Panel: Individual and/versus Social Creativity

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INTRODUCTION

The creative act is often thought of as an individual, even lonely, one: the inspiration in the bath, the artist isolated in the garret. The research student has to demonstrate that they found new knowledge and that it was "all their own work". But how often are these individual acts a realistic model of the creative process? Even if inspiration does come in the bath, how many conversations had taken place before that moment? How much time has the "lonely" artist spent in cafes arguing with other artists about their work? If individual research is so important why do we advise a good student to join a successful research department?

Is there an "and" or a "versus" relationship between individual and social creativity? To which extent are "thinking / working / designing / learning" social activities rather than primarily individual activities? How does social creativity manifest itself and along which dimensions can it be analyzed? Creativity unfolds and becomes alive in a cultural environment rich with objects that are the products of previous thinking. In most design processes the concern is not with the individual thinker but with the overall quality of thought. Having a bright idea may be an individual act, but bringing it to fruition may be a much larger effort, requiring many contributors; sustained mental efforts and sustainable community efforts are a prerequisite for social creativity the discourse. "If there are enough eye balls, all bugs are shallow" (Raymond: "Cathedral and Bazaar" paper). Social creativity may have drawbacks based on the observation: "in case a project is late, the worst thing is to add more people to the project (Brooks: "The Mythical Man Month"). Perhaps the most promising approach to support social creativity is arranging informal ways for stakeholders to share experiences, so that they amplify their collective knowledge. Social creativity requires different settings than today's classrooms

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STATEMENTS

Linda Candy

The last fifty years of research has raised many questions and presented few answers as to whether we can fully understand creativity. Far from achieving a coherent and consistent picture of the nature of human creativity, it has served only to reveal the inherent complexity and 'mystery' of the subject. This is not to argue that creativity is not accessible to investigation. It is simply to draw attention to the limitations imposed by applying traditional scientific method to describing a phenomenon that is always changing. Much human creativity arises from activities that take place in a social context where interaction with other people and the artifacts that embody group knowledge are important contributors to the process: "...creativity does not happen inside people's heads, but in the interaction between a person's thoughts and a socio-cultural context." (Csikszentmihalyi, 1996. Creativity: Flow and the Psychology of Discovery and Invention, HarperCollins Publishers: New York.). Creativity is shaped by influences that are both outside our control and within it. Factors such as genetic makeup, geographical location, climate, economic resources, health, education, as

well as early formative and lifelong experiences, contribute to the scope for creativity that the individual person enjoys. The many contributory factors are usually investigated independent of one another and, hence, the multi-dimensional nature of creativity is not considered as a whole. A number of studies of creativity have investigated small-scale problem solving abilities. Other researchers place their confidence in what can be revealed by MRI scans of brain activity or uncovering the secrets of genetic. At the other end of the scale, case studies of individuals of outstanding creative scope have shown that a combination of factors usually contribute to the success or otherwise of the person's creative effort but these descriptions are highly individualised and not easily applied to the general case (Candy, 1999. Cognitive Modelling of Creative Knowledge Work for Interaction Design Criteria. Proceedings 4th International Roundtable Conference on Computational Models of Creative Design. J.Gero and M-L Maher (eds.), pp 57-79). In order to comprehend how the socio-cultural context impacts on individual and group creative processes, we need to examine how creative acts take place in a holistic and emerging context. This requires a methodological transformation that addresses the changes that take place in creativity potential in specific situated contexts.

Geoff Cox

It is proposed that there is a need for a redefined role for the creative subject (the producer/artist) in the light of recent debates on subjectivity, human-machine assemblages and dis-embodied exchange. The creative subject has been traditionally viewed as possessing quite distinct cognitive and mechanical processes with other workers or machines playing a secondary role, now things are not so clearly delineated. Moreover, post-structuralist theory would suggest that the artist-subject is nothing more than a rhetorical invention operating in much the same way as a creativity-machine that follows a crude rule-based system, auto-generating what already exists. In this way, both humans and machines are conceived as coded devices. If the creating subject or author has largely been discredited and dematerialised (even more so in the context of the Internet), there is a need to examine new demarcations, and the functions released by this disappearance. These questions of creative autonomy need to be inserted into the social production relations of the time, especially when people are making great claims for "auto-generative" computer artwork and creative endeavors. My position draws upon Benjamin's "The Author as Producer" essay, first presented as a lecture in April 1934 at the Institute for the Study of Fascism in Paris. In this Benjamin argued that social relations are determined by the relations of production and therefore progressive artists should try to transform those relations. The question remains how this might be recoded for contemporary creative productions using computers.

