Retrospective on the MCC Human Interface Laboratory

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Introduction

On July 27, 1990 MCC's senior management in consultation with the participating companies in MCC's Advanced Computer Technology Program elected to terminate MCC's Human Interface Laboratory. This decision ended a six and one-half year effort to build a large, integrated, multidisciplinary research program on user interface technology. The Lab produced numerous prototype technologies, many described in CHI conference proceedings. Nevertheless, its struggle to integrate the research disciplines, involve the participating companies, and survive changes in the structure of research funding provide a microcosm of difficult issues facing other user interface research programs.

Conceived in 1982 and established a year later, MCC was an experiment to see if industrial competitors could cooperate on precompetitive research. The strategic objective was to leverage R&D expenditures on large scale projects that none of the participating companies could afford to undertake alone. The original plan called for four programs: Packaging/Interconnect, VLSI-CAD, Software Technology, and Advanced Computer Technology. This latter program was designed to respond to the Japanese initiative in fifth generation computing, and consisted of research on parallel processing, symbolic databases, AI, and Human Interface.

The purpose of this panel is to present to the CHI community the lessons learned, both technical and organizational, in the rise and demise of MCC's Human Interface Laboratory. We will describe the vision, the technology prototypes, the technology transfer challenges, and organizational conditions that permeated the Lab's existence. The panelists include some of those who played key roles during the Lab's short life. Each will present a unique perspective on the Laboratory and its research produce. These perspectives will range from manager to researcher, from producer to consumer, and from MCC to participant company.

Bill Curtis
Director, Software Process Program
Software Engineering Institute
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The Human Interface Lab was born in December 1983. I was asked to join the Lab as the founding Technical Director, since the Program Vice President for Human Interface had little previous experience in user interface technology. The original participating companies (CDC, DEC, Harris, Honeywell, NCR, Sperry, and later Bellcore and Kodak) suggested three initial interest areas that included speech recognition, machine vision, and a vague request for more easily used interfaces. After an assessment of progress in speech and image recognition research, it was decided that MCC would have difficulty accelerating the pace of results already being achieved at MIT, Carnegie-Mellon, Michigan, and other research universities. Thus, we did not believe that undertaking research in these areas at MCC would provide the participating companies with a competitive advantage over non-participants in fielding products based on these technologies. The research program was initially designed to accelerate the pace of developing user interfaces that integrated knowledge-based capabilities (natural language, intelligent advising, design assistance, etc.) with media-based capabilities (graphic metaphors, interactive worksurfaces, handwriting recognition, etc.). The integrating concept was to be an intelligent user interface management system that integrated these technologies. This focus also supported the goal of integrating interface prototypes with results from other Advanced Computer Technology Program projects.

The research goal required multidisciplinary research. Accordingly we hired specialists in artificial intelligence, computer graphics, cognitive psychology, electrical engineering, computational linguistics, etc. We established four groups: language-based dialogues, intelligent user assistance, graphics-based dialogues, and mul-

ti-media integration. Rivalries were strong as groups competed to establish their place in the disciplinary pecking order. An operational decision to allow the individual teams to pursue their separate research agendas reduced the need for a Technical Director position, so in 1985 I joined MCC's Software Technology Program to build the Software Process Research area.

In 1985 and 1986 the four research groups each worked toward their own prototypes, with little effort on integrating them into a common interface architecture. In part, this represented a bottom-up strategy where the initial technologies had to be prototyped before it was possible to determine what functionality would have to be supported in an integrated architecture. In truth, however, these schisms represented the difficulty of building a multidisciplinary research team. 'Paradigm wars' characterized much of the effort in the early years, with each group establishing its own beachhead. The research groups focused on building research efforts that were acceptable within their discipline, rather than creating new paradigms that integrated characteristics across several disciplines. During his sabbatical at MCC in 1986, Don Norman tackled the problem of allowing the building of prototypes to get separated from answering the scientific and technical questions about the principles behind the technology. Technical integration cannot be achieved until the notion of multidisciplinarity pervades the cultural atmosphere and becomes an accepted group norm. If this attitude does not emanate from the research group, it must be imposed from the leadership through building active collaborations toward a common architecture. 'Paradigm wars' were a fundamental problem limiting the integration of research results in many of MCC's software-based programs during the early years.

James D Hollan
Director, Computer Graphics & Interactive Media Research Group
Bell Communications Research

I was director of the MCC Human Interface Laboratory from January 1987 to April 1989. As my part in this panel I will describe the research program we followed during that time, speculate about the forces that resulted in the termination of the laboratory, and endeavor to focus the discussion on the strategic issues influencing the maintenance of vigorous long range competitive research.

