ISSA Proceedings 2002 – Developing The Art Of Argumentation. A Software Approach

What is reasoning and argumentation?
Reasoning and argumentation are closely related. Reasoning is a cognitive activity, argumentation is reasoning, exercised in a social context.
Reasoning is a process or activity in which an actor constructs, analyses or evaluates inferences. Argumentation is a kind of reasoning, conducted in a social setting where the actors recognize that they are partaking in a social activity. The following definition is useful for our purposes:
Argumentation is a verbal and social activity of reason aimed at increasing (or decreasing) the acceptability of a controversial standpoint for the listener or reader, by putting forward a constellation of propositions intended to justify (or refute) the standpoint before a rational judge. (Eemeren et al., 1996, 5)

Teaching reasoning with uncertain effects
Reasoning and argumentation are pervasive in a modern complex society. Quality of reasoning is not. Several features indicate the deplorable state of reason.
There are strong indications that natural reasoning capacities of men are flawed. A number of embarrassing fallacies are performed by a large majority of subjects. (Nisbett & Ross 1980, Kahneman, Slovic & Tversky 1982, Dawes 1988) The early findings about the fallacies from the 1980's have been questioned from an evolutionary standpoint. If men were as bad in reasoning as the findings suggested, it is hard to explain the evolutionary success of mankind. Furthermore, if some of the early experiments were reframed, correct reasoning was forthcoming. (Gigerenzer 1991, Gigerenzer & Hug 1992, Cosmides & Tooby 1992). Not all fallacies are explained away, however. Considerable doubts about the natural reasoning capacities therefore remain. (Samuels, Stitch & Tremoulet 1999).
Furthermore, there is a large, consistent set of results showing faulty reasoning

at everyday professional tasks. Since the 1950's the accuracy of clinical judgement has been compared to diagnostic judgement or prediction, based on a statistical formula. The outcome of these investigations is that in several domains, well educated and experienced professional judgement perform no better than intelligent and inexperienced subjects, employing no domain knowledge beyond a statistical formula. (Meehl 1954, Brehmer 1980, Dawes 1994)
However, another finding of Deanna Kuhn is that education matters and has a general impact on reasoning. Reasoning skills transferred between domains and college educated were consistently better than non-college educated subjects. Her studies indicate that college education is related to a kind of reflective metaskills or a kind of thinking about one's own knowledge.

Reasoning skills are an outcome of college education. At present, however, it is unclear whether, and to what extent, reasoning skills are improved through courses particularly designed for that purpose, e.g. courses in logic or in critical thinking. After reviewing evidence of effects of courses in critical thinking (CT), Tim van Gelder concludes:
Currently it is difficult to make a convincing case …that CT courses are of any substantial benefit. On one hand there are various studies indicating no significant benefit from CT instruction. On the other, there are some studies which do appear to find some benefit. … The belief, common among CT teachers, that CT courses are better for improving CT than formal logic courses does not appear to be supported by the available evidence, such as it is…. An important question, which is left unresolved by these studies, is whether CT courses harm their students. It appears possible that typical CT courses actually reduce CT performance. (van Gelder 2000b)

College education has a general effect on reasoning skills, but it is an open matter whether courses particularly designed for the furthering of such skills have the intended effect or even the opposite effect. Whether courses in formal logic has any effect is similarly an open matter.
We know little about the effects of traditional methods for teaching reasoning or critical thinking over and above the general effects that college has. We might surmise that effects of such teaching are weak or non-existent. Had there been strong effects, they probably would have been discovered.
But perhaps there are non-traditional methods for teaching reasoning, using modern informational technology? Such methods typically rely on argument

diagrams.

Software Packages Supporting Reasoning

The practice and teaching of reasoning and argumentation lend themselves to diagrams. A large number of textbooks present arguments in the form of boxes and arrows. We would expect this from the nature of reasoning and the restrictions on non-diagrammatic modes of presenting reasoning.

There are several software packages supporting reasoning via graphs with nodes and connections. The software packages are directed at different user groups. At the low end, one finds Belvedere. The program has been produced in Pittsburgh and Hawaii. It is directed at secondary education students. It is mainly an aid for drawing diagrams that illustrate logical connections and nodes for facts, hypotheses or assertions.

In the middle of the user spectrum, one finds Reason!Able and Athena. Reason!Able was produced at the University of Melbourne, Athena in Sweden. Both are directed at tertiary education, ranging from first year to postgraduate students or for elementary use by professionals.