Jacob Eisenstein

In *The Structure of Scientific Revolutions*, Thomas Kuhn proposes a description of scientific change in terms of two distinct processes: normal and revolutionary science. Normal science is guided by a "paradigm," which consists of symbolic generalizations, metaphysical commitments, exemplars, and shared values, among other things. Revolutionary science occurs once scientists begin to call into question the existing paradigm. Revolutions are resolved through the election of a new paradigm. I claim that these ideas can be extended, with some caution, outside of science. For Kuhn, a paradigm was meant to refer to a shared example that serves as a model for later work in a field. Certainly this much happens in art. A paradigmatic painting—Picasso's *Les Demoiselles d'Avignon*, for example—hints at things that later painters try to elaborate on. This painting represents a sharp break from earlier tradition, while simultaneously establishing a new tradition. Within normal art, decisions can be made strictly on the basis of considerations that are internal to the discipline. The paradigm itself provides a standard for the evaluation of paradigmatic work. To be sure, no paradigm constrains decision-making absolutely. But if an artist or scientist has a rich and complete understanding of the paradigm, then social contact does not seem essential to the development of her work. On the other hand, the revolutionary artist who abandons the paradigm has no easy justification for the decisions she makes. The community will likely agree that the paradigm needs to be abandoned. But there will be no consensus as to what is to replace it, and there will not even be a standard for evaluating proposals. One of the main functions of revolutionary change in art is to bring the art form into touch with culturally relevant contemporary phenomena. The revolutionary art work that successfully appeals to cultural phenomena will be far more persuasive than the art which does not. Examples abound: consider the impact that the arrival of photography had on the development of impressionism. In order for an artist to have a deep and meaningful impact, her work must demonstrate a careful attenuation to the social and cultural world beyond her artistic discipline.

Gerhard Fischer

The power of the unaided, individual mind is highly overrated; without external aids, memory, thought, and reasoning are all constrained. The Renaissance scholar does not exist anymore. Human beings have a bounded rationality: there is only so much we can remember and there is only so much we can learn. Talented people require approximately a decade to reach top professional proficiency. When a domain reaches a point where the knowledge for skillful professional practice cannot be acquired in a decade, specialization will increase, collaboration will become a necessity, and practitioners will make increasing use of reference aids, such as printed and computational media supporting external cognition. Much of our intelligence and creativity results from the collective memory of communities of practice and of the artifacts and technology surrounding them. Though creative individuals are often thought of working in isolation, the role of interaction and collaboration with other individuals is critical. Creative activity grows out of the relationship between an individual and the world of his or her work, and out of the ties between an individual and other human

beings. The social interaction among stakeholders in design can be characterized by a "symmetry of ignorance" or an "asymmetry of knowledge". Project complexity forces large and heterogeneous groups to work together on projects over long periods of time. Knowledge bases should include not only knowledge about the design process but also knowledge about artifacts of that process—parts used in designing artifacts, subassemblies previously created by other design efforts, and rationale for previous design decisions. Designers generally have a limited awareness and understanding of how the work of other designers within the project is relevant to their own task. The large and growing discrepancy between the amount of such relevant knowledge and the amount any one designer can remember imposes a limit on progress. Distributed cognition emphasizes that the heart of intelligent human performance is not the individual human mind but groups of minds in interaction with each other and minds in interactions with tools and artifacts. Distributed cognition between the individual human mind and artifacts (such as memory systems) often function well, because the required knowledge which an individual needs is distributed between her/his head and the world. But a group has no head — therefore externalizations are critically more important for social interactions. Externalizations (1) create an explicit record of our mental efforts, one that is "outside us" rather than vaguely in memory; (2) they represent situations which can talk back to us, critiqued, and negotiated; and (3) they can be shared. Organizational learning focuses on recording knowledge gained through experience and actively making that knowledge available to others. A central component of organizational learning is an organizational memory. However, its mere presence does not ensure that an organization will learn. Today, information is not a scarce commodity; the problem is to deliver the right knowledge at the right time to the right person in the right way. Until recently, computational environments focused on the needs of individual users. As computers are being used for more complex tasks by more people, it becomes apparent that environments supporting social interaction are needed. However, this perspective does not necessitate the development of environments in which the interests of the group inevitably supersede those of the individual. Individuality makes a difference, and organizations get their strength to a large extent from the creativity and engagement of their individuals. One of the important challenges for the future is to gain a better understanding of the relationship between the individual and the social.

