Usable Artificial Intelligence

Aaron Spaulding
SRI International
333 Ravenswood Avenue
Menlo Park, CA 94025
spaulding@ai.sri.com

Neil Yorke-Smith
SRI International
333 Ravenswood Avenue
Menlo Park, CA 94025
nysmith@ai.sri.com

Jonathan Grudin
Microsoft Research
One Microsoft Way
Redmond, WA 98052-6399
jgrudin@microsoft.com

Jack Zaientz
Soar Technology, Inc.
3600 Green Court, Suite 600
Ann Arbor, MI 48105
jzaientz@soartech.com

Anthony Jameson
DFKI, German Research Center
for Artificial Intelligence
Stuhlsatzenhausweg 3
66123 Saarbrücken, Germany
jameson@dfki.de

CHI 2008, April 5 – April 10, 2008, Florence, Italy
ACM 978-1-60558-012-8/08/04.

Abstract
"The AI and HCI communities have often been characterized as having opposing views of how humans and computers should interact" observes Winograd in *Shifting Viewpoints* [1]. Reconciling these views requires a thoughtful balancing of assistance and control, of mental and system representations, and of abstract process and contextualized workflow [2]. This workshop examines the gap between HCI and artificial intelligence (AI), with the goal of improving usability of AI systems.

Keywords
Human Computer Interaction, Artificial Intelligence, Knowledge Capture, Knowledge Representation.

ACM Classification Keywords
H.5 Information Interfaces and Presentation, I.2 Artificial Intelligence.

Introduction
The gap between researchers in human-computer interaction and in artificial intelligence persists, despite overlap of practitioners, annual conferences such as Intelligent User Interfaces, and some notable collaborations. From the HCI perspective, this gap is understandable, since user needs can often be met more simply and easily through engineered systems than by impractical AI approaches. It is challenging

enough to ensure usability in a system that acts consistently; designing for and evaluating systems that learn and evolve over time only adds complexity [3].

AI technologies are now entering the mainstream. Recommender systems help us discover music, pick movies to see, and find the perfect gift [4]. Reasoning systems are employed to analyze the stock market, detect SPAM email, and pick winning race horses [5]. Sophisticated tools allow users to automate their workflow without knowing a line of code [6]. Assistive agents help the elderly manage their health and raise alerts in case of emergency [7]. The maturing of AI technologies opens new opportunities to meet user needs and asks for evolving paradigms of interaction between the human and the computer.

Realizing the full potential of AI systems to assist users is dependent on creating a usable system that directly fills a real need and fits the user's workflow. More concretely, the user must have an understanding of the abilities of the system, of how to direct its operation, and of how those operations support desired tasks. The system must have information that is formal and complete enough for its reasoning and learning and must allow this information to be applied and altered at times appropriate for the user. Finally, the user must be able to assimilate and respond to the output of the system and, possibly, to its internal state or processing.

This workshop addresses how HCI and AI collaboration can lead to new developments that integrate the strengths of humans and AI systems. We characterize the salient issues within the two themes of *Knowledge Capture and Representation* and *End User Programming*.

Knowledge Capture and Representation

AI systems often incorporate structured knowledge bases. While these knowledge bases can take a wide variety of numeric and symbolic forms, they all depend on being populated with clear, meaningful content [8]. Providing this knowledge can be a challenge for well-practiced knowledge engineers. Few task analysis methodologies, for example, provide guidance on acquiring symbolic decision criteria or establishing domain prior probabilities for Bayesian models.

Enabling end-user construction of knowledge bases is even more challenging [9, 10]. End-users, while expert in their own domains, are typically unfamiliar with the formalisms used by AI researchers. Users are unable to provide complete, well considered, knowledge-sets, and may place high value on features not compatible with the chosen formalism. They are, however, often the best or only source of knowledge for a given system, particularly when the system is designed for end-user customization. In cases like this, careful attention must be paid to either developing end-user oriented knowledge representations or mapping end-user representations to those supported by the knowledge base. In addition to being aided in populating the knowledge base, the end-user may require support in validating the content of the knowledge base or determining how input knowledge covers the problem space.

End User Control

An interface for an AI system, like any user interface, must allow the user to provide instructions over an extended period of time. However, there has been a historic tension in providing user control of AI systems [11,12]. If the computer can do it, the thought goes,

the human doesn't have to. Unfortunately, this can lead to a conflict between the human and the system for control.

When well designed, an AI user interface can provide the user with more control, not less, by productively moving user control to a higher level of abstraction (e.g., providing a query that describes required information content without regard for differences in source formats) or a lower-workload process (e.g., selecting an album from a prioritized list instead of a large database) [13]. In these cases, the system automates tasks that assist the user in accomplishing her goals, but that do not represent a good use of her talents.

In some circumstances, the additional autonomy of AI systems may lead to surprising actions. This is particularly true with systems that learn or evolve behaviors. That such actions may be correct within the bounds of the knowledge base and algorithm may not matter if the action is incorrect, ill-timed, or inexplicably different from the end user's expectation. Providing users with application appropriate control and understanding of the AI process is critical to its perceived reliability [12, 14].

