



## Synopsis

**Slate** is a multi-faceted computational agent capable of assisting intelligence analysts with hypothesis tracking and generation, and other aspects of IA: making predictions, writing reports and recommendations, parsing and understanding not just textual/symbolic data but also *visual* data, creating possible future scenarios. It is a system that has been sponsored by ARDA, and to a degree by DARPA.

## Key Development Strategy

Research in psychology of human reasoning continues to drive the engineering of Slate. We believe that advances in human and machine reasoning will be generated by studying human reasoners, including analysts.

We seek to combine the knowledge and techniques of cognitive science and logic-based AI, with an advanced graphical user interface, to optimize the intelligence analyst computing environment. Real-world reasoners work in a heterogeneous fashion: they reason over diagrammatic as well as symbolic knowledge. Hence, we directly tackle the problem of bringing visual scenes directly into a logical system. Slate can then reason over this system.

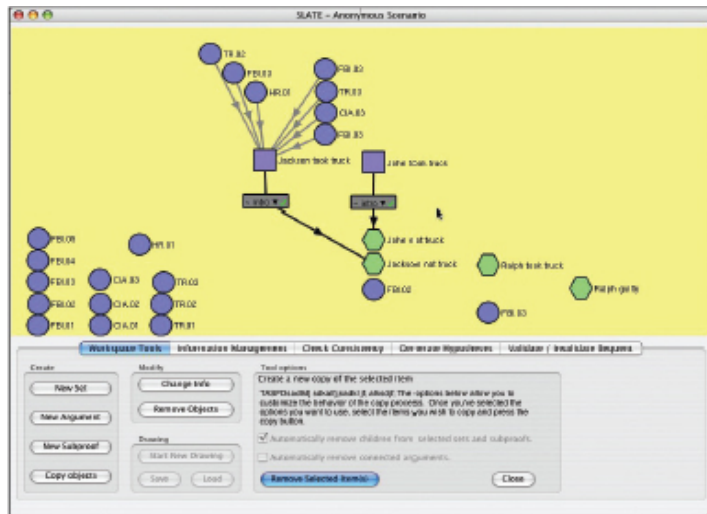


FIGURE 1: Screenshot of Slate being used to crack the “Philly Bomb” Case Study

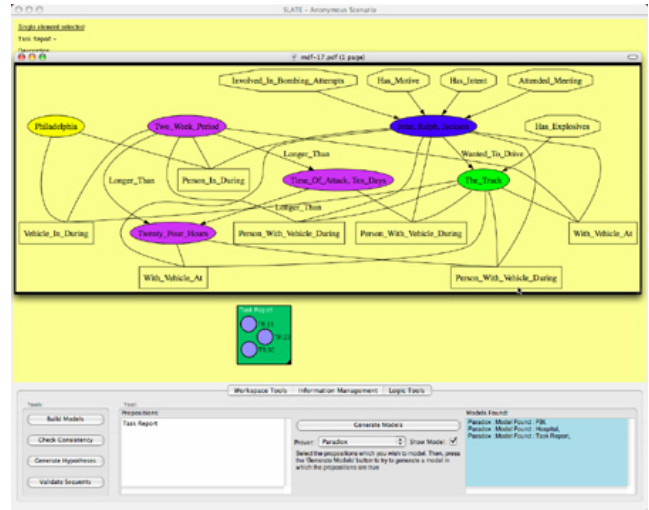


FIGURE 2: Example of Model Generation - New Order Digraph

## Unique Features

- Straightforward incorporation of diagrammatic as well as textual input.
- Methods and an interface that supports rendering arguments, proofs, scenarios, counterexamples, etc. in visual form.
- Seamless integration with model builders to present users with potential future scenarios in visual form.
- Powered by new forms of visual reasoning that exceed standard linguistic/textual reasoning in standard logics (like first-order logic).
- Seamless integration with all the fastest standard provers in the world today (e.g., Vampire, Otter, Oscar, etc.), and with the best model finder as well.
