Science in the Science Museum: Representations of Science for the Public

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Abstract

Science museums remain integral sites for the communication and production of scientific knowledge for and amongst the public. Whether entertaining, socially oriented, educational, or all three, museums continue to draw audiences and present science in innovative ways. More recently they have begun to challenge traditional views of science by encouraging increased social engagement from their audiences. In this vein, public understanding of science is not simply about conveying information; it is about understanding the nature of science and its place in our world. Ranging in topic and type, three exhibits from the Science Museum of Minnesota (*Disease Detectives*, *Mysteries of Catalhoyuk*, and *Race: Are we so different?*) all demonstrate how a modern science museum constructs and mobilizes science for the public. This project carries out a case study of each of these exhibits by drawing on semiotic and rhetorical frameworks to study of how they communicate particular scientific knowledge (microbiology, archaeology, and genetics and anthropology). It also explores how exhibits construct the broader picture of science as a discipline as well as how they engage visitors as social actors. This case study helps to open up the museum as a rhetorical space and provide a richer understanding of the ways in which modern museum exhibits continue to function as critical texts in the public sphere.

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Chapter 1

Introduction

This project is driven by a democratic goal: to explore, understand, and improve the way that science museums represent science for the public. For the past two-hundred years, the relationship between science and government has been growing closer and closer. Facing environmental, energy, health, and a myriad of other public concerns, the public's ability to understand and engage meaningfully with science is critical to its civic agency. Yet, as acknowledged by sixty years of scholarship on science literacy, the public's ability to act with what has been called an "adequate" (Doorman 1989) or "real" (Durant 1992) understanding of science remains problematic. The science museum, as a popular site where the public encounters science—both as children and then as adults—plays an important role in developing a public savvy in the ways of science.

Fundamentally, the public's understanding of science is a communication problem—a rhetorical problem. The effectiveness of science communication (especially science museum exhibits) impacts the public's ability to understand, employ, and act on scientific ideas in their civic lives. There are two related prongs to this problem. The first might be

termed the Accommodation Problem. This is the argument that the public needs a larger scientific vocabulary in order to read, understand, and criticize the ideas of science in their daily lives. For, if the public does not understand how stem cells work, how can they properly engage in policy debates about them? The second prong I will term the Image Problem. This is the argument that the public needs a richer understanding of what science is in the first place, for it is the public's understanding of what science is as a discipline within its social, cultural, economic contexts that most importantly impacts their basic relationship with science. The two problems are related, of course; the image of science emerges through (or below) the accommodation of science. Through exhibits on genes, global warming, atoms, nuclear power, dinosaurs, the human body, or a myriad of other engaging scientific and technological topics, the science museum represents and communicates an image of science that implicitly establishes how the public thinks about what science is.

I take the idea of an "image of science" from two sources. S. J. Doorman (1989) uses this phrase to effectively explain the democratic potential of science communication. It is worth outlining his two arguments here. First is what Doorman calls the "public relations argument," which is based upon the belief that the public is skeptical or distrustful of science. The public relations argument assumes that this distrust is a result of flawed understanding of what science is; improving the public's understanding of science will remedy this mistaken impression and restore their trust in science. "Hence: it is in the interest of the scientific community to promote public discussion of science by offering the public a popular, though accurate, image of science" (Doorman 1989, 3). Doorman terms his second argument the "democracy argument," and he bases it upon the assumption that for a democratic society to function, its public needs to be informed on

issues that matter to the state. Thus, "public discussion about science will contribute to informed opinions, provided it takes place against the background of an adequate popular image of the character of science (e.g. its provisional nature, and the limitations of its claims)" (Doorman 1989, 4). In both of these arguments, the public's understanding of what science is—as a discipline and as a set of culturally embedded processes—is seen as an inherently valuable social goal. That goal is not merely an improved appreciation of science or increased knowledge of scientific principles, it is a richer, more accurate image/understanding of science itself.

Using similar arguments, John Durant, a notable museum theorist and the United Kingdom's first professor of Public Understanding of Science, also employs the phrase "image of science" when he discusses what occurs in science museums and science centers. His experience in these institutions points up the weaknesses of the representations of science he sees in museums:

> The image of science that I find in most science centres is one of clear, elementary principles waiting to be discovered by anyone with sufficient child-like curiosity and adult patience to search them out. By contrast, the image of science that I find in most science museums [. . .] is one of sure and solid progress in the mastery of nature. In both cases, science itself emerges as a fixed body of knowledge and practice, more or less totally beyond either doubt or dispute [. . .]. (Durant 1992, viii)

For Durant, these images of science sharply remove science from the contexts in which it develops and, in turn, from the public. In doing so, they undermine the democratic potential of museum exhibits.

Over the past three decades and in light of arguments like Doorman and Durant's,

science museums have more and more embraced a mode of display that highlights the science that undergirds the thematic content typically presented. This move is a result of continued social, philosophical, and rhetorical theorizing on the nature of science as a discipline and social practice—the strength of its epistemological claims, the social and rhetorical nature of its conclusions, and the complex relationship between economics, politics, and the advancement of science. As these more academic concerns filter into the public sphere, notions of science literacy and public understanding of science have evolved. The result is a move away from a view of science literacy based on specific facts and theories and toward a view of public understanding of science that embraces how science actually works, the provisional nature of scientific conclusions, and the way science's agenda responds to politics and culture. It is, in short, a shift to a concern with the public's image of science.

As exhibition designers have become more attuned to these concerns and to the way that their exhibits represent science, they in turn become more aware of the rhetorical effects of their choices, for it is through design and content choices that the messages promoting a particular image of science are constructed. Thus, in light of these arguments and these developments, this project is an inquiry into how the accommodations in science museum exhibits—what they say about scientific ideas and themes—construct a particular image of science. Thus, this project is an attempt to address the following research question: "How do science museum exhibits represent science for the public?"

The rhetorical nature of representation in museum exhibits can be grounded by linking it to the civic and educational goals of classical rhetoric, by locating a rhetorical concern within the museum literature itself, and by recognizing that it is their rhetorical nature that makes exhibits at times so controversial. First, the way that museums represent

science for the public and the effect this has on the public's civic potential has a strong connection with classical rhetorical theory. Rhetoric, a discipline forged in the heated forums of debate in ancient Greece, is concerned with the use of reason, emotion, and authority to persuade others of right, truth, and value in civic contexts. Aristotle's definition of rhetoric as the ability to "see the available means of persuasion in each case" was developed primarily with regard to discourse in the assembly, the law courts, and other public forums (Aristotle 2007, 1.1.14). Similarly, public museums—in their various artistic, historical, scientific, and technological forms—use arguments, entertaining displays, and their "epistemically privileged museum authority" (Hein 2000, 5) to establish the truth and value of important civic and cultural ideas. The discourse in museums is also civic in that it is civilizing: it promotes the values and ideas on which an informed, engaged citizenry relies. And museums recognize the need for effective public discourse to achieve these ends.[1] Thus, both museums and rhetoric share a common focus on the civic power of discourse in public spheres. The fact that this occurs not only in its explicit display content but also in the implicit messages that the exhibit tells about science only more strongly links museum communication to rhetoric.

Second, the rhetorical nature of museum representations (both explicit and implicit) is evident in both the rhetoric literature and the literature on museums. Broadly, Bruce Ferguson claims that, "Like rhetoric itself, [museum exhibitions] might be best described as strategic systems of representation; strategies whose aim is the wholesale conversion of its audiences to sets of prescribed values to alter social relations" (Ferguson 1996, 178). In her introduction to *Politics of Display: Museums, Science, Culture*, Sharon MacDonald establishes this with regard to science:

[1] See, for example, Ravelli (2006), Kavanagh (1991), and Blais (1995)

> Museums which deal with science are not simply putting science on display; they are also creating particular kinds of science for the public, and are lending to the science that is displayed their own legitimizing imprimatur. In other words, one effect of science museums is to pronounce certain practices and artefacts as belonging to the proper realm of 'science', and as being science that an educated public ought to know about. (Macdonald 1998, 2)

These views are supported by many others who identify a clearly rhetorical foundation to the work that museums do constructing and representing areas of knowledge and areas of the world for the public (Silverstone (1994), Hooper-Greenhill (1992), Hein (1990), Bennett (2004)).

Finally—and perhaps most clearly—the rhetorical nature of exhibits is demonstrated by the controversial existence of museums like the Discovery Institute's *Creation Museum* in Kentucky (which criticizes evolutionary science to advance a young earth creationist ideology) or the Scientology's *Psychiatry: An Industry of Death Museum* in Hollywood (which criticizes the medical and mental health professions to advance Scientology's therapeutic methods). The very existence of these institutions is evidence that the museum is a critical site for winning the hearts and minds of the public toward particular ideological and epistemological points of view. And, since at the center of the exhibits at both of these institutions is a criticism of the discipline of science itself, the effort of these exhibits to affect the public's understanding of what science is demonstrates the rhetorical power of all museums to inculcate a particular representation of science.

