Renaissance Panel: The Roles of Creative Synthesis in Innovation

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Abstract
The Renaissance ideal can be expressed as a creative synthesis between cultural disciplines, standing in stark contrast to our traditional focus on scientific specialization. This panel presents a number of experts who approach the synthesis of art and science as the modus operandi for their work, using it as a tool for creativity, research, and practice. Understanding these approaches allows us to identify the roles of synthesis in successful innovation and improve the implementation of interdisciplinary synthesis in research and practice.

Keywords
Hybrid Practices, Management, Innovation, Design, Art, Creative synthesis, Creativity, Interdisciplinary Work.

ACM Classification Keywords
H5.m. Information interfaces and presentation

Introduction
On the occasion of this gathering of the CHI community in Florence, we expand on the modern interpretation of the Renaissance ideal of creative practice through multidisciplinary synthesis. This 'creative synthesis' is an approach that combines people, tools and methods from different specializations to foster the innovation

process. This panel brings together experts in the practice of synthesis whose interdisciplinary work in human-computer interaction helps define the advantages, disadvantages and methods of fostering collaborative innovation.

We highlight four main roles for synthesis in innovation through expert perspectives that address the problem at different organizational scales. At an individual level, *hybrid professionals* use multi-disciplinary approaches for problem-solving. At a group level, *synthetic managers* foster interdisciplinary collaboration to investigate complex topics. At the macro-level, new tools and resources are being developed to enable creative synthesis across professions. At the societal level we observe large-scale systems that directly support the development of tools for synthesis and the formation of interdisciplinary groups. These methods can expand not only the application but also the underlying science of HCI.

The participants in this panel serve as case studies to inform products and practices in ways that foster creative synthesis. We also contrast creative synthesis to the dominant academic practice of specialization, and highlight the social barriers that discourage and sometimes disallow interdisciplinary work altogether.

Rise of the Hybrid Professional

Until recently the diagnosis of ancient art was a subjective practice based on historical and literary analysis. The transformation of this field in the past two decades was spearheaded by Prof. Maurizio Seracini, an art diagnostician practicing in Florence and trained in medical imaging techniques in San Diego. By applying medical equipment and know-how to the process of understanding how and when paintings, sculptures and architecture were created and changed, it became possible for the first time to have an objective analysis of artistic authorship and authenticity. This hybrid practice emerged out of the widespread availability of x-ray, infrared and ultraviolet imaging equipment in the medical field capable of scrutinizing flesh in high detail - and the lack of any such techniques in art restoration.

A Florentine by birth, Seracini was aware early on of the potential for applying such techniques to exploring the nanometers of paint that distinguish one artist's contribution from another on a painting, as well as to find hidden works behind paint or even through walls. Precision scaffolds were developed to allow the delicate cameras to pan steadily across a work of art; and specialized software was designed to allow technicians to compare different wavelengths for differences that indicate historic alterations. In his most analysis example to date, Seracini was able to discern the master’s sketch from subsequent layers in Da Vinci's *Adoration of the Magi* at the Uffizzi [1]. While Seracini's methods are far more accurate than traditional art history analyses, his conclusions encounter obstacles because of the economic and cultural value that are attributed to paintings. He continues to face opposition from art historians and curators whose interpretations and professional status his analyses threaten. Prof. Seracini’s career serves as a demonstration of the power of hybrid professionalism, as well as the problems faced when treading in a specialized field carrying tools from another world.

New practices can also serve to revitalize traditional industries, providing social benefits to local communities. Sergio Dulio, who worked on the IBM team that developed the CATIA three-dimensional

modeling software, is bringing mass customization to the Italian shoe industry by building on the tradition of high quality craft. Traditional cobblers used a hand-carved wooden ‘last’ or shoe form. By scanning each wearer’s foot and producing a computer-machined last, shoe-makers can produce high-quality footwear that fits each consumer ideally. The synthesis of CAD/CAM techniques and the shoe-making industry can revitalize a community that has for centuries been built on individualized production.

