Improved Reasoning with *Convince Me*

Patricia Schank and Michael Ranney
Mathematics, Science, and Technology Division, Graduate School of Education
University of California, Berkeley, CA 94720
(510) 654-8931
schank@garnet.berkeley.edu, ranney@cogsci.berkeley.edu

**ABSTRACT**

This paper describes *Convince Me*, a tool for generating and analyzing arguments. Results indicate that the system makes people better reasoners while they employ it, and yields transfer to situations unsupported by the software.

**KEYWORDS:** Connectionism, reasoning, instruction.

**INTRODUCTION**

Over the past few years, we've developed a progression of computer-based methods for studying beliefs. Each technique employs the Theory of Explanatory Coherence (TEC), and its connectionist implementation, ECHO [3, 5, 7]. We have found that ECHO usefully predicts people's evaluations of the hypotheses and evidence from their structured arguments [5, 6]. Based on these studies, we developed a TEC-based "reasoner's workbench" computer program—*Convince Me*—and a curriculum for teaching "scientific" reasoning [3, 4]. While other formal systems exist for the analysis and generation of arguments [e.g., 1], it seems that no other that includes a computational, theory-based model that yields predictions about the plausibility of an argument's many propositions. Five hours of training with the *Convince Me* software and curriculum made novices behave more like "scientific reasoning" experts; they more strongly (a) discriminated evidence from hypothesis, (b) doubted statements they rated as more hypothetical, and (c) associated believability with evidence-likeness [5]. While the distinguishing characteristics of data and theory are still vague (even for experts), our system lends sophistication to novices' discriminative criteria. But how much of these gains are due to the software versus the curriculum? Do they transfer to unsupported practice? This study assesses the software's effectiveness by contrasting people's performance under two conditions: doing exercises with *Convince Me* versus on paper, given identical written tests, instructions, and curriculum.

Figure 1 shows a person's argument regarding abortion in *Convince Me*. People can use the program to enter their ideas (bottom right, Figure 1), indicate which ideas explain and contradict which others, rate how strongly they believe each notion, and run an ECHO simulation to see which ones their argument helped to support, reject, or leave neutral—from the simulation's point of view. They can also ask *Convince Me* to report (a) a "model's fit" correlation between their ratings and ECHO's activation.

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**RESULTS**

Our findings replicate the essential results of [5] regarding hypotheses and evidence, and suggest that *Convince Me*’s knowledge-eliciting interface and simulation-driven feedback are critical for subjects' learning.

During the exercises, *Convince Me* users' beliefs were more in accord with the structures of their arguments, as evidenced by belief-activation correlations (p<.05; Figure 2). The software also yielded transfer: Belief-activation correlations for *Convince Me* users (a) did not significantly dip during the post-test, when they did not have access to the software, and (b) were higher than those for both their own pre-test, and the Written Group's post-test (p<.05). In contrast, correlations for the Written subjects rose less during the exercises, and their post-test was nonsignificantly higher than their pre-test performance.
Subjects in both groups made about the same total changes to their arguments, but Convince Me users changed their argument structures twice as often as their ratings \( (p < .05) \). The trend was reversed for the Written Group, who changed their ratings twice as often as their arguments \( (p < .05) \). Users don’t appear to view Convince Me as just a game they try to win by changing their ratings. On the contrary, Convince Me users seem more likely to reflect on and change the fundamental structures of their arguments.

DISCUSSION

Convince Me itself appears to help people coherently structure and revise their arguments, even beyond the enhancements offered by the curriculum. That is, the full system is both an effective “_reasoner’s workbench” and a learning environment that yields transfer to situations unsupported by the software and its attendant feedback. Future work will involve evaluating the utility of Convince Me’s argument listing and diagram representations, modeling human processing limitations [2] in Convince Me, and continued analyses of the nature of scientific reasoning.

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REFERENCES