The rhetorical potential for science museum exhibits to construct controversial representations of science for the public is evident in more mainstream exhibits as well. Following on the heels of the Enola Gay controversy at the National Air and Space

Museum, the Smithsonian Museum of American History's 1994 exhibit *Science in American Life* attempted to historically situate the advancements of American science in the 20th century. It displayed twenty-two case studies, organized around five themes: "Laboratory Science Comes to America," "Science for Progress," "Mobilizing Science for War," "Better than Nature," and "Science in the Public Eye" (Gregory and Miller 1998, 215). A hint at the controversial aspects of this exhibit can already be found in the titles to these sections, but more importantly, "the exhibition's remit is explicit in its title: it deals with the extrascientific impact of science—that is, it deals with the social, rather than the science itself" (Gregory and Miller 1998, 217). Though characterized as anti-science by its critics, this exhibit took an atypical perspective, showing science and its effects on society, the good (penicillin and contraception) as well as the bad (the atomic bomb and DDT). Thus, it praised and blamed particular scientific discoveries by assessing the impact they had on American life. The exhibitors of *Science in American Life* recognized that their task "involved walking a difficult line: to present an honest view of the past that avoids taking sides yet still credibly addresses issues that capture the imagination of a contemporary audience" (Molella and Stephens 1996, 97-8). However, the controversy that erupted over this exhibit demonstrates the rhetorical challenge—both political and social—of representing "an honest view" of the history of science.

That the rhetorical nature of exhibits and their representations for public ends is grounded in classical rhetorical theory, and recognized by the rhetoric and museum communities, and that this is pointed up by the very existence and goals of controversial exhibits, exploring the nature of the representations of science in science museum exhibits, embed this project within the subfield of the rhetoric of science. In particular, the science museum exhibit falls within the public dimension of the rhetoric of science. As

sites where the public encounters science, science museums represent a particular rhetorical challenge: "When the jargon of science is officially employed, it intimidates the layman. When it is voluntarily adopted, it represents a desertion of a particular audience, that of the common citizen" (Wander 1976, 228). Traditionally, however, this aspect of the rhetoric of science has received the least amount of attention. Instead, the discourse of the rhetoric of science tends to center on two primary areas: the hard case and the disciplinary case. To make the hard case that science and scientific knowledge is rhetorical, first and second generation rhetoricians of science explored the rhetorical practices of both scientific giants (e.g., Newton, Darwin, and Watson and Crick) and modern professional scientists. In other words, the rhetoric of science has been traditionally concerned with exploring the rhetorical dimensions of "what scientists think and do" (Reinel 1999, 163). These analyses have lead to disciplinary reflections about whether rhetoric, as a theoretical framework and method, is able to understand, analyze, and explain these practices. In the process, the public dimensions of the rhetoric of science—how science is accommodated for the public and how it is mobilized to persuade in a variety of forums—has been less developed.

When this area of the rhetoric of science is developed, it tends to focus on public policy. For example, in his thorough "Introduction" to the *Landmark Essays on Rhetoric of Science: Case Studies* outlining the scope and subareas of the rhetoric of science as a discipline, Randy Allen Harris defines public science as "the quest for legitimation and authority that science often pursues in public" (Harris 1997, xxxiii). These public arenas include the more traditional civic contexts where the place of rhetoric has always been obvious: courts and congressional hearings.[2] Studies in this vein make the important

[2]See Weaver (1997), Waddell (1997), and Reeves (1997)

connection between science and its role in public science policy, but they leave underdeveloped the ways that science is used to create the public's relationship with science in the first place.

Public policy, of course, relies on the public's support, which is built on the public's understanding of science: funding levels depend on the degree of support for science, and the public's views on topics like stem cells, global warming, and nuclear power remain important. But before science is used in law courts, congressional hearings, or other political and policy contexts, the public encounters science in schools and media—and as emphasized here, in museums. In other words, before science is mobilized to effect public policy, science is mobilized to define the public's understanding of science. Sites and forums for public science establish the legitimacy and authority of science below the purely political arenas where that legitimacy and authority are again used and renewed. Together they lay the groundwork for how the public conceives not only of the scientific ideas under discussion, but of science itself. As I will discuss in Chapter Two, this shifts the rhetorical focus from judicial and deliberative contexts and genres to epideictic ones.

Even though museums are concerned with civic discourse and they play an important role in establishing the groundwork for public science policy, they clearly challenge traditional rhetorical theory. As Alan Gross (2005) has noted, the multimodality of the museum exhibit "seems to stretch the machinery of classical rhetoric beyond the breaking point" (5), Here Gross recognizes that rhetoric has largely been concerned with oral and written discourse, and the adaptation of it as a theoretical framework for analyzing other kinds of texts threatens to undermine its critical value. However, Gross and others have already taken up museums from a rhetorical point of view, and when they do, they tend to locate their studies in one of three ways: as objects for rhetorical criticism, as

opportunities for theoretical refinement, or as sites of public memory. Treating the museum generally as an object for rhetorical criticism, Dickinson et al. (2005, 2006) unpack the implicit ideological narratives in history and cultural exhibitions in order to illuminate the potentially disruptive work museums carry out, even in their goodwill to educate and celebrate. Using criticism to help refine and extend rhetorical theory, Gross (2005) profitably extends Perelman and Olbrechts-Tyteca's notion of presence and in doing so makes a case for future rhetorical analyses of museum exhibits. Gross (2006) answers his own call for expanding rhetorical theory by importing Habermas's notion of "systematically distorted communication" into the rhetorical toolkit and demonstrating its usefulness by analyzing the revision process of an historical museum exhibition. Using rhetorical criticism to explore public memory, Hasian (2004), Katriel (1993, 1994), and Taylor (1997) all study museum exhibits in order to understand the role museums play in producing and reproducing culture. Thus, though museums in their visual, multimodal, spatial, and material facets stretch rhetorical criticism, this has not stopped critics from profitably exploring them.

However, while the science exhibit exists at the intersection of public accommodation, civic engagement, and public policy, making it amenable to rhetorical analysis, the science museum and its exhibitions have not been thoroughly explored from a rhetorical point of view.[3] This dissertation proposes to begin remedying this lack by analyzing the way that certain science museum exhibits construct and represent science for the public. To do this, I carry out a qualitative case study of the Science Museum of Minnesota that combines semiotic and rhetorical tools to explore the science museum exhibit's textual, spatial, and

[3]Jorgensen-Earp (2006)'s work on the Titanic exhibition is one of only a few who deal directly with an exhibition in a science museum, but her work is more focused on metaphors and visual display than on science itself.

visual processes of accommodation and the ways that these represent science for the public. Primarily, this dissertation looks at the way that science is constructed by museum exhibitions in order to do the persuasive work of moving the public to think and ultimately act differently. Without assuming a correct way to represent science and knowing that different representations can emerge in one and the same museum (even within the same exhibit), this dissertation looks at representations of science in a science museum in order to understand how those representations position the public. To do this, the rhetorical nature of the exhibit must be explored, for it is not only *what* the representation of science is that matters, but also *how* the museum constructs and activates it that is critical.

Thus, that rhetoric has something to contribute to the understanding and evaluation of civic popularizations of science, particularly as it constructs science through public museum exhibits, is not news. Museums are clearly rhetorical simply because they are thoroughly discursive, public, and civic institutions. But in what way are they rhetorical? What does it mean to refer to museums as rhetorical? I take up these questions in Chapter Two, where I demonstrate that because they praise the artifacts and ideas they display, because they entertain and educate their audiences, and because they reinforce and potentially alter cultural values, museum exhibits serve as exemplary instances of epideictic rhetoric. Before turning to this discussion, the remainder of this chapter describes the research site, the three exhibits studied, and then outlines the remainder of the dissertation.

The Science Museum of Minnesota

Located in Saint Paul on the banks of the Mississippi river, the Science Museum of Minnesota (SMM) is a large, hybrid science institution. In 2008, the SMM had nearly a 900,000 visitors, and, combined with its outreach to the broader Minnesota community, the SMM and its exhibits reach well over a million people every year. The museum itself comprises 370,000 square feet, including 80,000 square feet of exhibit space. The remainder is allocated to an Omnitheater, employee offices, exhibit fabrication studios, a state of the art collections facility, and restaurants and shops. The SMM was chosen because is serves as a representative of a class of modern science museums found across the country, making it a useful choice for a collective case study exploring the way that science museum exhibits represent science for the public.

Three factors make the SMM a representative institution. First, its mission statement—"Turn on the science: realizing the potential of policy makers, educators, and individuals to achieve full civic and economic participation in the world" (Science Museum of Minnesota 2009)—captures the museum's value as an educational, economic, and civic institution, which are the hallmarks of modern museology. In light of recent shifts in museology, museums across the country are re-envisioning their roles in the community to engage more than just educational goals: they envision themselves as accessible sites for the promotion of citizen engagement. The SMM's goal, then, reflects a broader trend.

Second, the SMM is neither a science museum nor science center, but a blend of the two. Traditionally, the science museum is an institution driven by large thematic exhibitions, collections, dioramas, and many didactic panels. The science museum is more

akin to a natural history museum that emphasizes science. The science center, on the other hand, is epitomized by the Exploratorium in San Francisco. It is an institution driven less by collections (in fact the science center may have no collections to speak of) and more by interaction, where visitor participation is key and the installations tend to be smaller, more distinct, and less connected to an overarching narrative. As a blend of the two, the SMM merges interactive components with large thematic exhibits. The exhibits chosen for this project thus integrate both kinds of exhibit elements. This institutional blending is more and more common in science museums across the country, where science center principles (those of interaction and engagement) are embraced by museums that were traditionally driven by collections and thematic exhibits.