- Integrates probabilistic-based approaches with logic-based approaches. See Figure 7.
- Automatic generation of the first drafts of English reports, to then be polished by the human user. See Figure 3.
- Extensive built-in libraries of case studies and problems.
- Support for all established forms of reasoning: deduction, induction, abduction (particularly the Wigmorean variety), model-based, existential, probabilistic – all of these available in a visual form.
- New, effective forms of hypothesis generation.
- CL/IKL-compatible for interoperability with existing and future databases, knowledge bases, and other IA tools and technologies.
- Uses many-sorted logic (MSL) as its underlying representation for information. MSL is an extension of classical first order logic (FOL) which, in many cases, makes expressing facts about the world much easier.
- Seamlessly integrated with Kostas Arkoudas’ *Athena* (an interactive theorem proving system) and NDL.

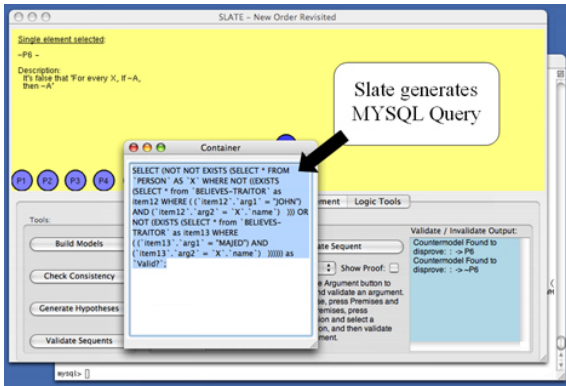


FIGURE 3: Hypothesis generation and confirmation/disconfirmation over relational databases (SQL)

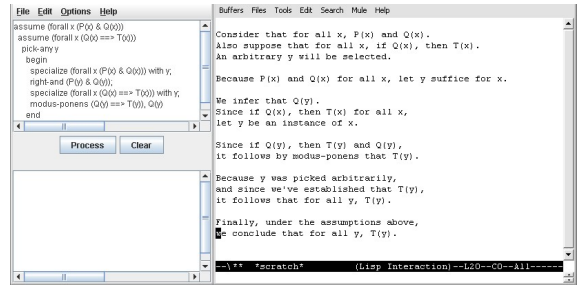


FIGURE 5: Conversion from proof format (in NDL) to English

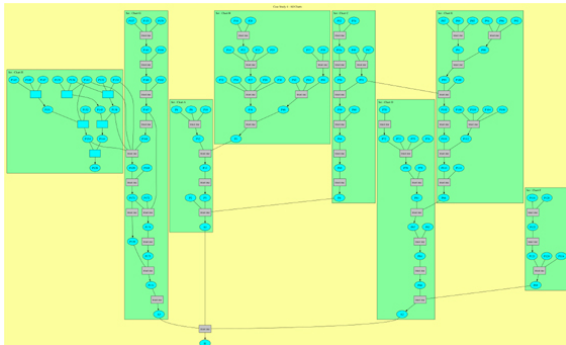


FIGURE 4: Roundtrip interoperability for all of Hughes' Case Study 4

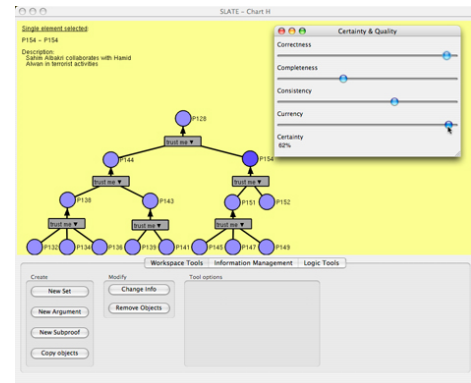
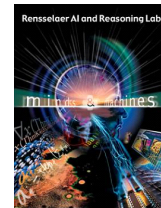


FIGURE 6: Integrating probabilistic schemes with traditional true/false/unknown schemes

## Other Domains

Slate is an intelligent assistant for reasoners in *any* domain (e.g., mathematics). Therefore students of IA can also be trained on Slate. In fact, students in introductory logic courses at RPI are currently using Slate in Fall 2005.



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For more details on these projects and others in the RAIR Lab visit:

RAIR Lab: <http://www.cogsci.rpi.edu/research/rair>



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