Directed to the high-end of the user spectrum is the program Genie, produced at Carnegie-Mellon University, Pittsburgh. Genie enables the user to draw influence diagrams and calculate conditional probabilities and expected utilities on the basis of probabilities and utilities, entered by an expert user.

The three levels of software differ with respect to how much of calculation they employ. At a low level, Belvedere contains no calculations. Reason!Able and Athena, at a middle level, contain some assignments of numbers and, in Athena, some capacities for helping the user to use certain rules-of thumb for filtering away his worst arguments. Genie, finally, contains advanced theory-based capacities for calculations, based on expected utility and Bayesian probabilities.

Reason!Able and Athena. Software and Educational Assumptions

Reason!Able and Athena have been developed independently of one another. The Reason project at the University of Melbourne was started in 1997 and the first version of the program was deployed in 1998 in philosophy classes. The project behind Athena was conceived in 1998 through a collaboration between Blekinge Institute of Technology and Lund Institute of Technology. The ancestor of the present software was used in 1999 as a basis for teaching argumentation to students in professional education. Below, we compare the two programs with respect to cognitive assumptions.

Athena and Reason!Able are similar with respect to user interface and facilities. These similarities probably depend on the need to teach hierarchical structure of reasoning, an approach inherent in the teaching tradition. Furthermore, the limited space of the computer screen forces a design enabling focus and zooming.
The two software packages agree in emphasizing that reasoning should be taught as a practice rather than the application of logical theory. The cognitive skills of reasoning are multidimensional, involving features beyond application of logical structure.

Reason!Able is more focused on analysis of arguments where Athena is neutral between analysis and production of argument. Reason!Able has more structure on the analysis side whereas Athena has more facilities for creating output.
The two programs and the related educational packages also make assumptions about teaching and its institutional context. There are respects where our approaches differ. Reason!Able is an offspring from philosophy oriented towards cognitive science, Athena has a background in philosophy of social sciences and theories of practical knowledge.
Other differences concern project tactics. Reason!Able has been thoroughly tested for educational outcome. The results show clear progress in critical abilities among students. Athena has been thoroughly developed through an iterative process where tests of software concerned usability related to software improvement.
It is an open matter how much of similarities and differences stem from principles and how much from pragmatics. All projects will involve a mix of guiding principles and pragmatic decisions taken in the face of unforeseen opportunities. With these reservations, the following comparison can be made.

Reason!Able is knit to an educational context of critical thinking, taught directly by experts on critical thinking. Athena has been developed in a context of argumentation for professionals.
The Athena approach and the Reason!Able approach seek a middle ground between an extreme mentalism and an extreme situatedness. There might be a difference in degree long this dimension. Reason!Able assumes that analysis of reasoning is to be taught independently of the social contexts where reasoning is used. Athena has been developed as direct support for tasks related to educational role-play. The Athena approach is equally focused on social games for educational purpose where the software plays an important part in preparation.

Research about the acquisition of reasoning skills is yet inconclusive. It would premature to conclude that the one approach is more promising than the other. But even an inconclusive comparison can sharpen our concept for planning, designing and conducting development of software and education in argumentation.

A comparison of software capacities
Both programs Reason!Able and Athena are directed at users in higher education or in professions. Both have been widely tested in teaching. Below we can see screen shots of the two programs and a table of comparison.

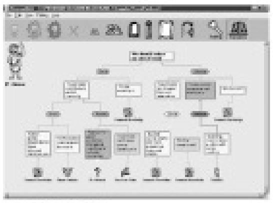
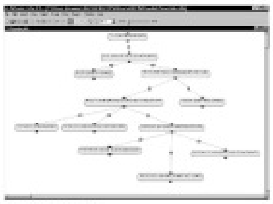

Fig 1 – Reason!Able interface
Fig 2 – Athena interface

The logical properties of the two programs are rather similar. Both programs enable the user to represent a hierarchic breakdown of arguments. "Acceptability" (in Athena) and "probable truth" (in Reason!Able) are direct counterparts and so are "relevance" (in Athena) and the "strength of reasons and objections" (in Reason!Able). Neither of the programs calculates any value of the conclusions but users will have to judge for themselves the added effects of subordinate premises to superior conclusions.

