ABSTRACT
The 6th Conference on Creativity and Cognition is being held on June 13-15, 2007 in Washington, DC, under the sponsorship of the Association for Computing Machinery’s (ACM) Special Interest Group on Computer Human Interaction (SIGCHI) (http://www.cs.umd.edu/hcil/CC2007). The organizers believe that a central goal for research in this emerging topic is to enable more people to be more creative more of the time. Our conference demonstrates that innovative research methods can be developed to study creative work that spans disciplines from arts to sciences. Conference industry supporters included IBM, Microsoft, SAP, and Google and government supporters include U.S. National Science Foundation and U.K. EPSRC Equator project. Support was also provided by the U.S. National Academies.

ACM Classification: H5.2 [Information interfaces and presentation]: User Interfaces. - Graphical user interfaces.

General terms: Design, Human Factors

Keywords: creativity, exploration, discovery, innovation, user interfaces, social computing, design

INTRODUCTION
The great French artist Henri Matisse said “Creativity takes courage.” I think his point was that since innovation is disruptive, creative people will have to deal with strong reactions from those who wish to preserve the existing order as well as those who are promoting their own innovations.

Studying creativity in academic settings also takes courage, but for different reasons. Creativity is such a vast and vague topic that traditional researchers are often skeptical of work that promises to improve creativity. Worse still, the popular press is filled with self-help books by sometimes unscientific types who promise much but can’t document their success. In computing circles the devotion to careful measurement for productivity support tools means that something so complex and subjective as creativity support tools has not been an acceptable topic. In fact, the ACM Computing Reviews Classification System whose 1500 terms organize the field does not include creativity, innovation, exploration, or discovery.

In some circles, creativity has been seen as the province of artists or musicians, rather than scientists and engineers. The popular literature and cultural values often suggest that creative people work in the arts, theater, film, or entertainment worlds. Replacing these narrow and outdated views with a more inclusive vision takes time and effort.

Ernest Edmonds and Linda Candy have been courageous in running the ACM-sponsored Conference on Creativity & Cognition five times in England since 1993 (http://www.creativityandcognition.com/cc_conferences/). Their belief in the validity of this topic produced a lively conference series that engaged artists and scientists, as well as musicians and programmers. They helped define the area, encouraged researchers, and eagerly mixed artists with scientists. Their own research was to rigorously study year-long collaborations of artists with programmers who were creating new media projects [1].

During this time, developers have been offering increasingly powerful programming and authoring environments for text, music, programs, photos, graphics, animations, video, and many other domains. Similarly, the design world went digital enabling product designers, graphic designers, and architects to create their work using powerful computing environments. World-famous architects such as Norman Foster and Frank Gehry claimed that their innovative buildings would not be possible without computer tools that enabled them to create complex structures with even more complex exteriors.

All through history technology has amplified the powers of creative people, from the telescope and microscope to the compass and the camera. As designers of computer tools gained sophistication, they moved from tools that enhance perception to tools that enhance problem solving. Designers also became aware of the growing potential for communication and collaboration tools that enable coordinated action in support of creative endeavors among teams and larger communities.

In the sciences, domain-specific discovery support tools began to emerge in physics, chemistry, biology, and related fields. These tools did more than use automated data mining algorithms; they offered rich opportunities for data manipulation, visualization, hypothesis formation, hypothesis testing, collaboration, and presentation or results. The excitement was about the powerful interfaces that enabled rapid exploration of multiple hypotheses and combinatoric strategies that allowed users to try thousands of variations. This shift was more than productivity improvement; it was about changing
work strategies. Thomas Edison had quipped that innovation was 1% illumination and 99% perspiration, but now the perspiration could be reduced substantially. Another transformation could be captured by modern Edison who might remark that innovation is 1% inspiration and 99% collaboration.

These support and collaboration tools across disciplines were eagerly adopted by those who recognized their advantages. Commercial success and growing communities of users were evidence of a breakthrough, but the scientific study of design principles and rigorous evaluation of efficacy was slower to develop. Design principles for productivity support tools could be validated with controlled studies that measured time to correct completion of benchmark tasks, but creativity support tools were different. Three hundred years of scientific methods based on a reductionist model and controlled experimental studies had produced huge benefits, but the complex nature of human discovery and innovation can not be studied like pendulums or solid state materials.

APPLYING RIGOROUS RESEARCH TO INSPIRED EXPLORATION
Some researchers began to understand that design of tools to support discovery and innovation was a worthy subject of study, but they were torn by devotion to rigorous and controlled studies. However the desire for close study of how domain experts make discoveries has pushed many researchers to adopt case study, observational, and interview methods with small numbers of users. The goal is to capture those creative moments and understand how design features of software tools helped bring them about. The desperate desire for validity has led many researchers to sacrifice two other research goals: replicability and generalizability. This is a risky tradeoff, so carefully documented methods are needed to answer critics who fear misleading interpretations based on experimenter bias [2]. These are realistic concerns, but many researchers see high payoffs in understanding how creative people can be supported with powerful tools. These researchers argue that creative work in science, design, or the arts evolves so rapidly that replicability is a less relevant goal than in the physical sciences.