The ability to extend and modify tools empowers users, but this control is often outside the reach of non-programmers. Programming-by-example techniques involve intelligent assistants watching users and then creating a procedure based on their actions [6, 15]. These systems bring up additional user control issues: they must provide feedback such that the user is confident the system interpreted their actions correctly and learned the right procedure. When a mistake is made, there should be a clear path for the user to correct the procedure [6].

Audience

The intended audience of this workshop consists of practitioners and researchers of human-computer interaction, artificial intelligence, knowledge capture, end user programming, assistive and agent technologies. We aim to foster interactions among this interdisciplinary set of participants by including presentations from distinct perspectives and by allocating ample time for discussions.

This workshop follows the success of the AAAI 2007 Spring Symposium, *Interaction Challenges for Intelligent Assistants*, a forum that brought together practitioners from HCI and AI fields to explore HCI issues from the perspective of artificial assistive agents.

Immediate and Long Term Goals

The goal of this workshop is to bring together HCI and AI researchers and collectively gain insight into both usability challenges in developing AI systems, and effective means of meeting these challenges.

Rather than to showcase specific technologies, the specific goals of the workshop are:

- To understand processes and methods for the UI design of AI systems.
- To develop insight into the usability challenges in developing AI systems, and effective means of meeting these challenges.
- To collect a set of example approaches and solutions, working towards understanding underlying

patterns and principles for designing and evaluating intelligent systems.

- To consider how to increase awareness and appreciation of usability issues in the AI community.
- To gain an understanding of the most promising areas for collaboration between the HCI and AI communities

The workshop will produce a working draft in the form a poster, informed by participant presentations and discussion, and focusing on the emerging areas of connection between HCI and AI. The working draft will suggest areas for future research and expanded practice.

References

[1] Winograd, T., *Shifting viewpoints: Artificial intelligence and human–computer interaction*. Artificial Intelligence 170 (2006) 1256–1258

[2] E. Horvitz. *Principles of Mixed-Initiative User Interfaces*. Proceedings of CHI '99, ACM SIGCHI Conference on Human Factors in Computing Systems, Pittsburgh, PA, May 1999.

[3] Grudin, J., *Turing Maturing: The Separation of Artificial Intelligence and Human-Computer Interaction.* Interactions 13 (5) (Sept–Oct 2006) 54–57

[4] Linden, G., Smith, B., & York, J. (2003). *Amazon.com recommendations*. IEEE Internet Computing 7(1) (Jan.-Feb. 2003), 76-80

[5] Trippi, R. R., and Turban, E., *Neural Networks in Finance and Investing: Using Artificial Intelligence to Improve Real-World Performance.* McGraw-Hill, New York, 1992

[6] Little, G., Lau, T. A., Cypher, A., Lin, J., Haber, E. M., Kandogan, E., *Koala: Capture, Share, Automate, Personalize Business Processes on the Web*. CHI Letters: Human Factors in Computing Systems, CHI, 2007. 9(1) 943–946

[7] A. Cesta and F. Pecora. *Integrating Intelligent Systems for Elder Care in RoboCare*. In W. C. Mann and A.Helal (Eds): *Promoting Independence for Older Persons with Disabilities*, IOS Press, pp. 65-73, 2006

[8] K. Barker, B. Porter, and P. Clark. *A Library of Generic Concepts for Composing Knowledge Bases*. First International Conference on Knowledge Capture, 2001

[9] Sowa, J. F., *The Challenge of Knowledge Soup*. Episteme-1 Conference, Goa, India, 2004.

[10] Thomere, J., Rodriguez, A., Chaudhri, V., Mishra, S., Eriksen, M., Clark, P., Barker, K., Porter, B., *A Web-based Ontology Browsing and Editing System*. In Conference on Innovative Applications of Artificial Intelligence, Jul 2002.

[11] Isbell, C. L., and Pierce, J. S., *An IP Continuum for Adaptive Interface Design.* Invited paper, Design of Personal Task Environments session, HCI International 2005.

[12] Bradshaw, J. M., Feltovich, P. J., Jung, H., Kulkarni, S., Taysom, W., Uszok, A. *Dimensions of Adjustable Autonomy and Mixed-Initiative Interaction.* Agents and Computational Autonomy 2003: 17-39

[13] Lieberman, H., Espinosa, J., *A Goal-Oriented Interface to Consumer Electronics using Planning and Commonsense Reasoning*. International Conference on Intelligent User Interfaces (IUI-06), Sydney, Australia, Jan 2006.

[14] Rich, C.; Sidner, C.; Lesh, N.; Garland, A.; Booth, S.; Chimani, M., *DiamondHelp: A Collaborative Interface Framework for Networked Home Appliances*, IEEE International Conference on Distributed Computing Systems Workshops, pp. 514-519, June 2005

[15] Blythe, J., *Task Learning by Instruction in Tailor,* In Proceedings of Conference on Intelligent User Interfaces (IUI-05), San Diego, CA, Jan 2005.