The third feature that makes the SMM representative of the larger class of science museums in the United States is the fact that it builds and rents traveling exhibitions and OmniTheater films. While there are a million visitors to the museum proper, the SMM's exhibits are seen in 54 other United States museums and museums in ten other countries, raising the number of people that encounter the SMM's productions to almost two million. Fabricating and renting out their exhibits to other institutions means the representations of science at the SMM get propagated across the country. While fabricating exhibits and renting them is an important source of revenue for the SMM, it also rents traveling exhibits from other sources. This circulation of exhibits between institutions means that major science museums have become more similar. Large museums in cities across the country share many of the same exhibits, thus flattening out the differences between them, at least in terms of the large exhibits they display. Of course, all institutions will have their own exhibits and collections, but many of the large exhibits that draw the public in have been or will be seen elsewhere. Thus, many of the exhibits that enter or leave the SMM

find homes in other institutions, helping to make the SMM a representative of the larger class of science museums.

The Exhibits

In this dissertation, I explore the question of how science exhibits represent science through three exhibits at the SMM, each chosen because together they represent a broad array of topics and exhibit styles.

Disease Detectives

Disease Detectives, an exhibit created by the the Science Museum of Minnesota, premiered in January 2008. It provided visitors an opportunity to explore disease-causing microbes through the science of epidemiology. "In this immersive exhibit, museum visitors investigate infectious disease mysteries by role-playing various medical professionals. Participants meet interactive patients, analyze lab tests and learn about the transmission and prevention of infectious diseases" (Fink 2008). The three cases ("The Birthday Surprise," "World Traveler Blues," and "The Unwelcome Visitor") address three different modes of disease transmission: food- and water-borne, airborne, and vector-borne. The exhibit also addresses personal stories, current science, and activities on the history of infectious diseases, the body's defenses, and flu prediction. Because of its immersive, experiential focus, this exhibit highlights an interactive, inquiry-based mode of exhibition. While remaining highly textual and visual, its main emphasis is to place the visitor in the roles of doctor, lab technician, and epidemiologist. Thus, rather than simply conveying the nature of science didactically, it embodies it. For a virtual tour of the

exhibit, please visit: **http://www.diseasedetectives.org/**

The analysis of this exhibit occupies Chapter 3, where I argue that as an interactive, inquiry-driven exhibit, *Disease Detectives* nevertheless creates a representation of science that falls squarely into the deficit model: creating a passive public and missing opportunities to engage social, political, and economic issues surrounding infectious disease. This is reinforced by the titular "detective" metaphor. As such, *Disease Detectives* serves what I call the paradigm case for the public understanding of science.

RACE: Are we so different?

RACE: Are we so different?, (hereafter *Race*) a spring 2007 exhibit sponsored by the American Anthropological Association (AAA) and designed by the Science Museum of Minnesota, explores the relationship between science and race and the life of the concept in society. The exhibit is part of a larger AAA sponsored project (`http://www.understandingrace.org`). As a major portion of this larger project, the exhibit explores three themes: the lived experience of race, the science of human variation, and the social history of the idea of race. These three themes are developed in a free-choice, non-linear exhibition. The exhibit and attendant website have both won a series of awards (Steffensen 2008), and the exhibit will continue to tour the US for the next six years. For a virtual tour of the exhibit, please visit:
http://www.understandingrace.org/about/virtour.html

I turn to *Race* in Chapter Four. Because this exhibit's goal is to affect the way that the public thinks and acts regarding race. The image of science is functional here rather than thematic. In other words, the scientific information is mobilized to alter a social reality, not to front the science itself. Yet, as it seeks to effect social change, I argue that the way

that the representation of science is generated through a fundamental dissociation between race as a socially real concept and race as a scientifically invalid one. In the process of making this dissociation, Anthropology is exonerated for its role in generating and propagating racial science. This leads to an inaccurate historical representation of science through a traditional progress narrative, which, once again, reinforces an image of science that does little to empower the public to engage in science more broadly.

Mysteries of Çatalhöyük

Mysteries of Çatalhöyük, a 2001 exhibit created by the Science Museum of Minnesota, displays an ongoing archaeological dig in central Turkey. The excavation is of one of the earliest known neolithic city-like settlements in human history. For this reason, the discoveries found there and the insights these offer us about early human existence are fascinating in their own right. However, because of the political realities on the ground in Turkey, the exhibit team was unable to return to the United States with any real artifacts. Thus, because of the exhibit's unique relationship with artifacts, much of the exhibit communicates the process of science: the scientists and their methods are displayed more prominently than the conclusions they have reached about the site and the people who lived there. The goal is to develop a "real" public understanding of science. For a virtual tour of the exhibit, please visit:

`http://www.smm.org/catal/virtual_tour/tour_the_exhibit/`

Mysteries of Çatalhöyük's depiction of science as a social process is taken up in Chapter five. Because this epitomizes the attempt to develop the Public Understanding of Research—what in the next chapter will be identified as the most recent iteration of a civic minded approach to science literacy—how this exhibit constructs science is attended to

very closely. I argue that the exhibit's representation of science results in a number of tensions, most notably between what it means for science to be a social activity. While this exhibit does an effective job elaborating on the process of archaeology, because it represents a particular archaeological methodology, there is an inherent limitation to the degree to which the public may walk away thinking that the process depicted in the exhibit applies to other, perhaps other more "scientific" sciences like physics, biology, and chemistry.

Conclusion

Together, these three exhibits span a range of display topics, types, and goals. While they do not capture all the ways that science exhibits might represent science, they do cover three typical exhibit modes. The remainder of this dissertation explores the themes and exhibits described above. In the next chapter, I begin by drawing on a Deweyan conception of scientific and social inquiry in order to ground the museum's civic motivation to promote a public understanding and ability to engage with scientific and social inquiry. I then discuss science literacy, public understanding of science, and public understanding of research as the manifestation of these Deweyan goals in the literature on science communication broadly. Next, I discuss the rhetoric of science museum exhibits in more detail, showing how they embody the functions of epideictic discourse. The purpose of this chapter is to review the literature on epideictic, science museums, and the broader philosophical foundations that drives the way that the science museum represents science for the public. In the Chapter Three, I describe the methods used to discern the representation of science in the SMM. Chapters Four, Five, and Six contain my analyses of

the exhibits described above. carry out. Finally, In the conclusion, I offer some summative remarks about the rhetoric of science museums and the potential for science museum exhibits to build the public's understanding of science in order to affect social action.

Chapter 2

Public Science Exhibits as Epideictic: A Review of the Literature

This project's driving concern with the image of science constructed by science museum exhibits and the potential of these images to empower a critical public places it in three bodies of theory: John Dewey's pragmatic philosophy, the public understanding of science, and epideictic rhetoric. Accordingly, this chapter explores the scholarship representing these three theoretical frameworks, incorporating key sources from museum theory along the way. Much has been written about each of three areas, and I do not intend to be exhaustive here. Instead, this review is selective. Its goal is to establish the nature of the concern with how exhibits represent science and then to establish that these representations and the exhibits that communicate them are epideictic.

In order to establish the rhetorical concern with how museums represent science for the public, I first begin with a review of the debate between John Dewey and Walter Lippmann. I start here because the arguments they had over the proper role of the public

in democracy ground any discussion of what the public is able to know and act upon as informed citizens. Science museums, because they educate citizens on science, are part of an industry that promotes an informed, civically engaged public. In other words, science museums are inherently Deweyan. Because of their Deweyan role accommodating science for the public, I next turn to the bodies of literature on science literacy, the public understanding of science, and the public understanding of research to flesh out the frameworks that drive the communication of science in the public sphere. Finally, I locate these frameworks and the exhibits that embody them within epideictic rhetoric. As sites of public accommodations of science, exhibits not only celebrate and entertain, they educate and have the power to alter important social values. Consequently, when driven by the public understanding of science (or science literacy or the public understanding of research), science museum exhibits function epideictically to change the publics with whom they communicate. As they do so, exhibits celebrate an image of science. What that image looks like is this project's guiding question.

John Dewey: The Public, Science, and Inquiry

The call for a civically engaged public to understand a particular image of science can be found in John Dewey's pragmatism, which serves as an important theoretical foundation on which to ground any discussion of the public understanding of science in general and the democratic potential of science museum exhibits in particular. Dewey joins a deep concern with the public, democracy, and education to a theory of inquiry that he believes will contribute to a civically engaged public. That the museum community has embraced his philosophy only helps justify the fit for applying his philosophy here.

The central issue over the public's ability to traffic in science and whether this is required for a robust democracy—the question at the bottom of any concern with the public's understanding of science—is captured in the Lippman/Dewey debate. This debate pitted a technocratic model of policy making based on an elitist conception of government and a deep skepticism about the possibility of an educated, civically engaged public (Lippmann (1993)) against a pragmatic model based on an understanding of the public's origins and continual development that necessarily linked the public with the state through communication (Dewey (1927)). In *The Phantom Public*, Lippmann arrived at his elitist conclusion by arguing, first, that an enlightened and politically engaged public had never existed, and second, that perpetuating the myth of an educated public participating fully in governmental policy decisions was unhelpful, misleading, and counterproductive for the advancement of democracy. After all, the decisions of the state are many, and the public is in no position to become competent to a useful degree in one of those areas, let alone all of them. Instead, Lippmann argued: "What is left for the public is a judgment as to whether the actors in the controversy are following a settled rule of behavior or their own arbitrary desires" (Lippmann 1993, 135). Thus, Lippmann concluded that the place of the public is to align itself with a party or elite decision-making body, make certain that the appropriate decision procedures are followed, and stay out of areas that are beyond its scope and understanding.

