HCI and Creative Problem-Solving at Lancaster

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ABSTRACT

The Creative Problem-Solving Research Group (CPSRG) at Lancaster University is a collaboration between psychologists and computer scientists conducting research into creativity, problem-solving and design at the interface between humans and computer systems. Our aim is to develop theoretical understandings and practical interventions that address how creative individuals and groups manage conflicting demands of novelty and divergent thinking versus constraint, domain relevance and minimization of task load. Current projects include creative design in virtual and ubiquitous environments, developing methodologies for inspirational design, and impacts of expert reasoning on creative problem-solving.

Categories and Subject Descriptors

I.2.8 [Problem Solving, Control, Methods, and Search]: Heuristic Methods. I.5.2 [Design Methodology]. H.5 [Information Interfaces and Presentation]

General Terms

Management, Design, Experimentation, Human Factors.

Keywords

Creativity, problem solving, design, innovation, insight, investigative expertise.

1. INTRODUCTION

The CPSRG was initiated by Tom Ormerod in 2004 to facilitate interdisciplinary research on creativity, problem solving, expertise and design. With four academics from Psychology and Computing, and eight researchers reading for PhD or enrolled in post-doctoral research, this group provides a critical mass of interdisciplinary expertise and a forum for weekly seminars. The Psychology Department performs world-leading research into the nature, acquisition and support of design expertise; the development and evaluation of design processes and support tools for innovative design; and in particular creative-problem solving in work situations. The Computing Department conducts internationally recognized innovative research into the design of collaborative interactive systems, the development of methods and tools for supporting creativity in design, innovative methods for learning design together with cognitive

models for skill acquisition. Computing is also involved initiatives at the boundary of arts and technology that intersect with CPSRG's focus on technical innovation and creativity.

2. RESEARCH TOPICS & PROJECTS

2.1 Studying Creative Problem Solving

Creative problem solving in design raises significant research questions. How do people solve complex and ill-defined problems? What makes a problem appear insoluble? How does insight arise? What role does analogizing play in finding and understanding problems as well as in generating and evaluating solutions? For example, we have also investigated how humans produce solutions to the travelling salesman problem, an optimization problem of key importance in industrial and commercial settings. We also developed cognitive ethnography as a methodology for studying creative expertise [3], and studied processes that facilitate design problem-solving [4, 5].

2.2 Modelling Creativity

Cognitive and computational models of planning behaviour in ill-defined problems [13, 14] and creative designing from a situated cognition perspective [1] further refine our theoretical understanding of creativity. Central to creativity is the interplay between more convergent analytic modes of thought and the role of imagination, and an off-shoot from this concern has led to preliminary results suggesting that a computational model of regret can be used to improve machine learning [6].

2.3 Supporting Creative Design

One research topic with arguably the highest impact on creative design processes and outcomes is that of developing tools, methods and practices to support creativity in design [16]. We are interested in studying methods of 'extreme design' where arbitrary constraints (such as limited time) can lead to radical ideas [21] and also ways of inspiring divergent thinking such as BadIdeas [7]. We are considering how tools could support better articulation of creative ideas, for example in the BadIdeas technique. Issues regarding creative environments for design range from virtual environments allowing manipulation of real-world constraints and their impact on creativity [11] to socio-organizational aspects that foster creative cultures.

2.4 Innovation in Teaching/Learning Design

Challenges for teaching or learning creative design appear throughout the design process, starting from problem specification, continuing with the relevant feedback that students need to receive, to the assessment of design-related activities and outcomes [17]. We have implemented new approaches to the teaching of interaction design, ranging from students' direct exposure to practitioners in the field [18], to alternative design briefs such as finding new applications for existing technologies [20]. We have also explored reduced-cost

routes for knowledge transfer consisting of addressing a business problem through student assignments [19].

2.5 Supporting Expert Problem-Solving

In addition to design, the group conducts research on creative problem-solving in other applied domains. For example, we are interested in ways in which expert criminal investigators come up with creative ways of testing their suspicions [12]. We also are currently exploring novel ways to design health and safety support systems for the construction industry [2]. We also have an ongoing interest in how expert users of shared information repositories can capitalize upon facets of embodied cognition in supporting tasks of information storage and retrieval [15].

2.6 Connecting with Arts and Design

While the central focus of the group is on more technical and problem oriented creativity, members of the group are also involved in connecting areas in arts, user experience design and product design. We have been part of several recent and ongoing AHRC/EPSRC networks in this area including LeonardoNet, NonPlace and Branded Spaces and past work has included formal models of the interactive performance and space as well more philosophical pieces.

In collaboration with the Cardiff School of Art & Design, we are currently leading one of the Designing the 21st Century projects, DEpTH [8], which is looking at issues of physicality in design, building on ongoing work on this area and including the Physicality 2007 workshop at this conference.

3. EDUCATION IN THE CPSRG

In addition, our interest in technological creativity is reflected in our practical teaching, most notably the research carried out by students on our Masters by Research in HCI. This EPSRC-funded programme is a joint venture focusing on the development and evaluation of interactive systems. It also offers an opportunity for experimenting with innovative teaching/learning techniques for the study of collaborative design.

Outside of Lancaster we have presented the concepts of teaching innovation in Singapore [9], used BadIdeas in teaching to the USI programme at the Technical University, Eindhoven, and Paula Silva, one of the groups' PhD students, chaired the 2007 HCI Educators Conference in Aveiro, Portugal [10].

4. PEOPLE

The work of the group is only as good as the people within it. As well as the authors this includes David Alford, Alex Sandham, Genovefa Kefalidou, Maria Jemicz, Lorna McKnight, Ben Short, and Ut Na Sio. We are also grateful to many outside the group whose work impinges and inspires us, in particular Jenn Sheridan and :thePooch:. for their various 'Scrapheap' events.

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