Bob Hughes

Any work-project can be described as a "journey through a landscape of possibilities". This is not just an arbitrary, theoretical description. First, it matches many creative workers' accounts of their subjective experience. Second, the metaphor very likely has a real, neural basis. John O'Keefe and others say that the brain's limbic system maintains a "cognitive map of the 3-D spatial envelope surrounding an organism", which is used and modified by many higher-cognitive processes - giving them a physical, spatial quality. I use the term "landscape" rather than the more general "spatial envelope" because a graph of the work process resembles a journey through a landscape: we start off at a position of safety, "pick our way" through high and uncertain terrain, and end up (hopefully) at a brand-new position of safety. These landscapes are more felt than consciously thought. Intuition and hands-on exploration are central. This is consistent with the "hippocampal explanation": spatial navigation relies heavily on physicality and unconscious processing. Hence, most of the knowledge and hypotheses we use when working are not readily communicable by language. Increasing team-size imposes an increasing "communication overhead", which eventually impedes "progress". This confirms the experience of creative workers whose managers require constant explanation, justification, preparation of plans etc. This is not to say "we always work best on our own" - only that co-workers must inhabit the same work-landscape, and share our implicit understanding of it. Work-landscapes are, of course, invisible: so senior managers usually ignore them. They give detailed orders that must be implemented faithfully. If it is a big task, they assume the more people the better. This is now a well-documented feature of the world of work: see Landauer's "The Trouble with Computers" or Fred Brooks "The Mythical Man-Month". Co-workers whose "landscape" is different from yours will tend to be confused, anxious, defensive or aggressive. Competition becomes "me against you" instead of "us against it". I propose that we should take these landscapes as seriously as our brains do, and make mountaineering the model for creative work: combining individual exploration, and team-effort co-ordinated by trust, mutual respect, and a shared, physical sense of the situation we are in.

Tom Hewett

A very old joke in the United States involves a tourist who is visiting New York City to see the sights. Finding himself confused, the tourist stops a busy New Yorker on the street to ask for directions. "Excuse me," says the tourist, "can you tell me how to get to Carnegie Hall?" Pausing briefly to think before hurrying on his way, the New Yorker responds, "Practice!" One consistent finding about creative contributions to society is that they are typically made by individuals who are experts in the domain in which they are working. The attainment of the level of expertise required to make such a contribution typically necessitates about 10,000 hours or 10 years of deliberated practice. in the domain of expertise. Deliberated practice requires conscious reflection on the skills being practiced to guide, shape, and refine them. As a result of this deliberated practice experts in a domain have a number of advantages over novices. They are better able to perceive meaningful patterns in the domain. The experts are fast at what they do and seem to utilize their working and long term memories more effectively than do novices. Experts typically see and represent a problem in their domain at a deeper level than do novices (e.g., they are better able to think about the deep structure of a problem whereas novices are more likely to latch on to superficial features). Experts have better self monitoring skills than do

novices (i.e., experts are more aware of errors and better able to make mid-course corrections in solving domain related problems). While domain expertise does not guarantee that one will make a creative contribution to the domain of endeavor, it is a necessary condition. Without expertise, nothing.

BIOGRAPHIES

Ernest Edmonds is General Chair of the Creativity & Cognition Conference series and is a Professor in the Computer Science department at Loughborough University. He has conducted research in human-computer interaction, particularly in the area of computing in art and design, for more than 25 years.

Linda Candy is a post-doctoral researcher at Loughborough University where she is currently researching computer support for the creative arts. Her main research areas include creativity research, interaction design, computer support for creative knowledge work and methods for usability evaluation. She has published widely on these topics.

Geoff Cox is an artist, teacher and projects organiser. He is presently Senior Lecturer in Media Arts, University of Plymouth working across the School of Humanities and Cultural Interpretation and School of Computing where he is part of CAiiA-STAR (Science, Technology, Art Research). Until recently, he worked at Camerawork Gallery, London.

Gerhard Fischer is a professor of Computer Science, a member of the Institute of Cognitive Science, and the director of the Center for LifeLong Learning & Design (L3D) at the University of Colorado at Boulder. Current research interests include education and computers (including learning on demand and organizational learning), human-human and human-computer collaboration, (software) design, and domain-oriented design environments.

