

# *the Skeptic*

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# The *Reason!* Project

Tim van Gelder describes the critical thinking program that won him the 2001 Skeptics Eureka Prize



*Dr Tim van Gelder, from the Department of Philosophy at the University of Melbourne is the winner of the 2001 Skeptics Eureka Prize for Critical Thinking.*

In a Dilbert cartoon, a character in a restaurant smugly avows that she would never use a credit card on the internet due to the risk of fraud. Meanwhile she is paying the bill by allowing the waiter to disappear for five minutes with her credit card.

The cartoon nicely illustrates how selective we often are with our caution. Skepticism is a kind of intellectual caution, and we are often only selectively skeptical as well. For example, I once knew a postgraduate student in chemistry who had converted to the Church of the Latter Day Saints. She seemed to leave her critical faculties on the lab bench at the end of each day.

## Teaching critical thinking

An interesting case of selective skepticism is the teaching of critical thinking at universities. Every year, hundreds of PhDs teach critical thinking to thousands of students around the world. The primary rationale for this activity is that it helps students think more critically.

This is certainly the way the subjects are usually “sold” to students.

But there is little evidence that these subjects actually have the intended effect. In fact, the general drift of the available empirical research is that they don't. For example, in one study at the University of Melbourne we pre- and post-tested students in a traditional critical thinking course. The students as a group performed no better at the end than they did at the start.

A colleague tells me that at the University of California Berkeley they once pre-, post- and follow-up tested students in an introductory logic subject. After one semester of training in the rules of reasoning, performance had actually gone down. By the time of the follow-up test, the lost ground had been recovered. Their spin on the results: studying logic had done no permanent damage to students' thinking skills.

We have been doing an exhaustive review of all available studies bearing on the efficacy of instruction in

## The Reason! Project

critical thinking. The studies are a real dog's breakfast. Indeed, the meagre quantity and generally poor quality of research on critical thinking instruction is scandalous.

Still, we can draw some tentative conclusions. Some studies find no gain; some find a slight gain. Overall, it seems clear that the widespread belief that critical thinking instruction improves critical thinking skills is not supported by the available empirical evidence. (That statement may not be the whole truth, but it does have the virtue of being more true than any other claim that short.)

Of course, most teachers of critical thinking do actually believe their courses improve critical thinking. (If they didn't believe this, they'd be frauds. I don't think they are frauds. Just as stuff-ups are generally more likely than conspiracies, in cases like this, self-delusion is more likely than deliberate deception.) They believe this partly because it is the conventional wisdom. They believe it partly also on the basis of their informal observation; they can "see" their students coming to understand the concepts and gradually improving their skills.

As any skeptic knows, however, conventional wisdom and informal observation are unreliable guides to truth. Most teachers of critical thinking are much like physicians prescribing blood-letting based on a combination of orthodox opinion and their selective, biased observations of apparently beneficial effects.

The depressing irony of this situation is that it is teachers of skepticism who are being selectively skeptical. They are failing to apply the principles they teach to their own teaching activities.

Sometimes teachers recognize the problem. Doug Walton is a leading

informal logician based at the University of Winnipeg. After decades of trying to teach introductory logic, he wrote recently that: "I wish I could say that I had a method or technique that has proved successful. But I do not, and from what I can see, espe-



*Reason! project team members (L-R) Yanna Rider, Tim van Gelder, Andy Bulka*

cially by looking at the abundance of textbooks on critical thinking, I don't think anyone else has solved this problem either."

The **Reason!** project at the University of Melbourne has been confronting the problem head-on. The goal is to develop a way of teaching critical thinking that produces substantial and demonstrable gains in critical thinking. Another constraint is that the method must be both affordable and effective for widespread use.

### What is critical thinking?

Critical thinking is a pretty large and vague topic. Within that domain we have been focusing on general skills of informal reasoning and argument. (Informal reasoning is, basically, any reasoning conducted in natural language such as English.) These skills are, if not the whole of critical thinking, at least at the heart of it. Also, they give many people a lot of trouble. In her landmark book *The Skills of Argument*, psychologist Deanna Kuhn reported the results of her intensive interviews with hun-