With this conclusion Dewey could not have disagreed more. Though he appreciated and respected Lippmann's arguments, in *The Public and Its Problems* Dewey attempts to clarify the proper role of the public in order to explain how it became, in his words, "eclipsed" and how it might again reoccupy its correct position. Fundamentally, the state, Dewey argued, is originally generated through an interacting public communicating and

working cooperatively to address a set of community problems. Because of the intimate relationship between the public and the early state, Dewey argues that in a democracy, the public is inherently necessary for the legitimation of the government, and thus Lippmann's argument that it should be a mere collective referee for elite decision-making relegates the public below its true station. Consequently, the possibility of a politically engaged public is justified by the origin and nature of the public itself. The public's route out of eclipse is through shared experience and communication, the same route that led to the existence of the state and the public in the first place. Instead of relying on experts to dictate policy, as Lippmann argued, Dewey is after a public that communicates.

As science and public policy have become more and more tightly bound, the public's understanding of, relationship to, and facility to discuss science has become part of the problem of the public's eclipse, and it is here that educational institutions like museums have a role. Acknowledging Lippmann's central problem, Dewey notes that in many public policy issues, "The questions involved, questions of science, agriculture, industry and finance, are highly technical," which leads him to ask a rhetorical question: "How many voters are competent to measure all the factors involved in arriving at a decision?" (Dewey 1927, 136). The solution, for Dewey, is to develop the means of communication whereby these questions can be discussed by the public. But this improved communication is not to be accomplished by increasing the public's scientific vocabulary. While an admirable goal, Dewey argues that the discovery of "methods of instruction [. . .] which will enable laymen to read and hear scientific material with comprehension, even when they do not themselves use the apparatus which is science" do not yet exist, and hence will not solve the problem (Dewey 1927, 164). This allows Dewey to move away from a concern with the problem of accommodating scientific information and instead

focus on the problem of conveying the image of science as a process of inquiry.

Dewey's understanding of inquiry, science, and its relation to the democratic public sphere is critical because it creates a different public image of science and reinforces a new relationship between science and the public. While "the technological application of the complex apparatus which is science has revolutionized the conditions under which associated life goes on," the public may not "understand how the change has gone on nor how it affects their conduct. Not understanding its 'how,' they cannot use and control its manifestations" (Dewey 1927, 165). Until our public institutions (schools, museums, and the media) begin to properly treat the "how" of science (*i.e.*, science as inquiry), Dewey argues that the public will continue to be lost, abdicating its responsibility to those in the guise of scientific authority. Understanding science as a process of inquiry will provide a foundation for social inquiry, the process whereby the products of science enter the realm of public policy.

By treating science as mode of inquiry, Dewey effectively humanizes it, making it less abstruse and more familiar. He does this by identifying the general pattern of inquiry that covers three realms: common sense, science, and the social. In each case, the pattern is the same, thus giving the general public—who has copious amounts of experience with the common sense type—a foothold on the scientific realm. Dewey formally defines inquiry in his specialized vocabulary as "*the controlled or directed transformations of an indeterminate situation into one that is so determinate in its constituent distinctions and relations as to convert the elements of the original situation into a unified whole*" (Dewey 1991, 108, italics in original). This definition holds for all three realms. Inquiry begins with an indeterminate situation; the situation is deemed (and defined as) a problem; the definition of the problem prefigures possible solutions; via reasoning, these solutions are

refined in order to arrive at one that yields a working hypothesis that is then tested; evidence is gathered and then used to transform the situation and solve the problem. For Dewey, this process is the same whether you seek the source of an odor in your kitchen or if you seek the structure of DNA.

While Dewey's conception of science is, of course, more complex than this (as is his conception of common sense inquiry), the general pattern holds. As he argues, "The attainment of unified method means that the fundamental unity of the structure of inquiry in common sense and science be recognized, their difference being one in the problems with which they are directly concerned, not in their respective logics" (Dewey 1991, 84). For my purposes here, the common logic of inquiry that grounds both science and common sense demonstrates that science is accessible, at least in general terms. This is emphasized by two features relating these modes of inquiry.

First, in both realms—the scientific and the commonsensical—the definition of the problem occurs linguistically, for it is only once the problem can be set in words that we can begin to form hypotheses for its resolution. The definition of a problematic situation, while determined by external objective conditions (*i.e.*, reality), is never truly objective or free from the issues of framing, especially at the highest level of social interaction. This fact raises the concern that the simple origins and beginnings of the process of inquiry are not merely the unproblematic statement of a problem. Further, it requires locating the situation and thus the problem within its appropriate context. We can, of course, inquire into a problem with a set of prefabricated terms, but the inquirer must at least attempt to be conscious of the source of these terms in the process of inquiry. Otherwise the confinement of a prefabricated language may prefabricate the solution. This, to some degree, must occur; however, while we may wish that the inquirer would attempt to be in

control of that language as much as possible, she must at least be aware that at bottom the definition of the problem is one that may need to be inquired into if the solution or resolution reached is inadequate. While the language of scientific problems is more abstract and disinterested than that of common sense inquiry, it is nevertheless a language, and, for Dewey, this makes any problem (and possible solution) provisional, revisable, and open to new possibilities. The public can identify with this, for to an even greater degree, their own common sense inquiries are linguistically defined. Consequently, the linguistic nature of all inquiry places science in a familiar epistemological position.

The second feature is that scientific inquiry is built out of common sense, so there is a fundamental sense in which the problems that science grapples with are ultimately graspable by the public. Yet, this relationship is problematic: "The paths of communication between common sense and science are as yet largely one-way lanes. Science takes its departure from common sense, but the return road into common sense is devious and blocked by existing social conditions" (Dewey 1991, 83). Those social conditions are embodied in the language gap that Dewey acknowledged above, yet the fact that science emerges out of common sense inquiry again allows the public access to its conclusions and social import, however "devious" the route from science back to common sense might be. For Dewey, one route back is through social inquiry, which is where issues in science meet the public. Social inquiry returns us directly to the public sphere and the public's relationship to science.

Ultimately, Dewey's philosophy helps to connect common sense, scientific, and social inquiry in the museum, all for the purpose of harnessing the democratic potential of the public through communication. In Dewey's words:

> The essential need, in other words, is the improvement of the methods and

> conditions of debate, discussion and persuasion. This is *the* problem of the public. We have asserted that this improvement depends essentially upon freeing and perfecting the processes of inquiry and of dissemination of their conclusions [. . .] It is not necessary that the many should have the knowledge and skill to carry on the needed investigations; what is required is that they have the ability to judge of the bearing of the knowledge supplied by others upon common concerns. (Dewey 1927, 208)

By connecting common sense and scientific inquiry, by humanizing scientific inquiry and its provisional nature, and by helping create that return road from science to common sense by way of social inquiry, Dewey grounds the civic and communicative potential of the science museum exhibit.

Thus, Dewey's conception of the public, his treatment of science as inquiry, and his call for the public to grapple with science where it impacts society (rather than in all its technical glory), philosophically grounds the role of science museum communication for citizenship, including that which occurs in the museum. Dewey advocates a mindset, a way of thinking about science in society, and he encourages communication about scientific ideas in the public, as well as the communication of science as a process of inquiry, not unlike that of common sense inquiry or social inquiry which the public is more familiar with. In these ways, Dewey's philosophy drives both the narrow goals of science literacy as well as notions of the public understanding of science. It is to these concepts that we turn next.

Understanding Science: From Literacy to Research

While Dewey's pragmatic philosophy grounds the general concern in the public's ability to understand and grapple with scientific ideas in the public sphere, in the science museum, the exhibit's civic and educational ends have been conceptualized through science literacy, the Public Understanding of Science (PUS), and the Public Understanding of Research (PUR). These three frameworks have been promoted by appealing to the need to advance and celebrate science, educate the public in scientific facts and methods, and to promote in them a broader grasp of science as a social process in order to encourage civic engagement and social change. In other words, science literacy, PUS, and PUR ground the exhibit's work of inculcating and altering the visitors' conception and understanding of science so that they act differently in the future. In general, these frameworks aim to promote a public able to grapple with science in society, which is the larger goal of Dewey's philosophy just described.

The traditional educational goal of improving the public's appreciation and understanding of science was first developed under the framework of science literacy. Generally, science literacy "stands for what the general public ought to know about science" (Durant 1993, 129). What, however, "What the general public ought to know" means has been hotly debated for most of the 20th and 21st centuries. When it was first discussed in the 1950s (Laugksch 2000, 73), the motivation for science literacy was "likely to have been the concern of the American science community about public support for science in order to respond to the Soviet launch of Sputnik" . While locating the argument for science literacy here highlighted the general, nationalistic aim of the concept, it at also served to inspire further debate. As it went through periods of

"legitimation" and "interpretation," the concept of science literacy became more and more varied and thus less and less helpful—what counted as science literacy for one was not sufficient for another (Roberts 1983, cited in Laugksch (2000), 72).