Interdisciplinary Managers

The invention of new human-computer interaction techniques often results directly from applying digital tools to existing applications. This method can yield an incremental improvement much as we find in traditional product development. Prof. Hiroshi Ishii of the MIT Media Lab has used a "top-down" approach to transform interaction through a conceptual leap that is methodically applied to various domains. He practices two types of creative synthesis directly as part of his work: the fostering of interdisciplinary groups and the application to multiple professions ranging from the technical to the artistic.

Prof. Ishii is commonly thought of as the father of Tangible User Interfaces [2], an interaction paradigm which seeks to seamlessly merge the digital and physical worlds through direct manipulation and ambient interfaces. Hiroshi's early success was spurred by a collaborative work platform (Clearboard) developed as part of his professional engineering work, which was based on the need for multidisciplinary collaboration on an intuitive shared interface. Upon arriving at the Medialab, Ishii's work became the product of a collaborative multi-disciplinary team that worked through various disciplines, bringing art and design together with engineering. The seminal 'Tangible Bits' paper was the synthesis of his work and that of two students (Underkoffler and Ullmer). The tangible paradigm has since evolved with each new member of the group. The synthesis of these fields has emerged as a tool for the exploration of the tangible interaction domain, with the assumption that any new interaction technique be applicable in at least three distinct domains. Prof. Ishii applies creative synthesis as a method to both generate and evaluate new ideas for broad-ranging impact. While his work is one of the most cited within human-computer interaction, it remains hard to contextualize in the broader HCI community.

Tools and Resources for Synthesis

The explosion of digital content has spurred the development of tools that help us digest it, in part by synthesizing disparate information sources into a readily perceived whole. Scientific visualization illustrates the need for tools that allow synthesis to be performed abstractly and across disciplines. Visualizations are necessary to understanding the relationship between different entities, but most visualization is concerned with pre-determined areas of interest and as such do not lend themselves to the serendipity of interdisciplinary synthesis. Tools such as *Many Eyes*, developed in part by Fernanda Viégas, extend this with conceptions of collective intelligence [3]. Many Eyes supports the construction of a wide variety of visualization paradigms resulting from one or more sets of data. This approach supports the synthesis of visualizations across domains by multiple users, each adding unique interpretations to the dialogue. These visualization approaches set the groundwork for a

shared presentation of data that can drive communal acts of creative synthesis.

Economies of Creativity

The ability to synthesize knowledge from disparate fields is nurtured by the availability of not only tools but also the larger-scale systems that make the resources available for cross-disciplinary work to take place. Web repositories such as Wikipedia and Project Gutenberg concentrate on making textual information freely available. But a wealth of multimedia content remains hard to parse. Paolo Galluzzi, the director of the Museum of History of Science in Florence, has placed the entirety of the museum's holdings on-line to foster research. These include works on paper as well as three-dimensional objects and the associated curatorial text, audio and video annotations. This enterprise necessitated the development of spatial software to organize the immense collection in a way that could be explored chronologically, thematically, and so on. By making scientific knowledge available in an intuitive interface, Galluzzi's virtual museum is both a resource and a tool that encourages creative synthesis.

Specialization is so entrenched in our practice that interdisciplinary creation relies on new social systems to enable professionals in different fields to work together. The free software movement directly fosters interdisciplinary work on individual and group levels through frameworks that allow anyone to contribute to the development of large-scale software projects. Free software is built on shared languages, discussion forums and repositories. Pioneers such as Benjamin Mako Hill embrace this notion of a 'free culture' that encourages contributions from experts and amateurs alike. At the organizational level creative synthesis depends on the availability of information and the structuring of systems that foster its exchange. But free software and open information repositories face direct opposition from intellectual property conventions such as copyrights and competitive business practices such as closed hardware and software. A collaborative means of attribution such as the creative commons license will facilitate the implementation of creative synthesis at various levels of the innovation process.

Conclusion

The dialogue between experts in this panel offers a perspective that seems somehow intuitive to members of the CHI community: that synthesis is the key method of operation. This stands in contrast to the nature of research specialization. This panel presents a group of experts that inform our understanding of synthesis as a systematic methodology for individual, group, and societal innovation by illustrating its practice in various interdisciplinary works on different scales. For these researchers and practitioners, synthesis offers insight into creativity and the creative process not possible within traditional models.

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