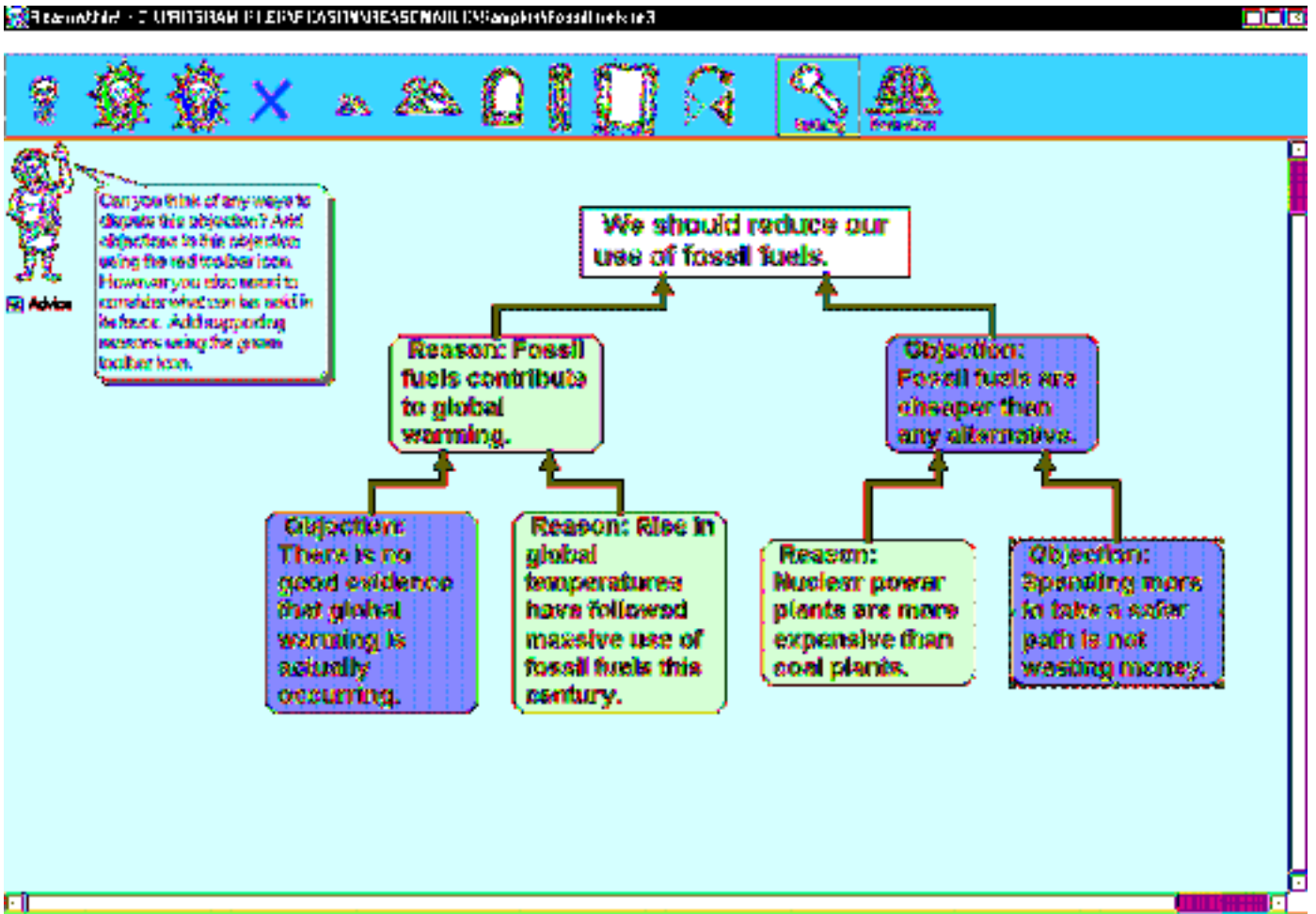
dreds of people from all walks of life. She found that over half of people could not reliably exhibit even the most basic general reasoning capacities. For example, while almost all subjects readily held opinions on questions such as why criminals are often repeat offenders, a majority could not provide any genuine evidence at all for those opinions.

How can we help people improve general reasoning skills? The bottom line from cognitive science is that cognitive skills improve with practice. (No surprise there.) We also know that to be effective, practice should have certain properties. It should be motivated,

scaffolded, guided, graduated in difficulty, and there should be feedback. And to be really effective, there should be lots of it.

Unfortunately, nobody had ever really systematically investigated whether this general result applies to informal reasoning and argument specifically. Some evidence actually points the other way. One thing we know is that lots of practice on formal reasoning problems (mathematics, chess, formal logic) does not help much with general reasoning. The benefits of formal training don't seem to carry across to different contexts and domains. A chess grandmaster might be a very average lawyer.

Pessimists conclude that there is no such thing as general reasoning or critical thinking skills. All you can do is practice and improve your thinking within some particular domain – say, shopkeeping, or quantum mechanics. The pessimists are not surprised that critical thinking courses make so little difference: the courses are trying to teach skills that never really exist.



Reason!Able 1.03 screenshot

If the pessimists are right, we're in serious trouble. The world would be a much better place if only there was more critical thinking. They are saying, in effect, that we should give up on that dream, since general critical thinking skills are a myth.

My hunch is that they're wrong. Some people clearly do have strong general reasoning skills. Tests of critical thinking are designed to test such skills. People perform differently on such tests, depending on their skill levels. The real question is whether such skills can be learned – or whether they only ever emerge the way a butterfly emerges from a caterpillar.

Our conjecture is that general reasoning and argument skills can be learned, and that practice is the key. However it has to be practice of the right sort. It has to have the generic features listed above. But the practice must also focus on the right ac-

tivities. Formal training is not going to do it because of the transfer problem. To improve general informal reasoning, people have to practice general skills in lots of different domains. To get transferable skills, they have to practice transfer.