The primacy of reasoning practice. A dilemma of rigour and relevance
Athena and Reason!Able software and instructions provide techniques for reasoning. What are the implications of such software approaches to the issue as to whether reasoning is an art or a science?
The art-science dilemma is common in higher education, sometimes expressed as a dilemma between rigour and relevance (Schön 1991). From the theoretical perspective, it might be tempting to teach formal methods and models, derived from hard-core science, for practitioners to use. But the practice of reasoning does not seem to benefit.

Figure 3 Comparison of Reason!Able and Athena.

Reason!Able	**Athena**
Graphic tree structure. Cut, paste, drag&drop. Can fold up the structure. Zoom.	Graphic tree structure. Cut, paste, drag&drop. Can fold up the structure. Zoom.
No counterpart.	Can open several windows and compare arguments. Can construct larger arguments by copying parts between windows.
Evaluation separated into "Evaluate claim" and "Evaluate reason". Values are assigned via a temperature scale.	Evaluation separated into "Acceptability" and "Relevance". Values are assigned via a temperature scale.
The user him/herself must stepwise perform the calculation of superior levels from subordinate levels.	The user him/herself must stepwise perform the calculation of superior levels from subordinate levels.
Strictly hierarchic breakdown. Every subordinate node has only one superior node. Circularity is excluded.	Mildly hierarchic breakdown. Each subordinate node may have several superior nodes. Circularity is excluded.
No counterpart.	Can filter out "weak branches of argumentation" where Accept * Relevance < x.
Enables the user to classify grounds for belief	No counterpart
Contains advisor and extensive help files.	Contains a brief tutorial.
Only short text input. Prints of tree graphs.	Extensive text input and storage. Various tree graphs and tables can be produced in a report generator and then printed.
Installed program.	Installed program or run from CD.

Fig 3 Comparison of Reason!Able and Athena

Among teachers of scientific reasoning, there is scepticism about effects of formal logic proper. For instance, in his fourth edition of *Understanding Scientific Reasoning*, Ronald Giere abandons his previous teaching approach modelled on deductive logic. His former method of using formal schemata seemed both mechanical and an extra burden in trying to reconstruct the point of the method of reasoning. Nor was his specialist colleagues satisfied with the pedagogical simplifications. (Giere 1997, vii) Nor is there yet any systematic evidence of improvement on performance in reasoning through courses in formal logic. (van Gelder 2000b)

Furthermore, consider, for instance, reasoning in mathematics. Even if we grant that the ultimate court of appeal in deductive reasoning is formal logic, deductive reasoning in mathematics had existed for more than two millennia before Frege invented predicate logic. Today, the mathematical practice of deduction is carried on without appeal to propositional or predicate logic. In fact, not even mathematical logic – mathematical studies of the properties of logical systems – tends to employ formalized predicate logic.

The other strand of the dilemma involves starting from practice, or more exactly, not practice as it is but as it should be. Here, one finds proponents of informal logic. Not all reasoning is independent of domain, some of them claim. Hence, such reasoning is not formal. Steven Toulmin has pleaded this position with considerable influence since the 1950s (Toulmin 1988). He has proposed alternative ways of structuring arguments, described in a vocabulary reminiscent

of formal logic.
While formal logic involves an account of how structure contributes to the success of reasoning, no such account is given in Toulmin's approach. Where formal logic and mathematics can be used to evaluate arguments, they also explain why the truth of the premises in a valid argument wanders over into the conclusion. No such account can be given in Toulmin's theory and evaluations or recommendations drawn from it are not based on a theory of truth-conduciveness. So an approach to reasoning without backing from logical theory faces problems of unification and justification. How can normative practice be justified without any theory justifying it? From the theoretician's perspective, it may seem that the practitioner's knowledge and precepts consists of a bag of tricks of the trade, based on no more unifying theoretical insight than a cookery book. This has been a long-standing objection to the study of logical fallacies of reasoning (Woods & Walton 1989).
There is a corresponding dilemma in the construction of software related to reasoning. This distinction roughly overlaps another distinction. In van Gelder's fortunate phrasing we can speak of one type of program as *intelligence possessing*. (van Gelder, 1998, 22) Such programs include the logical machinery for constructing proofs, drawing inferences or for making calculations. For instance, the programs construct natural deduction proofs or truth tables. Or, like Genie, they calculate conditional probabilities or expected utilities.