Bob Hughes is the author of "Dust or Magic - creative insights from the multimedia world" (Addison-Wesley August 1999). He has worked as a calligrapher and teacher in the 1970s, as an advertising copywriter and creative director during the 1980s, and as a multimedia developer and creative consultant since then. Interests include narrative (including oral storytelling), science-explanation, consciousness studies, and history.

Jacob Eisenstein recently completed his undergraduate studies in philosophy at Stanford University with an honors thesis entitled: "Computers, Creativity, Kuhn: Philosophy of Science and the Artistic Machine." He is on the Research Staff of RedWhale Software, where he studies intelligent interfaces, machine learning, and the automation of design knowledge. His other research interests include machine creativity, philosophy of science, and evolutionary algorithms. He is a bass guitarist who performs regularly in the San Francisco Bay area.

Tom Hewett is Professor of Psychology and Professor of Computer Science at Drexel University, Philadelphia, PA, USA. His current research includes collaborating with a group of computer scientists developing a scientific problem solving environment. He is also part of a research group working on development of support for networked engineering design. Dr. Hewett is a published software author and has published papers both on evaluation and design of interactive computing systems, and on the use of computers in teaching.

Full Papers

Supporting Creative Work Tasks: The Potential of Multi-Modal Tools to Support Sketching
Jana Sedivy and Hilary Johnson, Queen Mary and Westfield College, London, UK

Integrating Craft Materials and Computation
Glenn Blauvelt,Tom Wrensch, Michael Eisenberg, University of Colorado at Boulder, USA

Who or What is Making the Music: Music Creation in a Machine Age
Tang-Chun Li, McGill University, Montreal, Canada.

The Split-Brain Human Computer User Interface
Gregory P Garvey, Quinnipac University, Hamden, USA.

Composition Analyzer: Computer Supported Composition Analysis of Master Pieces
Shoji Tanaka, Jun Kurumizawa, Andre Plante, Yuichi Iwadate, Seiji Inokuchi, ATR, Kyoto, Japan.

Exploring Novel Ways of Interaction in Musical Performance
Bert Bongers, Centre Visual Art, Amsterdam, NL

How do Material Constraints affect Design Creativity?
Hisataka Noguchi, Chiba University, Japan

Preliminary Observations about Music and Decentralised Environments
Dante Tanzi, Laboratory of Musical Informatics, Milan, Italy

The New Metaphysics and the Deep Structure of Creativity and Cognition
Michael King, London Guildhall University, London, UK.

Skunk Works: "Speciation" Strategies for Creativity
Vittorio Mischi, Laboratory for Digital Renaissance, Geneva, Switzerland

Full Papers (contd)

A Proposal for a Framework for General Multimedia Art Creation Instruments
Kazushi Nishimoto and Kenji Mase, JAIST and ATR, Japan

Symmetry of Ignorance, Social Creativity, and Meta-Design
Gerhard Fischer, University of Colorado at Boulder, USA.

Ontology, Aesthetics and Creativity at the Crossroads in Information System Design
Alberto Faro and Daniela Giordano, University of Catania, Italy

What Would Cezanne Think?
Carol Strohecker, MERL, Cambridge, MA, USA.

Emotion Recognition and Its Application to Computer Agents with Spontaneous Interactive Capabilities
Ryohei Nakatsu, Joy Nicholson and Naoko Tosa, ATR, Kyoto, Japan

Composing Interactive Virtual Operas
Alain Bonardi and Frances Rousseaux, University Paris Sorbonne, France

Artistic Environments of Telepresence in the World Wide Web
Luisa Paraguai Donati and Gilbertto Prado, Institute of Arts, Unicamp, São Paulo, Brazil.

A CONCEIT A Collaborative Mapping in 3 Spaces
John Lycette, Greg O'Connor, Darren Tofts, Peter Webb, Christopher Waller,Victoria, Australia.

Creativity in Design Activities: The role of analogies in a constrained cognitive environment
Nathalie Bonnardel, University of Provence, France.

A Framework that Supports Collective Creativity in Design using Visual Images
Kumiyo Nakakoji, Yasuhiro Yamamoto and Masao Ohiro, NAIST, Japan

'Fake' and 'Real' Creativity Using Computer Aided Design: Some Lessons from Herman Hertsberger
Bryan Lawson, University of Sheffield, UK