



**CS 681 Fall 2008**  
**Designing Expert Systems**

# **Knowledge-Based Reasoning: Part III**

## **Mixed-Initiative Problem-Solving**

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# Discussion

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**What are some of the complementary abilities of humans and computers?**

**What are some of the complementary abilities of humans and computer agents?**

**What are some of the complementary abilities of humans and computer assistants in the context of webpage believability assessment?**

# Computational Abilities of Humans and Computers

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## Humans are

- slow
- sloppy
- forgetful
- implicit
- subjective

## but

- have common sense
- have intuition
- may find creative solutions in new situations

## Computer systems are

- fast
- rigorous
- precise
- explicit
- objective

## but

- lack common sense
- lack intuition
- have poor ability to deal with new situations

# What is Mixed-Initiative Reasoning

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Mixed-initiative reasoning concerns the development of collaborative systems where the human and automated agents work together to achieve a common goal in a way that exploits their complementary capabilities.

Such systems can either accomplish goals unachievable by the component agents, assuming they work independently, or they can achieve the same goals more effectively.

# What is Mixed-Initiative Reasoning

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Mixed initiative assumes an efficient, natural interleaving of contributions by users and automated agents

that is determined by their relative knowledge and skills and the problem-solving context, rather than by fixed roles,

enabling each participant to contribute what it does best, at the appropriate moment.

# Discussion

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**How do you see an ideal mixed-initiative environment for problem-solving and decision-making?**

**What are some key requirements for such an environment?**

# Mixed-Initiative Problem-solving and Decision-making

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## **Human**

Acts as the orchestrator of the reasoning process, guiding the high-level exploration.

## **Computer system**

Implements human's guidance by taking into account the human's preferred problem solving strategies, assumptions and biases.

The computer system is an extension of the reasoning capabilities of the human, much like a calculator is an extension of the computational capabilities of an accountant.

The emphasis is on enhancing human's creativity, relying on the human to take the most critical decisions, and only to critique and correct the more routine ones that are proposed by the computer system.

# Mixed-Initiative Problem-solving and Decision-making

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## Key requirements for a mixed-initiative environment:

- Automatic approach to problem solving and decision-making which is very natural and easy to understand. The human and the computer should collaborate in a natural way, similarly to how humans collaborate, as opposed to the usual human-computer interaction which is inflexible and mostly unidirectional.
- Because most of the complex decisions are based on incomplete and uncertain information, the decision-making environment should allow for the investigation of what-if scenarios, where the decision-maker can make various assumptions about a situation.



## Assessment Assistant:

- with basic interaction model
- with automatic interaction model
- with mixed-initiative interaction model

# Basic Interaction Model

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The user has full control over the assistant in all the reasoning modes. Each operation must be initiated by the user.

Defining a User Solution:

- Find and select a problem using one of the tree browsers.
- Make sure the Assessment Assistant is visible.
- Click on the 'New' button.
- Modify the proposed solution and provide a justification.
- Click on the 'Save' button to save the user solution, or click on the 'Cancel' button to cancel the definition.

# Mixed-Initiative Interaction Model

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Customizes the interaction in the “solving” mode. The assistant performs some operations automatically but the user can override them:

- The assessment editor is automatically opened after the selection of a leaf problem for which a solution is needed.
- The next leaf problem for which a solution is needed is selected automatically after you click on the ‘Save’ button or on the ‘Cancel’ button in the assessment editor.

*The user can select another node at any time.*

# Automatic Interaction Model

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Customizes the interaction in the “solving” mode. The assistant performs most operations automatically and the user can only override the order in which user solutions are defined.

- The assessment editor is automatically opened after the selection of a leaf problem for which a solution is needed.
- The assistant will move to the next leaf problem for which a solution is needed:
  - When the reasoner is open.
  - After you click on the ‘Save’ button or on the ‘Cancel’ button, in the assessment editor.
  - *When you click on any node other than a leaf problem for which a solution is needed.*

## Assessment Assistant:

- with basic interaction model
- with automatic interaction model
- with mixed-initiative interaction model

# Reading

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Tecuci G., Lecture Notes on Knowledge-Based Reasoning - Part III, 2008  
(required).

Tecuci G., Boicu M., Cox M.T., Seven Aspects of Mixed-Initiative Reasoning: An Introduction to the Special Issue on Mixed-Initiative Assistants, *AI Magazine*, Volume 28, Number 2, pp. 11-18, Summer 2007 (required).  
[http://lac.gmu.edu/publications/2007/BoicuM\\_AIMagazine\\_Intro.pdf](http://lac.gmu.edu/publications/2007/BoicuM_AIMagazine_Intro.pdf)