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CREATIVITY E

with Emerging Technologies

There is much to learn for the development of personalized technology systems by looking at creativity in action. By its very nature, being creative is a highly personalized process in which a person searches for original and novel ways of thinking and doing. Original and innovative outcomes, whether by the single artist in pursuit of a personal artistic quest, or by groups of designers combining their designing knowledge toward a collective achievement, arise in considerable measure from the

special and distinctive characteristics of creative ways of thinking. While everyone has the potential for creativity, not everyone is fortunate enough to have these characteristics in abundance. Of course, there are other factors, such as access to resources and, indeed, the good fortune to be in the right place at the right time. However, we claim that creativity is not accidental, and by understanding how it works, we can learn how to encourage and enhance it. By harnessing this knowledge, there are immense opportunities for the creators of innovative technologies to expand the repertoire of tools and toys that amplify the creative process.

One of the key features of creativity in people is the importance they give to the locus of control. For most, being able to determine exactly how and in what way the creative process takes place is a matter of paramount impor-

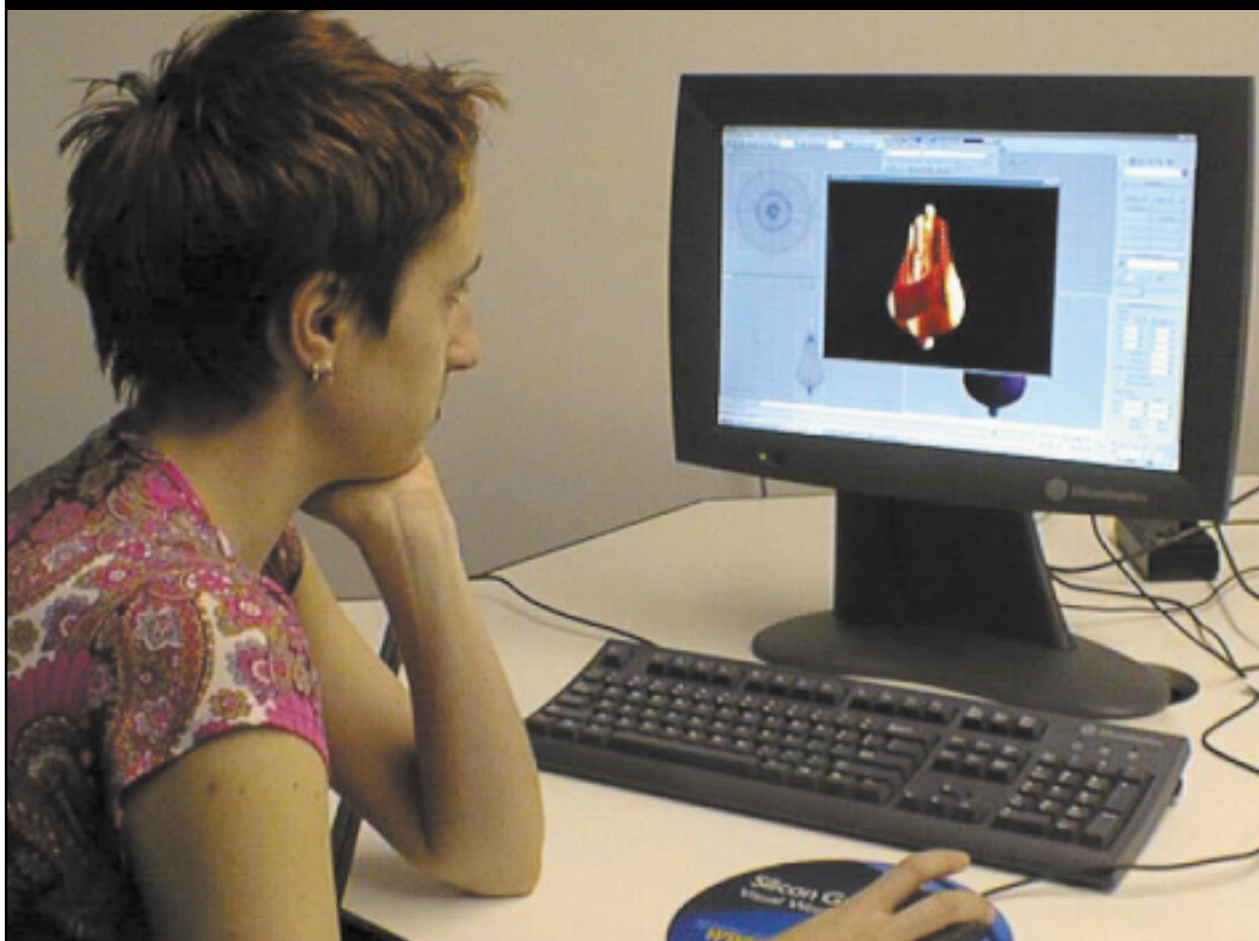
tance. This does not mean they need to personally handle every single aspect of that process, but rather they prefer to allocate the priorities and delegate tasks at any given moment. This is crucial to how successful the generation of ideas and artifacts is perceived. It also means that being driven or diverted by unsolicited factors, such as a tool that keeps breaking, can be damaging to the process at hand.

Another factor to remember is creative people are notorious for resisting rigid, formulaic approaches, and are not afraid to choose pathways fraught with risk and potential pitfalls. Experimentation with concepts, materials, and tools may initially lead to failure, but those failures are fertile ground for learning quickly how to move out of the conventional space of possibilities. Such traits mean the creative person will not be easily deflected from a chosen route and, if it involves a hard struggle such as learning a difficult technique, then so be it. This means

ENHANCEMENT

For the creative person, the ability to determine how the creative process evolves is of critical importance.

Figure 1. Bev Hood, an artist at C&CRS.



creative people are not inclined to look for easy ways to do things at the expense of achieving their creative aspirations.

