

Chapter VIII

From the Physical to the Virtual: Bringing Free-Choice Science Education Online

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Abstract

This chapter proposes a series of strategies for recreating science center exhibits online. It argues that while physical and electronic exhibits share certain common features, electronic science interactives based on physical exhibits must be re-conceived in terms of the strengths of the electronic medium. Like a televised magic show, digital media allow any number of special effects that interfere with the immediacy and raw authenticity of an onsite physical demonstration. This interference is inherent in any mediated experience. Rather than trying to overcome it, we suggest alternate approaches that take online users deeper into the scientific concepts underlying the physical phenomena on exhibit in the physical galleries. We outline several strategies that we have successfully used to engage user's imaginations and emotions in online science activities, to foster motivation, and to provide an initial conceptual framework that supports the learning process.

Introduction: New Interactive Approaches for New Interactive Media

“Interactive” museum exhibits and “interactive” human-computer systems were both born in the late 1960s (Hein, 1990). In fact, the earliest usage of the term comes from computer science and not museums (Oxford English Dictionary). However, first the Exploratorium in San Francisco, and then its progeny, picked up the term and developed increasingly sophisticated physical interactive exhibits during the 1970s and 1980s. Many of the exhibits designed in this period are still canonical in science centers around the world. During this same time, interactive computing remained mostly a laboratory curiosity (Apple’s Macintosh, the first personal computer with an interactive graphical user interface, was introduced in 1984). While many museums began experimenting with computer-based exhibits during the 1980s, few approached the sophistication and conceptual scale of their mechanical counterparts in the physical exhibit galleries. Many electronic interactives were variations on reference guides or trivia quizzes. By the time powerful desktop computers and sophisticated multimedia authoring tools finally enabled the production of high-quality electronic interactives in the 1990s, the pedagogical approach, design philosophy, and construction methods needed for physical science center exhibits had been articulated and formalized well enough for the Exploratorium to publish the first in its series of exhibit construction “cookbooks” (Bruman, 1991; Hein, 1990). Electronic exhibits, on the other hand, had no design principles or foundational best practices of their own. Few educational multimedia producers were (or are today) formally trained in computer science in general. Information architecture and interface design have only recently become specialties in their own right, and theories of virtual reality are still not widely applied to inform or justify design practices. Video games were (and often still are) seen as the educationally impoverished enemy in the same category as television, rather than as a model to be emulated (Prensky, 2001; Gee, 2003). But by the end of the 1990s, exhibit developers began to articulate best practices for electronic interactives based on watching visitors use them in the museum. These rubrics mostly focused on eliminating common hardware and software design flaws, rather than articulating an underlying approach to interaction design, or the process of conceiving the user’s experience while working with the program (Gammon, 2000).

With the advent and explosive growth of the World Wide Web in the mid-1990s, usability came to the fore as a widespread concern in the commercial sector, and usability experts such as Jakob Nielsen have helped codify principles of sound design that make Web-based materials user-friendly (Nielsen, 2000). After nearly a decade of serious Web design experience, Web developers now know a lot about how people use Web sites and what makes them usable. Usability analysis focuses on efficiency and user success at pre-determined tasks such as information seeking for personal research or completing an electronic commerce transaction. As we recently observed, these metrics, while helpful in preventing or remedying basic design problems, do not provide much guidance in structuring free-choice learning experiences online (Schaller et al., 2004).

While the genre of hands-on museum exhibits has its own underlying paradigm based in constructivist learning and cognitive science, development of online interactives has

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