Through the development and implementation of science literacy, two problems arose. First, just as its initiation in the 1950s stemmed from a need for public and economic support, science literacy continued to be invoked as a means of developing social and economic strength in our competition with other industrial nations. Here science literacy became too much a tool and buzzword for political and economic ends, thus compromising the educational and social goals that it was meant to serve. Second, even when these educational goals were addressed, the debates typically focused on substantive content. Arguing over what in particular the public should be literate about is partisan, ineffective, and reflects a top down model—what became known as the deficit model—of science literacy. Consequently, though it is still useful to think of scientific literacy as the general goal of what the "general public ought to know about science," there has been an important shift away from the debates about this conception of science literacy and to a richer conception of under the framework of the Public Understanding of Science (PUS).

Embracing PUS resulted in important revisions to the idea of science literacy. First, public understanding of science revises our understanding of the public. In traditional views of science literacy, the public is both deficient and homogenous. Projects in the public understanding of science problematize our understanding of the public by recognizing multiple publics, where different groups may have different relationships with science. Brian Wynne's work with the Cumbria sheep farmers in England after Chernobyl remains the most cited instance where the public knowledge and expertise contributed positively to a scientific understanding (Wynne 1996). As a result of studies like these,

Wynne and Irwin argue against a "'top-down' and dissemination-oriented model" and advance a view of the public that is sensitive to their "needs and interpretations" (Irwin and Wynne 1996, 9). This is to locate the public in a Deweyan situation; it implicates them in the contexts where science meets the public and makes room for social inquiry. Thus, the public understanding of science recognizes the public's agency as citizens.

The second revision brought about through the public understanding of science is to adopt a different conception of science. This revised conception of science is a result of continued work in science studies. By incorporating these views, Wynne and Irwin argue that in the public understanding of science "science will not be represented as a simple 'body of facts' or as a given 'method,' but as a much more diffuse collection of institutions, areas of specialised knowledge and theoretical interpretations whose forms and boundaries are open to negotiation with other social institutions and forms of knowledge" (Irwin and Wynne 1996, 8). This puts science in its context, embedding it in the society that legitimates and propagates its knowledge. Through this work in science studies, the emphasis on what John Durant called "knowing a lot about science" or even "knowing how science works" (i.e., the scientific method) was minimized, and a notion of PUS which came to include "knowing how science *really* works" (Durant 1993, 134). This shift created a public relationship with science that goes beyond mere appreciation, and it cultivated a public that knew more than just the basic facts and theories from a variety of scientific disciplines. The new model of PUS sought to foster a public that understood the nature of science as a way of knowing. Thus, the model of PUS now in favor seeks an actively engaged public that understands the way that science works as a social and cultural process.

According to Durant, "Knowing how science really works goes beyond science as

knowledge and science as idealized process to consider science as a social practice" (Durant 1993, 134). Here the move is away from an abstract and ideal scientific method (captured in "knowing how science works") and toward an image of science as a social process based upon the interactions between scientists. This locates science within the cultural context that informs it. The public, if it is to be scientifically literate in this way, needs "more than mere factual knowledge [. . .] and it needs more, too, than idealistic images of 'the scientific attitude' and 'the scientific method' [. . .] what it needs, surely, is a feel for the way that the social system of science actually works to deliver what is usually reliable knowledge about the natural world" (Durant 1993, 136). At a minimum, understanding science as a social process includes seeing the big picture of knowledge production: the development of a project, its relation to the scientific community, its completion, its reception over time, and finally its possible incorporation into the corpus of scientific knowledge. Being scientifically literate in this way begins to prepare the public to talk about, criticize, and make decisions about science. Beyond this minimum, Durant imagines exhibitions that display "the authors of all these [scientific] achievements [. . .] and the wider culture within which these people work" (Durant 1992, 10). This more complex view of science as a social process presents a picture of science that "knowing a lot about science" and "knowing how science works" misses. In order to be scientifically literate, then, one must grasp the underlying social nature of science as a process.

This move from scientific literacy, a term steeped in post-WWII and cold war values, to the more complex view of the relationship between public education and science represented by the varied approaches outlined by Durant, has recently been augmented by yet another concept: Public Understanding of Scientific Research (PUR). With scientific literacy we were embroiled in too many debates over a highly vague concept that

positioned the public as passive citizens. With Durant's tripartite definition of science literacy, supported by the public understanding of science movement, there began an emphasis on understanding science as social practice. With public understanding of research this emphasis is made a primary exhibitionary focus. The transition through these three frameworks represents an increased focus on communicating a robust and complex image of what science is.

PUR is advanced thoroughly in the volume *Creating Connections: Museums and the Public Understanding of Current Research* (2007), which united museum curators, education researchers, exhibition designers, newspaper editors, and many others interested in the public's relationship to science and technology. Writing in this volume, Lewenstein and Bonney argue for the eclipse of PUS on two grounds. First, PUS "has often carried the meaning of public appreciation of and support for science and scientists," which once again places us in the political and economic problematic, as well as within the traditional celebratory function of epideictic (Lewenstein and Bonney 2004, 66). Second, PUS remains too closely tied to quantitative views of science literacy and the deficit model of education. PUR, on the other hand, by shifting the focus to a two-pronged approach—the display of cutting edge science and display of the process of science—captures science literacy as understanding how science really works. Science museum exhibits, it is argued, are well-placed to communicate these points and to bring to life current scientific research and problems for a public affected by them.[1]

The take away from this brief history of the frameworks guiding science communication is to note the shift in focus from science literacy to the public understanding of science and research movements. This transition in the promotion of a

[1] I will explore PUR in further detail in Chapter Six.

different "image of science" has been one of empowering the public to develop a new relationship with science, a relationship that is based on an accurate understanding of science as a social process that takes place in their world. These transitions are not only educational, they empower the public and promote social change in the process. Traditionally, the celebration of science and the science exhibit's entertaining nature reinforce a particular image of science. Where these functions unreflectively construct an image of science under the rubric of science literacy (emphasizing facts, celebrating a simplistic notion of science), they reinforce a deficit model of science literacy. But criticisms of this model have led to a more reflective construction of an image of science—one that embraces a constructivist educational framework and that connects a robust public understanding of science that embraces the social, political, and cultural facets of science as a social process with a democratic, civically engaged public.

Rhetoric and the Image of Science: Exhibits as Epideictic

The concern with the public image of science is a concern with science communication. As I mentioned in the Introduction, it is via accommodations of science that the image of science is constructed and conveyed. This is a rhetorical challenge. To place the science museum exhibit within the purview of rhetoric, I argue that we must treat exhibits as instances of epideictic rhetoric. The precedent for treating the science museum exhibit and the way it represents science for the public as instances of epideictic rhetoric comes from within the rhetoric of science literature. While the traditional and most common study of the rhetorical relationship between science and the public is in terms of science policy, some rhetoricians have taken up the question of popular science, exploring the rhetorical

nature of the fundamental relationship between science communication and the public's understanding. In particular, Jeanne Fahnestock (1986) and Alan Gross (1994) have both explored public accommodations of science and the way the they represent science matter rhetorically. As exemplars of science accommodation for the public's understanding of science, science museum exhibits easily fall within the frameworks developed by Gross and Fahnestock, both of whom are critical for helping to conceptualize the science exhibit as a popular science text and for establishing the concern for the understanding and representation of science as epideictic rhetoric.

Jeanne Fahnestock (1986)'s landmark essay "Accommodating Science: The Rhetorical Life of Scientific Facts" explores what happens when formal scientific discourse (like a report or scientific article) is translated for a lay audience (through a popular magazine or a museum exhibit). Drawing from Aristotle's traditional genre divisions (deliberative, forensic, and epideictic), Fahnestock classifies traditional scientific reports as forensic rhetoric, for they are "largely concerned with establishing the validity of the observations they report," and accommodations of those reports as epideictic, for "their main purpose is to celebrate rather than validate"—traditional Aristotelian functions (Fahnestock 1986, 278-9). Fahnestock's focus is on science journalism and its "adjustment of new information to an audience's already held values and assumptions" (Fahnestock 1986, 279). Taking science journalism as a broad category and emphasizing its "adjustment" and accommodation of scientific information, it is easy to apply Fahnestock's theory to the museum, for it, too, is in the business of accommodating science rather than establishing or defending the validity of an idea. After all, the era when science museums conducted lots of original research has long since passed.

By looking at pairs of science and popular texts on the same research, Fahnestock

identifies two epideictic appeals at work in accommodations of science: wonder and application. She then finds the discursive shifts that occur as these appeals are employed. In her account, once translated for the public, the original report is presented as more certain and more significant, with hedges removed and the idiosyncratic nature of the research exaggerated. Thus, epideictic accommodations celebrating science for the public construct a particular epistemological authority that tends to misrepresent that of the original scientific document. Her depiction of the representations of science in popularized discourse helps us see that accommodations, in whatever form (and even if they do not present things in the way she describes), necessarily contribute to the public's understanding of scientific authority.

Alan Gross's "The Roles of Rhetoric in the Public Understanding of Science" also contributes to the groundwork for conceptualizing science museum exhibits and the way they represent science as epideictic. Gross's primary purpose is to show how rhetoric and rhetorical critics can contribute to the goals of the Public Understanding of Science. Rhetorical theory, he claims, has two roles here: it "is both a theory capable of analyzing public understanding and an activity capable of creating it" (Gross 1994, 5). In its analytic mode, Gross shows how rhetoric identifies two models of public understanding: the deficit model and the contextual model. Using the language of Fahnestock, he captures the core of the deficit model in this way:

> The deficit model implies a passive public: it requires a rhetoric that acts to accommodate facts and methods of science to the public's limited experience and capabilities. The goal is better appreciation of science; the genre is epideictic. (Gross 1994, 6)

As epideictic, science texts that fall within the deficit model treat communication

cognitively, ignore ethical and political concerns, and focus on "the state of the science" (Gross 1994, 6).