Another type of programs like Athena and Reason!Able have features van Gelder calls *intelligence enhancing.* The ideas of this kind of program is to provide a cognitive "lever" as an aid for the user's own intelligence. Such software, or more correctly software and educational modules, contain principles that generally are not justifiable from logical theory.
The dilemma of rigour and relevance when it comes to teaching reasoning amounts to this. Either we settle for logical theory that gives us necessary and sufficient conditions for good logical arguments. In such arguments, truth is transmitted from premises to conclusion. If we take this horn of the dilemma, we land with an abstract theory which bears little relation to reasoning skills in a general public. Or we settle for the relevance horn of the dilemma, aiming for methods that directly improve reasoning skills. But we have no strict definition of wherein good reasoning consists. But then it seems that we do not know what "improvement" of reasoning means. If we admit to this, how can we improve reasoning if we do not what improvement consists in?

Practice. Beyond the dilemma of rigour and relevance
An approach to reasoning that is not backed by logical theory or formal logic can be defended on several grounds.

The first line of defence is to say that even if we do not have a complete set of sufficient and necessary conditions for good reasoning, we can state some of the necessary conditions. Almost all writers on reasoning, whether formal logic or informal reasoning distinguish between a quality of the premises such as truth, probability, acceptability and a relation between premises and conclusion that might be called validity, entailment or (positive) relevance. Each of these demands is a necessary condition for an argument to be "demonstrative", i.e. that the conclusion is demonstrated by the premises and their relations to the conclusion.
In deductive (non-monotonic) logic, these two conditions are together sufficient conditions for having a demonstration of the conclusion. Nothing beyond the argument, i.e. properties of premises and their interrelations and relations to the conclusion is needed to settle whether the conclusion is acceptable. In non-deductive non-formalized reasoning, it is not so. Unknown premises can, when they are presented, topple an argument. The soap operas involving legal confrontations provide examples where the defence towards the end of the trial presents an ignored fact that reshuffles all probabilities laboriously constructed by the prosecution.

Necessary conditions can be drawn from probability theory or from evidential practice within sciences, humanities or professional practice. If the conclusion C is to be acceptable on the evidence of A and B, this presumes that there is no additional premise, D, such that D is highly probable and A, B and D imply non-C. If the police makes a biased selection of witnesses, hearing only those who think J. Doe committed the murder, they can construct an argument that seems to demonstrate that Doe did it. In our checklist whether we have a good non-deductive argument showing beyond all Reason!Able doubt that C is the case, we will therefore have to add that there is no probable extra premise beyond the presented argument that would make us conclude otherwise.
Another type of necessary conditions can be drawn from semantic assumptions of formal logic. Formal logic assumes that one symbol carries one interpretation. For instance "If A then A" would not be true if the two occurrences of "A" express different propositions. Non-formalized, non-deductive reasoning will have to make

a similar assumption.

To sum up the gist of this defence, software and education supporting reasoning does not have a strong unified theory giving sufficient and necessary conditions for having a good argument from which we are entitled to infer that C is the case. But there can be a collection of necessary conditions, justifying software and education. Such principles are drawn from a heterogeneous collection, each of them capable of justification. In this case, arguments get improved by removing a mixed bag of errors of reasoning rather than constructing a demonstrative argument.

The other kind of defence focuses on cognitive processes rather than results. It focuses on facilitating processes of reasoning rather than the resulting argument structure. For instance, there can be general principles for deductive reasoning processes, that are useful in many cases but which are not in themselves formal or deductive. An example is the heuristics of George Polya (1954, 1971) suggesting many general techniques for constructing proofs in mathematics. These techniques are generalizations of good mathematical practice drawn from those fields Polya knew. Such techniques are an aid to user success but they do not define or exhaustively explain wherein success lies. In this they contrast with logical model theory that defines validity of deductive reasoning and thus can provide insight into essential properties of valid reasoning.

Similarly, it might be possible to present very general principles giving heuristic guidance for the construction or reconstruction of arguments or trains of reasoning.

Principles of the kind presented above do not seem to be domain-dependent. They are necessary conditions on all reasoning of a certain logical *type*. For instance, restrictions against amphibolies have nothing to do with what we are reasoning about. Heuristics for conducting the reasoning processes is, presumably, independent of domain in another sense. The basis for heuristics is to facilitate cognitive processes. These processes rely on principles of cognition rather than principles pertaining to the domain.

Let us draw attention to some such principles, common to Athena and Reason!Able.