#### The quality practice hypothesis

We call this idea the quality practice hypothesis. The QPH guides our whole approach to improving critical thinking. The **Reason!** method, as we call it, is simultaneously an implementation and a test of the hypothesis. If we can design a learning method based on quality practice, and students really do start improving, we can be more confident that the QPH is true.

Unfortunately implementing the QPH is not easy. The central difficulty is that quality practice seems to require an expert coach to provide motivation, guidance, and feedback

on reasoning exercises in a wide variety of domains. Coaches like that don't come cheaply. In reality, the best we can expect is a single teacher - who may not be an expert - for every 20-30 students. That just isn't enough.

Our approach has been to develop software to help the student engage in quality practice, and to help the teacher help the student. We're using software to try to bridge the gap between the amount of coaching needed and the amount that is available. Computers can't provide everything, but they can provide a certain amount of scaffolding, guidance and feedback.

#### Argument maps

Over the past three years or so, we have developed a package called **Reason!Able** (slogan: Enabling Better Reasoning!). **Reason!Able** is a kind of practice environment for

reasoning on any topic. It provides a framework within which students are guided through the complex processes involved in articulating and then evaluating arguments.

One of the central innovations in **Reason!Able** is that all practice is based around argument maps. An argument map is basically a boxes-and-arrows diagram of reasoning. The claims making up the argument go in boxes, and the arrows indicate the logical structure of the argument.

Argument maps have various advantages over more traditional prose formats, due primarily to the fact that they can call upon a wider range of resources in order to help the user understand the reasoning. While prose is basically limited to monochrome text in linear order, argument maps can use shape, line, colour and position to convey information. The visual display spares the user much of the cognitive burden involved in interpreting the text to figure out what the reasoning is.

In **Reason!Able**, argument maps are not just static visual representations. Users themselves construct the argument maps by adding claims, reasons, and objections, and moving them around as necessary in order to clarify the reasoning. Arguments thus become concrete, manipulable structures rather than abstract objects which must be held in the mind.

### The Reason! method

In the **Reason!** method, students use the **Reason!Able** software to do intensive practice over a long period on a wide range of problems. The problems gradually increase in difficulty as the students build both their skills and their grasp of the relevant concepts.

Does the **Reason!** method work? Every time we teach critical thinking at the University of Melbourne, we evaluate the students' improvement using pre- and post-testing. The results are now indicating strong gains in general critical thinking skills.

In the most recent study, we pre- and post-tested the students with

two different tests. One was the widely-used California Critical Thinking Skills Test, which is probably the best objective (multi-choice) test of critical thinking available. The other was a home-grown written test, in which students were asked to critically evaluate the reasoning in a short text. All student answers were graded "blindly" by two experts who were quite independent of our team.

The results on both tests were about the same, with the students as a group showing almost a standard deviation improvement. This is about four times the gain found in typical critical thinking subjects, and almost twice the expected gain across three years of undergraduate education, as found in other studies. If this was IQ, we'd be talking about an average 15 point gain across the group.

These gains are, to our knowledge, much the strongest ever recorded for a comparable period or activity. Or, put another way, we think we've set a world record. Moreover we suspect this is just the beginning. The results are steadily improving as we learn from experience and refine the **Reason!** method, the software, and the associated learning materials. We're expecting even strong gains in this year's study.

### Encouraging results

The results to date certainly suggest that the QPH is correct, but it is too early to draw any firm conclusions. We still don't really know whether the gains are due to all the quality practice, or using the diagrams in the **Reason!Able** software, or something else entirely. We are conducting research intended to answer questions like these. For example, in the current study we are recording all student activity with the software, and looking at the correlations, if any, between quantity of practice and degree of improvement. A stronger correlation would be better evidence (though it would not conclusively prove) that improvement really is caused by quality practice.

Meanwhile, the challenge is to take the **Reason!** method out of its original environment and make it

available in a way that is useful and affordable to teachers in schools and universities. As a first step we have released the **Reason!Able** software, which has been picked up by dozens of educational institutions ranging from primary schools to the Australian Defence College. Although it is early days yet, many schools are introducing the software across the curriculum and across many year levels. The very broad relevance of the software is due to the fact that it helps with general reasoning and argument skills, and these are basically the same in most domains and at most levels.

We are following up with materials intended to help teachers introduce **Reason!**-type techniques into their classrooms, including tutorials, exercises, and lesson plans. This is a slow process, requiring lots of help from teachers themselves, as well as field-testing and refinement. Eventually we will also need to design and implement studies of the **Reason!** approach in the schools, to find out if it is really having the desired effect.

The **Reason!** project began as an idea to develop a piece of software to assist a more-or-less traditional university-level course in critical thinking. It has grown into a major effort to change the way reasoning skills are taught throughout the educational system, and even transform the way we represent and communicate arguments. It will be finished on the day when undergraduates arrive at the University of Melbourne and don't need training in critical thinking because they are already masters of the art.

Somehow, I think that's going to take quite a while.

### Further information:

The Reason! Project: <http://www.philosophy.unimelb.edu.au/reason/>  
Reason!Able: <http://www.goreason.com>

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