If the technology is to play any part at all in extending the boundaries of human thought and actions, then a critical issue is how to design the technical systems in such a way as to foster creativity. How can personalization in new technology contribute to enhancing creativity in the light of what we know about creativity in action in the real world? In order to design for the enhancement of creativity, we need to look beyond the surface issues of the human-computer interface. This means we need to go further than designing customizable interfaces or configuring better programming environments.

What is required is a holistic strategy for developing the technology in tandem with outstanding creativity in action. There are two essential components of the strategy envisaged:

- *Multiple inputs and outputs.* Skills and expertise from key disciplines must be deployed to generate multiple perspectives on the scene; and artifacts, exemplars, and results must be delivered into a range of outputs from galleries and exhibition houses to creative media companies and scientific journals.
- *Boundary or special case studies.* Explore the lessons learned from the outstanding examples of creativity and nonstandard working practices.

Creativity and Cognition Research Studios

The Creativity and Cognition Research Studios (C&CRS) is a new concept in resource and human support provision within which different kinds of art and technology projects reside.¹ The main purpose of C&CRS is to bring together expertise and common interests deriving from prior work in both human-computer interaction and art practice using new digital media. The methodological focus of C&CRS is experimental case study work in a collaborative environment where artists and technologists work as equal partners in the exploration and development of digital technology in creative practice. The idea is to provide a base for a number of interrelated activities comprising:

- Networks of artists and artists groups, media centers, and support organizations.
- Conferences and workshops, such as Creativity and Cognition sponsored by ACM's Special

Interest Group on Computer-Human Interaction (SIGCHI) [1].

- Art/technology projects for developing new technologies and new art forms in tandem.

To gain a clearer sense of the approach, C&CRS can be compared with the PAIR program conducted at Xerox PARC, and reported by Harris [3]. The programs have some important similarities and some fundamental differences. PAIR was used to maintain and stimulate the parent organization's culture as a fertile ground for new ideas and new forms of technological innovation as one program among many others. In the PAIR case, the primary driver is to enrich the company's scientific and product capability through a flow of new technological problems to be solved. By contrast, C&CRS's main focus is researching innovative forms in digital technology and art practice. This is done by facilitating the scientific research and new art practice through enabling artists to work in a technical and physical environment not normally available to them.

The interdisciplinary focus involves combining a rich set of human expertise and technological resources toward common goals. Having a broad range of people expertise across multiple scientific and technological disciplines is essential. This is predicated upon the notion of a co-evolutionary process where the existing technology is subject to new perspectives from which technology research derives new answers.

The COSTART Project

In the COSTART Project,² using visual art practice as the exemplar domain, three basic research questions were posed:

- What are the opportunities for innovative digital technologies in creative practice?
- What are the implications of using digital technologies in creative practice for human support structures and for the software design process?
- What is the impact of using digital technologies on creative cognition?

The project focuses on a series of artist-in-residence studies of creative practice using technology (see accompanying photo). One of the main findings is the existence of a very broad range of creative digital technology projects in the visual arts. A defining characteristic of the survey respondents was the diversity of imaginative approaches to cre-

¹Creativity & Cognition Research Studios: creative.lboro.ac.uk/ccrs.

²COSTART Project: creative.lboro.ac.uk/costart

ative practice using digital technologies.

Flexibility. A number of specific issues were identified about future requirements of creative technology environments inclusive of the network infrastructure, the hardware and software platforms, and the tools and applications. In particular, the concept of flexibility requires further exploration: as an example, the user's need to develop requirements during the creative process has profound implications for the technology.

Collaboration. While learning new skills or techniques is an important facilitator for creative practice, we found the role of collaboration is integral to that process. Some artists may want to take full control of the reins of the technology because it is pivotal to the way they work, while for others, it meets a temporary

of how creativity works. Often, the initial creative process does not concentrate upon the surface qualities of the work, such as the texture of the paint or the quality of sound from a particular instrument. Rather than start with surface considerations, the artist, for example, may well start with fundamental structuring considerations. This is where a significant opportunity for augmentation arises. By using intelligent agents to generate the concrete realizations of the structure decisions, the artist can see the implications more quickly. The significant role of the agents in the user interface is to enable the artist to think and act in terms of the structures while, as a result of the agents' work, see the implications easily and quickly [2].

At C&CRS, artists and technologists are developing systems for creative exploration through virtual

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need that can be met by a supportive collaborator. Technologists with little knowledge of art practice do not make good collaborators easily. Artists need collaborators who understand or are empathetic to their goals and their need to exercise control for themselves. Working through and with the eyes and hands of the person who provides technical expertise does not work for the core creative activities although it might be acceptable for the more mundane ones.

Structure. A focus by artists on the underlying structure of art works was identified. It appears from the evidence so far that computer use in art has an impact on the concern for underlying structure of the creative product as distinct from its outward physical and virtual object realization. Thus, the obvious advantages of computer graphics and VR may be less central than they first appeared. There are two possible scenarios: one is the artist working with computers is already inclined towards this concern, and because of the very nature of the computer, is facilitated in pursuing that concern. The other scenario is the computer itself has an influence in encouraging the artist towards a concern for underlying structure because it can make such structures easily visible and enables the artist to put more effort into that aspect of their work.

Fundamental to the argument is an understanding

and physical interactivity; pushing the technology and the art forward on several fronts at once from devices to programming tools; combining creative media in collaborative ventures. An understanding of the potential for supporting creativity is being pursued with the strategy of using multiple knowledge inputs and generating multiple forms of output, supported by the boundary case studies of expert artists at work. ■

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3. Harris, C. *Art and Innovation: The Xerox PARC Artist-in-Residence Program*. MIT Press, Cambridge, MA, 1999

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