Some principles for software support of reasoning and argumentation

Any software package will contain features that are useful in teaching reasoning and argumentation.

A first feature is the externalisation of mental processes. A well known principle for design of cognitive artefacts is that inner mental processes are less robust than external representations and manipulations on such representations. (Hutchins 1995, Norman 1999) Software supporting argumentation normally represent arguments as a kind of tree graphs containing nodes and connections between these nodes. To construct and overview complex arguments is quite simple.

A second feature is recursiveness enabling analysis and synthesis. A complex argument can be seen as a tree graph constructed from a set of elements or nodes, N1, N2....Nk. Each of these elements can in turn be analysed into nodes N11, N12, N13...N1p. Properties are assigned to the final or “lowest” nodes. The relevant properties of higher nodes are functions of the properties of the lower nodes. When it comes to argumentation, nodes are seen as statements, claims, or propositions and are assigned properties of truth, likelihood or acceptability. Subordinate nodes have connections to superior nodes, called “relevance” that indicates, roughly, how much of the subordinate acceptability goes to increase the acceptability of the superior node. In a deductively valid argument, 100% of the subordinate acceptability goes to support the superior statement.

A third feature of software use in education is that it enables a focus on processes. The graphical user interface is standardized and easily understood. All students will use the same work space as the teacher. By saving and retrieving their work, a group of students can plan and coordinate larger tasks. It becomes possible to distribute tasks between members of student groups, if subtasks take the form of subtrees. Communication between members in student work groups becomes easy. In a computer lab, teachers or coaches can follow student’s work processes. Demonstrations on-screen are easy. Lectures and student’s homework can present graphs and discuss them in public. The teacher will find it easier to become aware of shortcuts and minor tricks of his own and it will be easy to demonstrate them to students. All in all, teaching processes and learning processes become transparent and therefore design of them, planning, implementation and feedback to students becomes easier.

A fourth feature is facilitation of simple routine tasks. By copying and pasting, linear texts can be store in the program and labelled. Much typing is eliminated. The program can (or should) generate various forms of reports from information fed into the program. These reports combine linear texts with graphs. The worst arguments can be filtered away or hidden (in Athena) and so eliminated from reports to a user.

A fifth feature is that software facilitates an experimenting stance in analysing texts. It is possible to retrieve previous results, either by using saving them and opening them or by using the undo-command. It is easy to construct a preliminary structure of an argument, modify it to test one's reading and go back to the original reading. Tentative structures can be compared by opening several windows simultaneously.

Many of these features are common to all Windows programs or they can be developed with little programming.

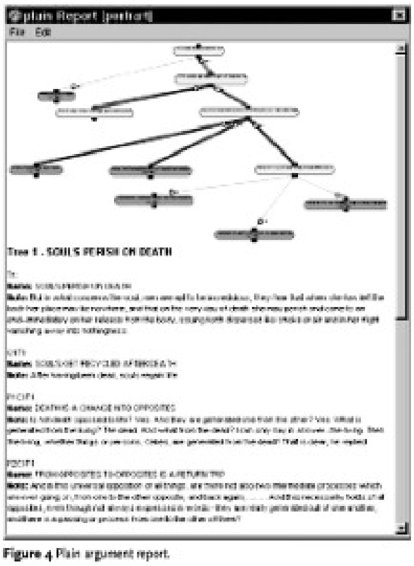

Fig 4 – Plain argument report.

Athena versus Reason!Able. The software packages compared

A difference between the two approaches involves relations of analysis and synthesis. The two programs are answers to different questions. Reason!Able emphasizes analysis of arguments whereas Athena is neutral between synthesis and analysis.

Reason!Able is a solution to the problem of making students construct arguments and classify the bases of the premises. It contains large help sections instructing users in how to construct arguments. There is an advisor telling the user what to do. Premises are classified according to the evidence on which they rely. There is a PowerPoint demonstration, going through the stages of argument construction. A typical use of the program would be in a course teaching how to structure and evaluate the arguments that have been presented on a topic.