ENABLING MORE PEOPLE TO BE MORE CREATIVE MORE OF THE TIME
Traditional descriptions of creativity often suggested that creative personalities -- the Einsteins and Picassos of the world -- were rare occurrences with special gifts who came along once in a generation to transform the world. The modern belief is that creativity can be taught, and that everyone can be creative. This is a radical transformation whose democratic values are a modern conceit. But the World Wide Web and the broad use of information and communications technologies has raised expectations that every student should be able to write, draw, take photos, make music, and edit videos. This is a remarkable transformation from the time just 400 years ago when scholar were generally copyists who merely transcribed or translated the words of Aristotle and other heroes. The expansion of printing and availability of books changed the expectations so that every student is expected to write original material. That expectation will continue to grow.

BRIDGING ARTS AND SCIENCES
Another controversy among those engaged in research on creativity support tools is the degree of commonality in the creative process across disciplines. Those who see differences perceive artists and scientists as wildly different in their approach; typically artists are thought to be intuitive, expressive, and spontaneous while scientists are rational, logical, and systematic. Those who see commonalities believe that artists and scientists have breakthrough moments of illumination as well as long periods of careful working on specific problems. Artists may make hundreds of sketches for a major work, just as scientists conduct pilot tests before running a major experiment. While there are certainly domain differences across disciplines and personality differences within disciplines, we believe that most creative individuals shift back-and-forth between inspired insights to logical deductions. They both know that careful practice and logical thinking are to be balanced with soaring insights and wild explorations. They both find that their creative practice is changed by the opportunities that the new technologies bring.

FROM PHILOSOPHY TO CONFERENCE ORGANIZING
The growing interest in creativity support tools led to a June 2005 workshop that brought together 25 key researchers for a lively open discussion [3]. Invigorated by this experience, we committed to running the Creativity and Cognition Conference June 13-15, 2007. Our outlook guided the call for papers for the conference:

We focus on creativity support tools for individual and group creativity, bridging among technology, science and arts to find common themes for user interface and new media design, and producing rigorous research with innovative designs and carefully conceived evaluations.

We welcome contributions from researchers, developers, practitioners, and policy-makers in many fields, including: computer and information scientists; diverse scientists, engineers, and architects; product, graphic, and interaction designers; writers, musicians, and new media artists; creative practitioners, corporate leaders, and educators; social scientists, ethnographers, and anthropologists.

CONFERENCE THEMES: The general focus of the conference is about cultivating and sustaining creativity: understanding how to design and evaluate computational support tools, digital media, and sociotechnical environments that not only empower our creative process and abilities, but also encourage and nurture creative mindsets and lifestyles. Topics appropriate for submissions include, but are not limited to:

- Principles for interface, interaction & software design
- Empirical evaluations by quantitative and qualitative methods
- In-depth case studies and ethnographic analyzes
- Reflective accounts of individual and collaborative practice
- Educational and training methods to encourage creativity with novel interfaces
- Social mechanisms in support of creative communities and collaboratories
- Emerging technologies, media, and approaches in the arts and creative practices
- Transdisciplinary methods and collaboration models

Forming our organizing and program committees also helped shape what we would produce. We sought to balance disciplines, nationalities, institutional affiliations, gender, age, and many other factors.

Our conference was enriched by an illustrious evening panel discussion on the theme of “Bridging Art and Science with Creativity Support Tools”:

Rita Colwell, Professor, University of Maryland, former Director, U.S. National Science Foundation
Sara Diamond, President, Ontario College of Art & Design, Canada
Paul Greenhalgh, Director, Corcoran Gallery of Art, Washington, USA
William Wulf, President, National Academy of Engineering, USA

Featured events during the conference were the keynote speeches by Mitchell Resnick, MIT Media Lab, USA and Thecla Schiphorst, Simon Fraser University, Canada. The 24 full-length papers were chosen from 104 submissions. Posters and demos gave a lively aspect to the conference with lively presentations and fresh work. The tutorials provided in-depth reviews for participants who wanted to develop an understanding of recent work, while workshops, gave participants a chance for spirited discussions that will help advance our field and build a cohesive community. We are especially proud of the Graduate Student Symposium because it brought together more than 20 new researchers and innovators from geographically diverse universities. We believe that engaging graduate students in varied disciplines and giving them interdisciplinary experiences will invigorate our field. The three-month long art exhibit, Speculative Data and the Creative Imaginary, in the National Academies Building will reach many visitors and expose them to the innovative work that is being done in new media forms.

It’s hard to convey the sense of satisfaction I feel when I reflect on the fact that we are bringing together so many diverse people and adding so many features to the Creativity and Cognition Conference series. We are reaching new audiences, promoting rigorous research, encouraging innovative explorations, and helping make creativity-related topics more acceptable in several disciplines. While we use and even enjoy our technologies, the joyous expressions you see among our participants come from our growing wonder at the human capacity for creative expression and innovative discovery. I think everyone involved with the conference is learning something new, is enjoying the unexpected connections they have made, and feels a sense of pride in contributing to a courageous community.