My primary goal when I came to the Human Interface Laboratory was to change the focus of the lab from a number of small independent research efforts to one ambitious integrated long range research project. I was convinced that the laboratory had the potential to do some truly exciting work on a scale appropriate to the MCC long range research vision. To focus the laboratory on a project that took full advantages of the resources and facilities of MCC, I coordinated research within the laboratory around the construction of an integrated interface design environment. We envisioned the tools we were building as evolving from an integrated Human Interface Tool Suite (HITS) toward a general user interface design environment (GUIDE) with ever increasing support for the overall process of interface design. HITS and its planned evolution into GUIDE were the experimental vehicles for grounding, motivating, and coordinating our scientific and technological efforts.

HITS was a research prototype. It was a mechanism to aid us in attempting to develop the scientific and technological foundations for principled and efficient construction of collaborative multimedia interfaces to high-functionality systems. We were led to build HITS by a concern with the role of tools in supporting the complete interface design cycle, the role knowledge plays in the development of such tools and in their integration, the importance of a flexible run-time environment to support multimodal interaction, and the need to develop a new metaphor to mediate the way to think about collaborative interfaces and the tools used to construct them.

During my tenure at MCC the Human Interface Laboratory moved from being a set of fairly independent small research groups into a large focused research group united around the construction of HITS and the underlying research ideas we were addressing with it. We had a very successful release of HITS to shareholders and were in the process of the development of a second release when I was asked to reorient the laboratory away from one integrated effort and away from long term research. I did not think this was the right strategic decision nor was I willing to do it.

Looking back at the evolution of the HI Laboratory, I will focus primarily on identifying major influences that are not confined to this one laboratory, but have had important effects on MCC as a whole and may be impacting other research laboratories. These forces are perhaps a bit clearer at MCC and may have operated somewhat faster there due to its youth.

The deep question the panel should address is not just what happened at MCC, but rather how any lab is to effectively pursue large scale long range research in human interface design. If we are not able to more effectively do that, we will continue to attack big science problems and issues in small science ways.

S. Joy Mountford
Manager, Human Interface Group
Advanced Technology Group
Apple Computer, Inc.

I was the leader of the Visual Metaphor team at MCC from 1984 to 1986, on assignment from Honeywell, Inc. I joined Apple at the end of 1986 as the manager of the Human Interface Group. Since then I have been involved in considering whether Apple should invest in several of MCC's programs.

I would like to illustrate some of the similarities and differences between MCC and Apple in the area of technology transfer. MCC has fostered an environment of scientists working on long-term research investment for several different computer companies. In Apple's Advanced Technology Group, we have a stronger engineering population working on advanced product development with a shorter term horizon. Apple's user is the purchaser of our machines, MCC's user is the software engineer at a parent company who may develop the MCC work further .

Apple's Human Interface Group develops a few key interface technologies for transfer to product development. Success is measured in terms of enhancements made to our family of products. The role of MCC's interface group was similar, developing a few interface advancements for use by all parent companies. The more companies that used MCC developments for their internal uses the greater the likelihood of funding.

Technology transfer is the key to a successful research and development environment. This transfer is relatively straight forward at Apple since there is one main platform of which we all develop our prototypes. Unfortunately, at MCC this transfer is not as easy, since all the parent companies have different hardware and software platforms. MCC typically developed on Symbolics machines in Lisp, and the parent companies were inexperienced in this environment. Transferring people with technology is another key feature to be supported which is difficult at MCC given the dispersed geographical locations.

Apple could invest in MCC to support new work for which we do not have in-house expertise, or to add additional capabilities to our platform by porting their research tools. However, big competitors to MCC are the universities who Apple already aggressively funds at affordable prices. Students will frequently transfer to Apple which brings us even more direct technology transfer. Unfortunately, much of MCC's existing software is difficult to port to our platform. MCC has multiple masters to help direct their research efforts so the impact and directness of communication is much less than unique funding of a university group. Furthermore, with the additional emphasis on legal protection for interface designs, companies are finding it harder to cooperate with other companies who may be competitors.

In order to make technology transfer successful, the same magnitude of investment needs to be spent back home to prepare for the receipt of the research or advance development. Most parent companies cut back their research funding at home due to the funding of MCC, and did not have enough resources to properly take advantage of their earlier investment in MCC. The same metric needs to be applied for companies to receive their own internal research projects.

I believe the major challenges facing every U.S. company is how to enrich the lives of people with affordable, usable technology. In order to meet this challenge the U.S. still needs to establish a collaborative, cooperative research center. A strong national program is needed if the U.S. is to stay ahead of foreign competition. A key to such a research group's success is the early establishment of better technology transfer mechanisms.