Reason!Able is an aid to teaching argument analysis or critical thinking. The

motivation assumes that the very construction of hierarchies and the classification of their parts is a learning problem for students.
The outcome of an analysis using Reason!Able is a diagram. The program is of little help when the diagram is finished. There is no indication what the diagram is for, other than a piece of communication from the student to the teacher.
Athena has no classification of premises, advisor or step by step tutorial. The process of analysing an argument has in other respects the same support from both programs.
When it comes to production of arguments, Athena has two features that are especially useful. One of them is a distinction between the argument content and a label or name for that content. The diagram shows only the labels, like the headlines of a newspaper. By double-clicking on a node, you can see and edit the content. In this way, each argument file can contain huge amounts of texts. This enables a user to copy argumentative texts from the Internet or from an e-text, to store those texts and build arguments from them. This, in turn, enables a teacher to distribute tasks in the form of digitally stored texts and to have students perform textual analysis with immediate teacher feedback in the computer lab.
Athena also contains a report generator, suitable for the presentation of diagrams and texts, as can be seen below.

These reports can be used to present an argument of a given text, for instance the cyclical argument for the immortality of the soul from Plato's *Phaedo*, available on the Internet. Or it can be used to synthesize the student's own arguments for a thesis. From the report generator, the texts can be printed or transferred to a word processor.

We conclude that Reason!Able is directed to the analysis of arguments while Athena is neutral between analysis and synthesis.

Basic assumptions about software use in education
Of the two approaches, that of Athena and of Reason!Able, Reason!Able has more features of a direct approach to teaching reasoning. By this I mean that the objectives of the course is settled as a course in critical thinking, taught as such by a specialist teacher, devoted to such courses.
Reason!Able has been developed as an improvement of traditional methods for teaching critical thinking. The objectives and the curriculum are those of critical thinking. Reason!Able has been designed with the intention to be an instrument in the hands of a teacher in critical thinking. Reason!Able contains an advisor,

intended as a complement or substitute of a human teacher.
Reason!Able makes stronger assumptions about a suitable progression of student work or student learning. It starts with the injunction:
“Enter the conclusion of the main argument here”

When the user starts typing, the argument expert gives the advice to type a sentence. Then the expert supplies cues about what characterizes the main thesis, e.g. user position on the issue. The reader can see more of the various uses of Reason!Able on the site referred to below.
The properties of Athena are more oriented towards software support for educational games and educational tasks related to a simulated setting outside the course module. Athena has been developed for use in various social settings for the educational games:
1. Expert duelling game. The students are given the assignment of delving into in a controversial topic they know little about, such as, “Allowing euthanasia” or “Allowing gene modified organisms”. The subject matter is sensitive and the ability to take a Reason!Able position is based on expert knowledge. After 60 hours of work, the groups of students appear as members of an expert panel in a public debate and speak for or against the topic. They are to successfully attack their opponents’ moral points of view and defend their own. The next day they trade places.
2. The seminar game is based on distributed literature, such as a chapter or a book, or on the students’ own reports. The opponents and respondents prepare their arguments and a handout with the main arguments, clarifications and pro/cons.
3. The organisational game is a simulation in which a manufacturing company has received a complicated offer from a possible customer. Should they accept or reject it? Two student groups write memorandums, one for and the other against, and present oral arguments before the company’s executive management team. It is important that the arguments are economically sound. In preparation, the students are forced in their group efforts to work out the key concepts in the course literature.

Both Reason!Able and Athena assume that the software is used for certain tasks. Reason!Able has, it seems, been used both for specific learning tasks and more realistic tasks, reminding of real life situations. Athena has only been used for realistic tasks.

Reason!Able is committed to a multitude of varying tasks in order to facilitate transfer from learning situations to real world use. Athena has more emphasized a few large, comprehensive tasks, embedded in a realistic social setting. Both these approaches can be supported by research about skills acquisition. (Voss et al. 1995)
The integration of tasks with software design draws support from a study of another software package for argument support (Belvedere). The study indicates that student learning depends on the social task and interaction rather than on software alone or teacher influence:
.. structuring interaction at the interface does not necessarily provoke argumentation. The initiation of argument rather seems to be related to task characteristics such as the use of competitive task design (Veerman 2000).

.. task characteristics and interface affordances interact and determine to a greater extent the constructiveness of a discussion than a tutor or moderator. While a 'reflective tutor', who checks information on strength and relevance, had some relationship to the production of constructive activities in the Netmeeting task, the Belvédère interface might have taken over this role. (Veerman, Andriessen & Kanselaar 1999)

The task-dependency of learning outcome forces the designer to place priorities on analysis or on production of arguments. If analysis is the main task, certain properties of software will come to the foreground, if production of arguments is the main task, other properties will be more important in design of course and of software.