The deficit model is juxtaposed with the contextual one, which encourages a tighter relationship between science and its publics. Here the rhetoric of science moves back to its concern with science policy:

> The contextual model is symmetrical: it depicts communication as a two-way flow between science and its publics. [. . .] The contextual model implies an active public: it requires a rhetoric of reconstruction in which public understanding is the joint creation of science and local knowledge. The goal is better integration of the needs of science and its publics; the genre is deliberative. (Gross 1994, 6)

It is within this model that rhetoric plays its active role by making possible the rhetorics of reconstruction that effectively bring the public and science together in a civically engaged, democratic process.

When Gross turns to an example of the weakness of the deficit model and the power of rhetorical redescription to clarify a "rhetoric of accommodation," he turns to a museum exhibit, *Food for Thought*, which he claims "illegitimately reduce[s] complex effects to simple causes" (Gross 1994, 7). In other words, like the shifts that Fahnestock describes, the museum, too, is an epideictic accommodation that constructs a particular representation of science. As Gross notes, the model of public understanding that leads to *Food for Thought* and other accommodations, has serious problems: "it embodies a mistaken view of science; it isolates science from contexts that give it public significance; and finally, it cannot address the ethical and political issues science raises, or ought to raise" (Gross 1994, 7). In Gross's view, then, the contextual model is the only one that

yields truly engaged citizens with a robust public understanding of science, and museum exhibits like *Food for Thought* tend to fall outside this characterization.

In large measure Gross's assessments are correct: the deficit model has inherent weaknesses that are evident in the texts he analyzes and in the texts analyzed by Fahnestock. And as I have discussed, a meaningful public understanding of science requires more than what the deficit model can provide. In this way, the contextual model, where it is implemented, is a vastly superior way of engaging the public in science, for it is where the communication of the contextual model is deployed that rhetoric makes possible ethically, politically, and socially relevant opportunities for the public to meet science. Nevertheless, there is a middle ground between these two positions, and to get to it, I will show that epideictic discourse allows for more than the deficit model provides (even as it necessarily falls short of the expectations of the contextual model). We must push epideicic beyond its traditional treatment as a celebration described in Fahnesock, and we must demonstrate that museum exhibits do more than is captured in by Gross's deficit model. In short, I will argue that the epideictic genre has a more expansive role in promoting the public's understanding of science, one that not only celebrates science and scientific values, but also educates and promotes social change. As Condit (1985) argues, epideictic both shares and shapes community. This shaping function is implicit but underdeveloped in most treatments of the accommodations of science. In what follows, I explore how our understanding of epideictic has been expanded to embrace the functions of education and social reform. I then argue that museum exhibitions work across these four functions, thus embodying the scope of epideictic rhetoric and making possible an engaged citizenry.

Epideictic Rhetoric: Traditional and Expanded Functions

Epideictic has a rich history in rhetorical theory, and recently, theorists have come to a fuller understanding of the several purposes inherent in the genre of epideictic rhetoric. Consequently, its scope has expanded, both within contemporary scholarship and application and through a rereading of classic texts. The traditional functions are grounded in Aristotle and include praise and blame and display. These have been expanded to show epideictic's educational and social functions. In establishing the traditional functions, Aristotle defines deliberative, forensic/judicial, and epideictic as the three genres (or species) of rhetoric early on in his *Rhetoric*. Each genre has distinct audiences, ends and means, temporal orientations, and locations. In Aristotle's account, the audience for epideictic speeches are observers or judges of the performance, the end of epideictic is praise and blame of the speech's subject, and the time is the present (though he recognizes that praise and blame relies on past actions). The traditional epideictic speech is the ceremonial address exemplified by the panegyric and the encomium, modeled famously in Pericles' *Funeral Oration* (Aristotle 2007, 1.3.4). In the epideictic speech, virtue and honor are celebrated while vice and the shameful are derided.

But the Aristotelian conception of epideictic also functions through display. Etymologically, epideictic is "epideiktikon" which comes from "epideiknumi (to show or display)" (Chase 1961, 294). According to Oravec (1976) and Chase (1961), Aristotle inherited epideictic as display rhetoric from his predecessors, especially the Sophists who embraced epideictic, because as non-citizens, they were unable to participate in the forums where pragmatic discourse—forensic and deliberative rhetoric—were employed. These epideictic performances were more concerned with display than civic or future

action. Chase (1961) cites Gorgias and his "dazzling oratory" as representative of the class of sophistic speakers for whom epideictic was all about display and performance. Gorgias is a particularly good instance of display, for as he ends perhaps his most famous extant piece of epideictic—his *Encomium to Helen*—by claiming it as a mere personal diversion. Sheard (1996) similarly describes the sophistic display element of epideictic rhetoric: "Associated with sophism and sophistry from its very beginnings, epideictic discourse was burdened from the start by suspicions of the speaker's self-indulgence and opportunism, his manipulation of audience sentiments, and his distance from the interests of the community" (Sheard 1996, 767-8). The display function of epideictic, in this traditional guise, is what is typically meant by the the pejorative description of an oratorical performance as "mere rhetoric"—no substance, just style. For his part, Aristotle downplays this function in his *Rhetoric*, instead focusing on its end of praising and blaming discussed above.

Accordingly, Chase (1961) argues for a conservative reading of the rhetorical genres. He argues that this function—"praise and blame"—captures the traditional conception of epideictic rhetoric and any attempt to expand epideictic beyond praise and blame is "without adequate classical foundation" (Chase 1961, 300). While Chase recognizes epideictic's display function predating Aristotle's classification of rhetorical genres, he argues that after Aristotle, praise and blame became the *sine qua non* of epideictic discourse. For him, giving epideictic any other function or expanding the scope of what counts as epideictic to include anything that does not fall into the judicial or deliberative genres turns epideictic into a catchall concept that makes it meaningless. While appropriate to an extent, Chase's reading of epideictic is unnecessarily limiting: it misses an opportunity to theorize about the educational and social functions that result through

display and praise and blame.

This expansion of epideictic to include these functions requires a rereading of Aristotle. There are two routes for this rereading: one through a criticism of Aristotle's genre distinctions and the other through a reconsideration of the epideictic audience. The first route follows Perelman and Olbrechts-Tyteca's criticism of Aristotle's original genre demarcations in order to establish epideictic's educational function. They argue that in Aristotle's *Rhetoric*, "We are presented here with a distinction [among the three genres] of a purely practical order, whose defects and inadequacies are apparent" (Perelman and Olbrechts-Tyteca 1969, 21). The difficulty in labeling a speech deliberative, forensic, or epideictic based upon either the audience's role (as in Aristotle) or in something else is problematic because of the nature of audience and the intent of the speaker.

The fact that some audiences are not unified in purpose but are composite implies that even in some settings where the audience is local it will be impossible to determine what genre is being performed because different audience members may play different roles. Extend the audience to a universal audience and the situation becomes even more problematic. Furthermore, the speaker's construction of the audience complicates Aristotle's simplistic view that the audience's role determines the nature of the speech. On the one hand, the speaker can misread the audience and poorly adapt to the rhetorical situation. This is built into Perelman and Olbrechts-Tyteca's notion that the audience is a construction of the speaker. On the other hand, Perelman hints at the fact that the speaker's construction can effect a change in the role of the audience itself.[2] Thus the determination of genre is not easily assessed, either from the speaker or audience's point of view.

[2]Perelman's example of Marc Antony's speech in Shakespeare's *Julius Ceasar* shows how an audience might have expected to play a role suitable to an epideictic speech, but the speech itself bleeds into something else entirely.

In criticizing his genre distinctions, Perelman and Olbrechts-Tyteca lament Aristotle's easy characterization of epideictic and reformulate it, using it to ground the nature of argumentation in *The New Rhetoric* and connecting it tightly to their fundamental concepts of value-judgment and adherence: epideictic creates social unity around certain values. They argue that Aristotle ignored epideictic's relationship to values because he lacked certain concepts that they are now able to employ: value-judgment and intensity of adherence. These reconceptualize epideictic and show it to play the important role of strengthening the audience's adherence to a set of values: "The purpose of an epideictic speech is to increase the intensity of adherence to values held in common by the audience and the speaker. The epideictic speech has an important part to play, for without such common values upon what foundation could deliberative and legal speeches rest?" (Perelman and Olbrechts-Tyteca 1969, 52-3). While not oriented toward action, epideictic sets the stage for action by reinforcing the values and beliefs that will guide action in the future.

In their theory, this turns the epideictic speaker into an educator, and because it relies on traditional values—those already present in society and in the audience—epideictic speeches "defend the traditional and accepted values, those which are the object of education, not the new and revolutionary values which stir up controversy and polemics" (Perelman and Olbrechts-Tyteca 1969, 51). These traditional values are the "unquestioned and unquestionable" values that get conveyed in educational situations (Perelman and Olbrechts-Tyteca 1969, 51). Epideictic, then, through praise and blame (and even in aesthetic display), serves a deep educational function that reinforces values. This role is critical, for as Perelman and Olbrechts-Tyteca note, the time lag between speaker exhortation and audience action can mitigate the effects of the former on the latter.

