memory to play catch-up to research on human vision.

This challenge by Suppes that in contrast to notable progress in human vision research we have not yet to model the simplest of our daily memory processes was responded to by Richard Shiffrin, whose research is focused on human memory processes (Shiffrin & Nobel, 1997). Shiffrin commented that an external measurement cannot determine a subject's cognitive process—multiplying 6×9 as opposed to 7×9 . Is there a neuron or localized area for a number, 6, as opposed to 7? Shiffrin believes that though it may take the next two decades for such a refinement, it is not inconceivable to make such progress in memory research. Shiffrin also noted that for high-level mental processes we do not yet have reasonable models, owing to the complexity of such mechanisms and the astronomical number of elements involved at that stage. One thing we need to note is that reasonable models available for low-level vision tend to be extremely specific and localized. At our present stage of memory research, he hopes to generate a dynamical model that predicts, describes, and explains a reasonable proportion of total variability in performance. In the future, high-performance computing for the behavioral sciences will need to include improved speed for the fitting of models to data and the evaluation of the hypothesized models.

REFERENCES

- GENÇER, N. G., & WILLIAMSON, S. J. (1997). Magnetic source images of human brain functions. *Behavior Research Methods, Instruments, & Computers*, 29, 78-83.
- SHIFFRIN, R. M., & NOBEL, P. A. (1997). The art of model development and testing. *Behavior Research Methods, Instruments, & Computers*, 29, 6-14.
- SUPPES, P. (1997). Perception, models, and data: Some comments. *Behavior Research Methods, Instruments, & Computers*, 29, 109-112.

Correspondence should be addressed to L. K. Edwards, Department of Educational Psychology, 323 Burton Hall, 178 Pillsbury Dr. SE, Minneapolis, MN 55455 (e-mail: ledwards@msi.umn.edu).