Soar-Based Intelligent Decision Support

A. Kalus
University of Portsmouth
and
DERA (Portsdown West)
England
UK
kalusa@sis.port.ac.uk

Kate Cook
DERA (Portsdown West)
England
UK

University of Portsmouth

DERA

Soar-Based Intelligent Decision Support

❑ Aim

- To explore the use of Soar-based models of real-time command decision making as a basis for the provision of *context and user-relevant* support to decision making, in *real-time, dynamic, and complex* environments.

Soar-Based Intelligent Decision Support

❑ Why?

- Traditional systems are designed to help a *wide range* of users in their decision making.
- However, there are some domains where it is critical that particular individuals make correct judgments for the safety of themselves and others.
- Therefore we look at building an *individualized* support system for such people.

cont:

Soar-Based Intelligent Decision Support

❑ Why?

- Traditional approaches [1] tend to:
  - generate options for the user to select, accept, or veto, *provided by the system designer,*
  - be based on analytical methods,
  - assume the user attempts to make optimal decisions under all conditions and in all environments,
  - assume the user has the time, ability, and inclination to act in an analytical manner.

cont:

Soar-Based Intelligent Decision Support

❑ Why?

- BUT:
  - Empirical findings [e.g. 2] show that under operational conditions, decision makers rarely, if ever, use analytical methods.
  - Instead they tend to match their current perceptions with something they recognize from previous experience, and make their decisions based upon that recognized experience

cont:

Soar-Based Intelligent Decision Support

❑ Why?

- In such real-time, dynamic, and complex environments decisions are thus made in a *naturalistic* manner [2]
- Such environments are characterized by the following eight factors:

cont:

Soar-Based Intelligent Decision Support

- **Why?**

  - 1. Ill-structured problems
  - 2. Uncertain dynamic environments
  - 3. Shifting, ill-defined, or competing goals
  - 4. Action/feedback loops
  - 5. Time stress
  - 6. High stakes
  - 7. Multiple players
  - 8. Organizational goals and norms.

cont:

Soar-Based Intelligent Decision Support

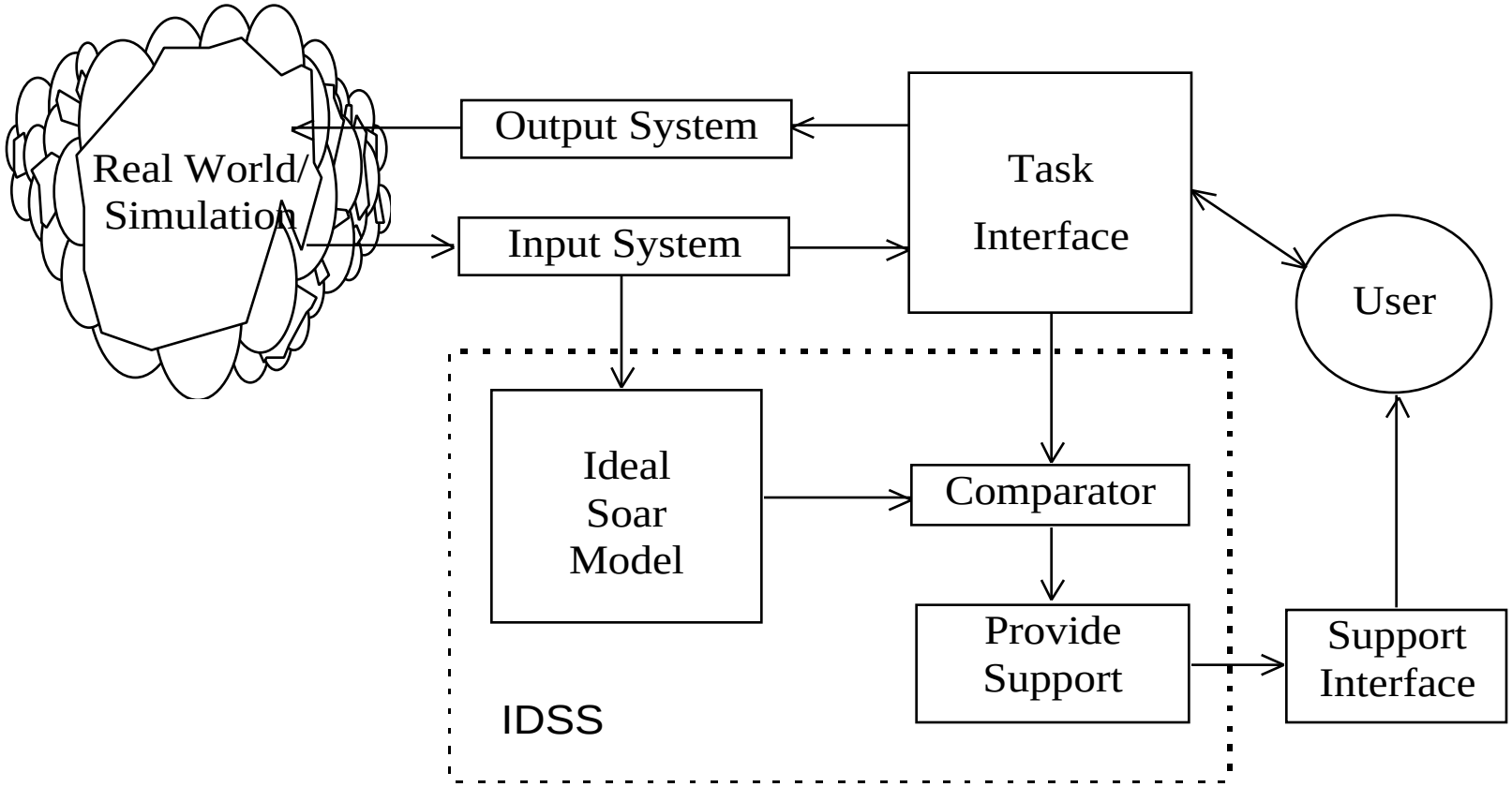
❑ Why?