Epideictic as education steels the audience against counter-arguments that may emerge between argumentation and action. Consequently, Perelman and Olbrechts-Tyteca, in criticizing the relationship between genres, in fact accept a practical distinction that reinvigorates epideictic, giving it a central, educational role within rhetoric: that of establishing and strengthening the values upon which subsequent persuasion rests.

The second route expanding Aristotle's theory of epideictic to include an educational function is through Oravec's landmark essay on the epideictic audience as "observers." By way of a close reading of Aristotle's *Rhetoric* and *Ethics*, Oravec shows that there is a relationship between the audience's roles of "observation" and "understanding," which are granted by Aristotle, and that "some aspects of epideictic work to produce an aesthetic response in the listener, and other aspects produce both judgmental and cognitive comprehension" (Oravec 1976, 167). Whereas the aesthetic aspect involves the audience's appreciation of the speech as display and entertainment, and the judgment aspect involves the audience's assessment of the speaker's ethos, it is the comprehension aspect that is directly tied to education. The audience is educated through the process of understanding the speaker and topic as objects of praise or blame, for these sorts of speeches are advisory: "often, the praise of an individual may easily serve as advice upon the future action of the audience, educating them through the imitation of great men" (Oravec 1976, 170)). In this way, Oravec arrives at the same conclusions as Perelman and Olbrecths-Tyteca, but via a different route: in epideictic, the audience—as observers—"theorize as preparation for learning and ultimately for action" (Oravec 1976, 166).

Grounding the educational function in more traditional educational environments and for more traditional purposes, Sullivan (1993) takes up epideictic in the classroom. He ably shows that through praise and blame, audiences are not simply asked to assess the

ability of the speaker; instead, they are being presented with versions of successful (or unsuccessful) individuals, and through these depictions or displays, the audience acquires a model for proper action. Thus, praise and blame is really enculturation: "Epideictic, then, has an educational function in that it brings the audience into the *ethos*, or dwelling place, of a culture" (Sullivan 1993, 72). For Sullivan, education consists of two parts: logos (virtue, practical reasoning, and reason) and pathos (cultural knowledge and emotion). In the case of the former, when teachers taught "reasoning and arrangement, the teacher was grounding the student in the culture's orthodox form of reasoning and thereby giving practical knowledge" (Sullivan 1993, 73). In the case of the latter, "teaching character, wisdom, and moral virtue was a way of humanizing the student and bringing the student into the lifeworld of his or her culture" (Sullivan 1993, 74). In both of these cases, Sullivan is arguing that not only are epideictic speeches educational in their ability to model proper social mores of the culture, but classical education itself is epideictic in that it teaches the fundamental ways of thinking and acting that the culture values. For Sullivan, educational enculturation, in whatever form, is always epideictic.

Condit (1985) also includes an educational function in her tripartite synthesis of scholarship on epideictic. For her, epideictic's power to educate is found in the "definition and understanding functions" (Condit 1985, 288). Here the speaker uses definition to "explain a social world" in order to clarify some troubling, threatening or confusing aspect of their joint lifeworld (Condit 1985, 288). This grants the speaker "the power of emphasizing the values and meaning in the paths opened for the future" (Condit 1985, 288). To round out her theory of epideictic, Condit adds two other joint pairings: display/entertainment and sharing/shaping community. Display and entertainment return Condit to the traditional functions of epideictic. Here she argues that this function of

epideictic performances allow the audience "to stretch their daily experiences into meanings more grand, sweet, noble, or delightful" (Condit 1985, 290). Similarly, the audience's judgment faculty also has an important social end: Epideictic demonstrates "the broad humane capacities" of a speaker allowing the audience to determine the quality of the eloquent leader.

Condit's third function—sharing and shaping community—captures epideictic's potential to alter society, and it follows from the more conservative educational function described above. It is also controversial. The social function of epideictic relies on educational experiences that reinforce the narratives, myths, and heritage of the culture. It educates in the traditional values of the society. However, Condit also shows that via the social function epideictic occasions create "opportunities for reformulating our shared heritage" (Condit 1985, 289). For Condit, this reformulation of community is a result of the speaker's reinforcement of particular values over others. With the power to define community (by sharing and emphasizing particular features of the culture), the speaker creates division through identification (in a Burkean sense), which alters the relationships and affiliations within the audience, and, in turn, the culture.

Epideictic's social function has been further developed by Sheard (1996) and given a strong historical foundation in Walker (2000). Like Condit, Sheard offers a synthesis of theories of epideictic, all with the aim of uncovering the social and public value of the genre. She, too, recognizes the traditional and more expansive roles for epideictic, arguing that it needs to be appreciated for "the ways in which it invokes shared values as a basis for promoting a vision of what could be" (Sheard 1996, 766). She argues that traditional views of epideictic—the ones that treat it as "mere rhetoric"— oversimplify what it can accomplish because they do not "help us explain [epideictic's] legitimate role in

institutional, social, political, or even personal change" (Sheard 1996, 768). Through her reconceptualization, epideictic becomes less of a genre and more of a feature of all discourse. And in the moments where epideictic makes itself felt, self-consciousness, self-reflection, and self-criticism leads to reaffirmation or reform. Using examples from Martin Luther King, Jr., Thomas Jefferson, Mario Cuomo, and Maya Angelou, Sheard makes her strongest case for the ameliorative power of epideictic:

> Their discourses urge change in the world by first urging on listeners a particular way of seeing that can illuminate and justify change and then appealing to a set of positive values assumed to be held in common that will guide such change. That is, the opportunity and potential for change begin with a vision of that change in the minds of those who can carry it out. In effect, then, epideictic discourse alters the reality in which it participates by making its vision a reality for its audiences and instilling a belief that the power for realizing the vision lies with them. (Sheard 1996, 781)

Epideictic, then, does more than celebrate, praise and blame, or even educate: it has the potential to push society in new directions.

Jeffrey Walker's *Rhetoric and Poetics in Antiquity* also recognizes this social function, but he locates it in a neo-sophistic rereading of the history of rhetoric. Walker grounds rhetoric in epideictic, showing that the earliest rhetorical performances were primarily epideictic, from which were born the other genres of rhetorical discourse. Like Perelman and Olbrechts-Tyteca, Condit, Oravec, and others, he links epideictic to values and future action:

> "Epideictic" appears as that which shapes and cultivates the basic codes of

> value and belief by which a society or culture lives; it shapes the ideologies and imageries with which, and by which, the individual members of a community identify themselves; and, perhaps most significantly, it shapes the fundamental grounds, the "deep" commitments and presuppositions, that will underlie and ultimately determine decision and debate in particular pragmatic forums. As such, epideictic suasion is not limited to the reinforcement of existing beliefs and ideologies, or to merely ornamental displays of clever speech (though clearly it can serve those purposes as well). Epideictic can also work to challenge or transform traditional beliefs—plainly the purpose of Plato's dialogues, Isocrates' panegyrics, and what remains of Gorgias's epideictics (particularly *Helen* and the surviving paraphrases of *On the Nonexistent*), and the sophistic Protagorean practice of antilogy that is parodied in the "speech of Lysias" in Plato's *Phaedrus*. (Walker 2000, 9-10)

Like the theorists discussed above, what Walker offers is support for the argument that epideictic reinforces cultural values and prepares them for future persuasive mobilization. But Walker does so not by expanding Aristotle or offering contemporary examples. He does so through a "revised account of the history of rhetoric in antiquity, one that understands 'rhetoric' in more or less sophistic terms as centrally and fundamentally an art of epideictic argumentation/persuasion *that derives originally from the poetic tradition* and that extends, 'applied' versions of itself, to practical discourses of public and private life" (Walker 2000, viii). Thus, epideictic's social function and its potential to promote change can be seen in contemporary expansion of Aristotle as well as in historical and rhetorical texts.

Lawrence J. Prelli (2006), in his introduction to *Rhetorics of Display*, relies on

Walker's sophistic repositioning of the genre (as well as in Aristotle, Perelman, Burke, and others) to argue that display—as epideictic—is the "dominant rhetoric of our time" (Prelli 2006, 2). Prelli's work (and the work in his edited collection) join the traditional and expanded functions of epideictic together. As display, epideictic embraces its traditional dimension of aesthetic textual and oral performance, as well as physical and visual texts like monuments, maps, and museum exhibits. Prelli adds to this the important social function that makes these texts really matter: each text reflects rhetorical choices that have an impact on the audience and on the wider culture. These choices represent points of emphasis—what Perelman and Olbrechts-Tyteca discuss as "presence"—that both display and conceal at the same time: "rhetorical study of displays proceeds from the central idea that whatever they make manifest or appear is the culmination of selective processes that constrain the range of possible meanings available to those who encounter them" (Prelli 2006, 2). From those choices—the results of defining, celebrating, praising or blaming—culture is both reinforced and reformed.