George Collier
Computer Graphics & Interactive Media Research Group
Bell Communications Research

During the last two years and a half I had a part in creating a futuristic prototype of an application designed to support OSP telephone engineers. The MCC HI Laboratory created the ideas and technology which originally inspired the work. The transfer of this technology has been relatively successful, in fact, recently, a multi-million dollar project was started to develop a product based on the work. Drawing on this experience, I would like to use my time to develop a metaphor for the process which I participated in. I will assume the worthiness of the goal of tech-transfer.

In our society, the lonely genius is a powerful and important image of a scientist. Consider Einstein or an artist, struggling in a garret or patent office, creating that essentially personal and idiosyncratic invention which is fated (despite first misunderstanding) to revolutionize the field and bring its author everlasting fame. Rather than the lonely artist or scientist I would argue that a tech-transfer-ist (a horrible neologism) is like a primative trader of goods. Such a trader voyages up the river visiting strange and mutually hostile communities searching for common ground and opportunities to barter. The foundation of trade is respect for the partially understood ways of these communities and faith in the enduring power of enlightened self-interest. The tech-transfer-ist trades the goods from down the river for the goods of the people up the river.

In my case, I traded with MCC, the OSP Planning and Engineering area in Bellcore, Computer Technology Transfer area in Bellcore, Applied Research in Bellcore, and others. I traded in software, time, ideas, publicity, people, papers, inspiration, etc. Fundamentally then, I believe that in order to create tech-transfer we must take inspiration from the class of adventuresome merchants such as Vasco da Gama, despite the lowly image of this profession. The goods we trade in will be many and varied, not easily measured in that coinage of the scientific professions: number of professional papers per year. We are, however, already merchants, for successful scientists and engineers are in the business of selling ideas to a professional community. On the other hand, the number of great artists, discovered dead of hunger, draped over their revolutionary paintings is tiny. I suggest that we have the skills to sell our ideas, we need simply to broaden our community and increase our range of trade goods.

Requiem - Bill Curtis

I returned to the Human Interface Laboratory in December 1989 after it had been without leadership for almost 9 months. During this time, rising costs and departing companies left the Lab desparately short of funding after 1990. Four fundamental problems hindered raising the funding required to stabilize the Lab.

First, during the mid-1980s most American corporations decentralized their financial decision-making down to the division level and below. While making business decision-making much more flexible and responsive, this had a profound effect on research funding. Senior management is responsible for the future positioning of a corporation a decade out, and is able to justify substantial funding for long-term research. Division management is responsible for profit performance on a quarterly basis and wants research (advanced development really) to effect product revenues within 18 months. The effect of decentralizing the research funding for the Lab was to change the motivation for investing in the research. Although long-term research was still the stated interest, short-term deliverables became the coin of the realm.

Second, a corollary of the decentralization of funding was that typically no individual division-level manager could provide the full funding needed for membership in the Lab. Thus, participation costs had to be syndicated across numerous divisions and often matched by corporate R&D. This magnified the amount of time required for marketing. Pressure was placed on the entire Advanced Computer Technology Program to split into smaller components to reduce the funding needed for each project, and to allow companies to join that could not afford the tariff for the entire program. This pressure to split the research programs for funding purposes eventually pervaded each of the Labs comprising the Advanced Computer Technology Program, with the consequent impact of eliminating any drive toward research integration.

Third, the emphasis on shorter-term deliverables made technology transfer an even more critical issue in funding decisions. The Lisp machines that had been a boon to producing faster prototypes in most research areas, became a bane because division-level staff under pressure to produce products did not have the time to port Lisp machine software into their own languages and platforms. In many cases funding decisions were damaged by the absence of advanced development staff to receive MCC technology and transform it into productizable software, and by the realization of line organizations that they were ineffective in using software developed in their own R&D laboratories. Lack of funding for technology transfer activities became a debilitating issue in the decision to fund the Human Interface Laboratory.

Finally, human-computer interaction is a young field. Most of the senior members of this field are in their forties, and those in corporations have not risen much past middle management. Thus, in most American corporations there is not a senior manager whose responsibility is user interface. Similarly, there is not a single location or manager where corporate responsibility for user interface has been placed, as would be the case with database, compiler, or operating system products. Thus, user interface does not exercise the influence in corporate politics and funding decisions that older, more established computer technologies exercise. The growing importance of user interface in the marketplace may improve this situation. However, for a company to effectively capitalize on this trend they must have an organizational focus and senior leadership to pull together the resources to establish usability as a corporate product quality goal.

In the final analysis, these four trends compounded to shrink the funding for MCC's Human Interface Laboratory below the level needed to support the critical mass required for an MCC scale research effort. A smaller effort was difficult to justify, since it would compete with lower priced research in universities. Thus, the Lab succumbed to these pressures as MCC began restructuring itself to accommodate national changes in research funding.