- Given these factors, success of traditional systems has been limited [3]
  - ‘(the above 8 features) typically defeat static, bounded models’
  - ‘such an approach may force decision makers to adopt highly unfamiliar modes of reasoning;...worse they may fail to exploit user knowledge or expertise...’

Soar-Based Intelligent Decision Support

The System

Architecture for a Soar-Based Decision Support System



Soar-Based Intelligent Decision Support

- **The System: the 'ideal' Soar model.**

  - The 'ideal' Soar model is a cognitive model of this particular individual, developed off-line. The user has been able to prepare his 'ideal' responses to the various situations that may arise.

  - Currently, it is a static model.

Soar-Based Intelligent Decision Support

- **The System: the Comparator.**

  - This module takes the ideal Soar user outputs (what the user said he would do) and compares them to the actual user outputs.

  - Any difference is used as input to the ‘provide support’ module.

Soar-Based Intelligent Decision Support

- **The System: provide support module**

  - Specifies the sets of possible mismatch conditions and sets of support tools needed to make good the difference.

  - Based upon a set of task aiding conditions and task aiding styles derived from [4].

Soar-Based Intelligent Decision Support

❑ Results:

- On the simplified Electronic Warfare task chosen for this, results are encouraging in that the system is able to ‘track’ the user and compare outputs.
- However, ‘objective’ methods of assessment need further investigation so that the user’s performance with and without this aid can be measured.

Soar-Based Intelligent Decision Support

❑ Future Work:

- To integrate this model with a more sophisticated and complex simulator than the one originally used.
- An important issue is if it can be assumed that the input is ‘seen’ in the same way by the model and the user, and the extent to which the model can ever wholly represent the user’s perception of a situation.

cont:

Soar-Based Intelligent Decision Support

❑ Future Work:

- To develop methods of assessing the usefulness of this idea of individual support.
- To look at how much trust the user would have in such a system.
- To investigate ways of presenting the outputs to the user - e.g. continuously or on demand?

Soar-Based Intelligent Decision Support

- References:

[1] Sheppard C. (1994) *Decision Support in Military Systems*.
DRA Customer Report DRA/CIS/CSS5/CR94005/1.0

[2] Klein G.A. (1993) *Decision Making in Action.* Ablex Publishing Corp., Norwood, New Jersey.

[3] Cohen M.S. The Bottom Line: Naturalistic Decision Making, chapter 15, in [2]

[4] Campion J. & Brander G. (1996) *Decision Making: Principles, methods, and Illustrations of Decision Aiding.*
DRA Customer Report DRA/CHS/HS3/CR96061/1.0