Strong mentalism and strong situatedness. Ideas of social skills education
Athena and Reason!Able both take a position intermediate between strong mentalism and strong situatedness. Under the label "strong mentalism", we would count teaching assuming pure understanding among students, irrespective of social roles or social tasks. Communication takes place mainly between student and teacher. The aim of this communication is to send instructions, regulate cognitive feedback and evaluate student progress. The teacher teaches or coaches, the student tests his understanding by asking or suggesting solutions to tasks. Tasks are given to student in order to develop or test his cognitive structure. These tasks are corrected as informative feedback to students or evaluated as a basis for grading.
Under the label "strong situatedness", we would count educational settings that

emphasize apprenticeships, imitations and social relations among performers. Cognition is assumed to be inseparable from the social setting and the situations where it is exercised. Very little of the knowledge acquired is assumed to transfer to other social settings. Therefore, education or training is highly role-specific.
Both Reason! Able and Athena seek out a middle ground between these extremes. Tim van Gelder explicitly refers to these extremes and opt for a position in between. (van Gelder 2000a) His recommendations for education include social tasks such as staging and interaction. Athena has been designed with the explicit purpose of use in such contexts.
Current research rejects both extreme positions. Social skills are developed in several ways.

Enactment of arguments in social roles have considerable transfer effects not merely on the social skills but on the cognitive reasoning skills as well. Participation in forensics education and debating demonstrated large positive impact on critical thinking improvement. (Allen et al. 1999) It is known that educational games in general have such effects. (Argyle 1986, Ellington & Earl 1998)

The Athena Approach to Social Skills
Basically, the following features are part of our approach to teaching general argumentation skills:
Game focus. By turning argument duels into games, played by teams, defined and regulated by strict rules, we create an impersonal setting where the emotional pressures involved in confrontation are minimized.
Strategy focus. By emphasising skills at level of social strategy, we can avoid problems related to varying, socially embedded features of the social skills.
Meta-skill focus. By focusing meta-skills of cognitive analysis, we can obtain a higher degree of transferability than in first-order behavioural skills.

Athena brings a game focus to the design of the learning situation. The learning task is described as the acquisition of a technique more than developing personal features. We have described the social construction of game situations and their evaluation. The presentation of these argumentation games has similarities with team sports. Tasks are assigned to ensure that students have few or no previous convictions and they are assigned impersonal roles. The evaluation and feedback focuses on cognitive improvement of team performance.
Athena brings a strategy focus to the social skills. Like motor skills, social skills

have a hierarchic structure (Argyle 1988). At a lower level, social skills are similar to motor and behavioural skills.

Social skills also have components of a strategic nature. Cognitive analysis, plans and a design of general features of social performance underlie the exercise of such skills. The exercise of such elements of skill involve an understanding of the social roles and the social arena plus a design of a plan underlying the enactment of a role in relation to other actors and an audience. These strategic components of the skill are far less dependent on race, culture, class or gender. A main purpose is that students will be able to read social situations via the performance of other actors and plan for a suitable social strategy for himself (herself).

Conclusion

We have described and compared the ideas behind two software packages, Reason!Able and Athena, intended for the education and training of non-expert professionals and students of higher educations. The software packages are quite similar, much due to the hierarchical nature of reasoning, the tradition of teaching via argument diagrams and principles of software development. The educational ideas of both approaches opt for a same position intermediate between strong mentalism and strong situatedness.

The main differences between the approaches is that Reason!Able primarily is devoted to analysis, containing advisory functions, while Athena has relatively more emphasis on student production, e.g. through different selective report functions. Reason!Able assumes a more definite structure and progress in a course of critical thinking. Through several tasks, the user is assumed to transfer his skills to non-educational contexts. Athena has less facilities for steering student learning. Athena is more geared to comprehensive students tasks, embedded in role-play in order to promote efficient learning and transfer to professional tasks.

These differences are gradual rather than absolute. It would be premature to judge about the virtues or vices of the respective packages. There is little known today about conditions of effective methods for teaching critical thinking, reasoning and argumentation. A critical reader should keep his mind open and try out both packages.

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Athena: http://www.athenasoft.org.
Belvedere: http://lilt.ics.hawaii.edu/belvedere/index.html.
Genie: http://www2.sis.pitt.edu/~genie/.

Reason!Able: http://www.goreason.com/

Project page:
www.athenasoft.org

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