SUPPORTERS
Finally, the success of this conference was greatly enhanced by the generous support from corporations and government agencies, whose financial assistance enabled us to do so much more. The corporate supporters made it clear to the organizers and potential participants that our conference was an important bridge between academia and industry. We thank them with enthusiasm and appreciation: IBM, Microsoft, SAP, and Google. In addition, Yahoo! Berkeley Research provided support for one of the workshops. Support from the U.S. National Science Foundation came in two much appreciated forms: funding for the Graduate Student Symposium and for the Art Exhibit. Support from the British Equator project enabled us to expand the Graduate Student Symposium support to include more international students. The U.S. National Academies also supported our conference in two ways: providing their beautiful building as the venue for our opening evening reception and providing curatorial assistance for the three-month long Art Exhibit that was curated by Pamela Jennings, CMU, USA.

REFERENCES
The history of the human race is one of increasing intellectual capability. There has been a steady development and accretion of new tools for intellectual work and an increasing distribution of complex activities among many minds. Despite the transcendence of human cognition beyond what is inside a person’s head, many approaches in education and many studies and frameworks for cognition and creativity have disregarded the social, physical, and artifactual surroundings in which creativity, cognition and human activities in general take place.

The Creativity & Cognition 2007 program is focused on the theme of cultivating and sustaining creativity: understanding how to design and evaluate computational support tools, digital media, and socio-technical environments that not only empower our creative processes and abilities, but encourage and nurture creative mindsets and lifestyles.

We received 104 paper submissions and we were able to accept 24 full papers. The constraint imposed by the single-track nature of the conference did not allow us to accept some papers that certainly would have proved interesting, but at the same time it ensured the selection of rigorous and innovative papers. The selected papers reflect the research work of scholars and practitioners from 9 different countries: Australia, Canada, Denmark, Finland, Germany, Italy, Turkey, United Kingdom, and the United States.

The variety of disciplines, schools, and departments represented by the authors is rich and overwhelming. It includes contributions from the following disciplines: art & design, art & technology, interactive media, creative industries, human-computer interaction, informatics, computer science, engineering, cognitive science, psychology, architecture, archeology, visual arts, communication, and finally aesthetics. Many articles are grounded on multi-disciplinary collaboration and offer novel perspectives on narrative research, community engagement, and policy alternatives.

It is interesting to observe the number of papers with a focus on topics related to music (section “Music”). These papers represent the many others that we were not able to accept and looked at music as a privileged domain for a novel understanding of creative engagement and instrumental expertise. Such issues of instrumentality and materiality are echoed in other papers with a major focus on tools, media, and environments for education and collaboration (sections “Education” and “Collaboration Models”). Issues of narrative and representation are addressed by papers describing systems and interfaces for data visualization, information discovery and content creation, and for supporting, sharing, and disseminating creative activities and results (sections “Creating and Sharing” and “Support Tools”). Finally, issues of design methodology and evaluation are addressed by case studies and ethnographic accounts ranging from industrial design to everyday design (section “Design Methods”).

The Demonstrations and Poster papers draw attention to promising new work that amply represents the breadth of the conference. Over 30 submissions were received of which we were able to accept less than half due to space constraints. The strength of this exciting part of the conference adds an important dynamic during which delegates can engage directly with tools and works focused on creativity.

We list students’ contributions to reflect the lively and multidisciplinary environment of ideas and future research expressed by the Graduate Student Symposium.

The goal of the CC2007 proceedings is to create an archive of high-quality research papers and practical experiences, as well as a lively forum for community building. In selecting research papers for Creativity & Cognition 2007, we
emphasized relevance and rigor, in the belief that design problems (broadly defined) are unique, and replicability and generalizability may be at times counter-productive objectives for design and creativity research. We tried to tackle this trade-off and promote community building by considering and balancing relevance and rigor.

We wish to thank the program committee and reviewers; their varied backgrounds and expertise have made it possible to gather and select a valuable set of contributions. We also thank the Creativity & Cognition Studios for supporting the nominations of two prizes for especially noteworthy contributions to the field: one for research and the other for practice oriented papers.

We are very pleased with the program of C&C 2007 — and we hope that all of you will be too.
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Erik Champion, UNSW Asia, Singapore
Hal Eden, University of Colorado, Boulder
Mark Fell, University of Technology, Sydney
Ross Gibson, University of Technology, Sydney
Andrew Gorman, University of Colorado, Boulder
François Guimbretière, University of Maryland
Andrew Johnston, University of Technology, Sydney
George Khut, independent artist and researcher
Bill Kules, Catholic University of America
Mike Leggett, University of Technology, Sydney
Lizzie Muller, University of Technology, Sydney
Adam Perer, University of Maryland
Mike Phillips, University of Plymouth
Yusuf Pisan, University of Technology, Sydney
Catherine Plaisant, University of Maryland
Chiara Rossito, Royal Institute of Technology, Stockholm
Stephen Scrivener, Chelsea College of Art and Design, London
Mike Sharples, University of Nottingham
Chris Speed, University of Plymouth
Greg Turner, University of Technology, Sydney
Anna Ursyn, University of Northern Colorado
Alastair Weakley, University of Technology, Sydney