In order to point up the central place of epideictic display today (and to bring this discussion back to museums), Prelli turns to Sharon Macdonald's collection *The Politics of Display: Museums, Science, Culture*, as an instance of the growing interest in rhetoric and display.[3] As Prelli notes, only two of the studies in Macdonald's collection are explicit about their rhetorical focus, yet his broader interest in the text is important here: "this book suggests that museums, exhibitions, and other presentations are displays of rhetorical interest and significance" (Prelli 2006, 11). That rhetorical significance is found in the choices that show forth, demonstrate, and reveal and conceal, as well as in the way the projects "expose the play of politics behind science museums and exhibitions" (Prelli

[3]MacDonald's text is discussed below in regard to how museums authorize science.

2006, 10). Prelli's concern with epideictic in science exhibits (and his concern in general) demonstrates a key facet in this important rhetorical concept (a facet that expands traditional definitions): epideictic discourse not only uses and reinforces our values, it also has the power to shape them.

The ancient genre of epideictic is thus a very powerful lens to help us see and explain the multifaceted purposes of the modern science museum exhibit. These texts celebrate, praise and blame, educate, and have the potential to alter and reform society through a reliance and emphasis on shared values. Gross and Fahnestock's precedent for discussing popularizations of science as epideictic can now be seen as embracing the more traditional functions: popularizations and accommodations were primarily celebratory, praising the science being translated. However, what made their concerns matter in the first place was that these popularizations had educational and social functions. Fahnestock's comparative analysis shows that the image of science that emerges through accommodation is different in critical ways from the science in the scientific article. In other words, popularizations affect the public's understanding of what science is, and, ostensibly, also impacts how it relates to science in the first place. Similarly, Gross's concern over the failings of the deficit model, while mostly aimed at encouraging a more rhetorically robust contextual model, also bristles at the way that science is constructed. While epideictic in the sense that they celebrate and promote scientific ideas for the public, these types of discourses are also epideictic in the sense that they educate, reinforce, and alter social values. Thus, as we saw above, Gross and Fahnestock establish the precedent for treating science accommodations and their representations of science as epideictic discourse, but the expansion of epideictic to explicitly embrace social change gives accommodations more power than they let on. As I show in the next section, this is true of the epideictic science

museum exhibit as well.

The Epideictic Functions of Science Museum Exhibitions

Institutionally, museums carry out a number of overlapping and integrated activities, including collection, preservation, research, exhibition, and education.[4] This project centers on exhibitions for three reasons. First, an exhibition is the outward culmination of many (if not all) the other purposes combined, and as such it is a captures the basis for the museum's existence. Second, many museums' fiscal health is more and more predicated on their exhibits' success in gathering a public audience, which occurs mainly through creating (or renting) large thematic exhibits. Third, the museum's exhibit is where the museum's epideictic functions are most clear. While collecting, educating, preserving, and researching have important rhetorical facets, the rhetoric of the museum really comes to life where the museum as institution meets the public, that is, in the exhibit. As epideictic, exhibition captures the four distinct (though overlapping and related) functions described in the previous section: they celebrate, entertain, educate, and promote social and cultural change. This section clarifies these functions in terms of museums and argues that it is here, as epideictic, that the image of science matters most.

In terms of traditional epideictic functions, museums in general are doubly celebratory: in their individual exhibits and as temples to the particular aspect of culture they promote, museums celebrate (and less commonly denigrate) the topics and themes they display. At the museum level, museums are but temples praising and celebrating a particular portion of public culture. At the exhibit or artifact level, the museum has made

[4]The educational facet captures part of what the exhibition does, but it also encompasses other public programs.

choices to highlight, emphasize, and praise the objects, moments, and people they display. The art museum provides an obvious exemplar. Not only does the inclusion of a piece of art in the gallery celebrate it as a piece of *Art*—essentially praising it as an instance of human creativity and ingenuity—but the whole museum is a paean to human creativity and its aesthetic variety and growth. In other words, the artistic spirit and art's cultural import are celebrated and praised by the art museum's very existence. Similarly with natural history, science, and technology museums: exhibits select particular cultural moments and offer them up for celebration, and just like the art museum, these museums' very existence celebrates their thematic areas of knowledge as central to the culturally literate citizen. Essentially, these museums celebrate what is deemed significant for the public to know.

Historically, museums have also celebrated those who created or owned them. The earliest cabinets of curiosity and princely studios were as much about celebrating the collector as they were about celebrating the collector's version of natural world. Olmi (1985), in his discussion of Lodovico Moscardo's seventeenth century collection in Verona, captures this:

> Bearing in mind that most important European princes had devoted themselves to creating museums, it seems evident that [Moscardo's] real aim was to ennoble his own activity. Not only did the creation and enrichment of a museum constitute an occupation worthy of a nobleman; they were also means of acquiring renown and prestige and of turning the owner's home into an almost obligatory sight for everyone. (Olmi 1985, 138)

Similarly, royal collections served to celebrate royal power (Hooper-Greenhill (1992)). They have also traditionally celebrated the dominant culture over the defeated one. Putting colonial artifacts and peoples on display—and in particular the nature of those

displays—established and reinforced a hierarchy that implicitly and explicitly privileged Western culture over all others (Levine 1991). Many in the museum world continue to struggle to revise these old displays and create new ones that do not reinforce old colonial relationships (Karp and Kreamer 1992). Moving past the celebration of one culture over another, the new model remains epideictic: it celebrates diversity.

Through their celebrations and promotions we can see the second of the exhibit's epideictic functions: entertainment. This is more and more the case, as some museums have become big business: they fight for tourist dollars against other forms of multimedia entertainment, they contain Imax or Omnimax theaters, and they put stores and cafes in central locations. The need to get visitors through its doors means that the museum must offer an entertaining, enjoyable, and not just educational experience. As Luke (2002) claims, "Any museum constructs a very concrete rhetoric for entertainment in the spaces of its built environment" and, as part of what he calls the "entertainment industry," the museums is "in business to keep its charges occupied, to hold them together, to engage their time and attention as a psychosocial means of furthering their containment" (Luke 2002, 2). The example of the blockbuster exhibit *Body Worlds* clearly demonstrates the entertainment functions of modern science museum exhibits. As a large, traveling exhibition displaying plastinated corpses and a number of light tables containing preserved body parts, the *Body Worlds* exhibit was, first and foremost, an entertaining exhibit appealing most directly to the visitors sense of awe and wonder (one of Fahnestock's appeals of accommodation). Faced with exhibitions of this sort, visitors, in their capacity as both observers of display and entertainment and as judges of its quality, vote with their feet on the value of museum exhibits, choosing to attend or not to the displays and exhibits that they find engaging.

The entertainment function of exhibits is most evident in the museum community's emphasis on the word "experience," which also captures the exhibit's educational function discussed next. Through visitor experiences, exhibits offer up entertaining opportunities for making meaning. This is a shift away from object-centered exhibits and towards those built on performance and interaction. Objects themselves have entertaining properties—as any dinosaur exhibit clearly shows—but the focus on experiences "takes collections seriously as a means rather than an end" (Hein 2000, 8). As Hein (2000) shows, the end of experience-based exhibits is akin to the power of a theme park like Walt Disney World "to mass produce and retail 'unique experiences' that are phenomenologically real" (Hein 2000, 80). One must look no farther than the hyperreal museum town of Colonial Williamsburg to see the extent to which entertainment becomes a primary function of museums (see (Handler and Gable 1997)). In the science museum, these experiences are typically less global. Instead, they are inquiry driven: provided with a scientific problem, visitors negotiate the different facets of the problem to determine a solution. This is an experience of the scientific principle on display rather than the uptake of it through didactic panels alone. These inquiry experiences are usually more entertaining than text panels, and if visitors are not enjoying their time with any one particular installation, they will surely move on, no matter the importance of the educational principle being demonstrated.

Education, the third epideictic function of modern museum exhibits, then, is intimately tied to entertainment. This is marked by the neologism "edutainment,"[5] which captures the typical modern museum exhibit experience. Yet whereas theme parks will

[5] According to the Oxford English Dictionary, "Edutainment" is defined as "An activity or product (esp. in the electronic media) intended to be educational as well as enjoyable; informative entertainment. Freq. attrib." The OED notes that even the first recorded instance of "edutainment" was attributed, giving the impression that its original source is unknown.

merely seem (or justify their experiences as) educational, the nature of museums requires education to take precedence: "The indispensable rules of evidence and legitimation that warrant a museum's credibility prohibit its use of some techniques of engagement—such as as those based solely on inducing fears and thrills—that enable theme parks to thrive and prosper" (Hein 2000, 85). This is to say that as "edutainment," exhibits lean more heavily on the educational side than on the entertainment side. This is evident in the exhibit's highly textual nature: the labels, the definitions, the didactic panels, and the general informational nature of the exhibit. In this way, "Modern museums are 'permanent tools' of education for the communities they serve" (Luke 2002, 218), and exhibits are their educational tools—sometimes treated as three-dimensional textbooks that "explain a social world" (Condit 1985, 288). Yet the relationship between education and entertainment implies that in the museum, education is not seen in its traditional, classroom sense. As Lisa C. Roberts (1997) notes, for museums, "education" became "too restrictive [. . . and] there has been a conscious shift toward the use of language like 'learning' (emphasizing the learner over the teacher), 'experience' (emphasizing the open-endedness of the outcome), and 'meaning-making' (emphasizing the act of interpretation)" (Roberts 1997, 8). These shifts in language help capture the fact that museums think critically about their visitor-centered learning.

Expanding on the educational half of the museum "experience," George E. Hein (1998), notes that the educational (and entertainment) function of museums has been present since museums went public in the eighteenth century (Hein 1998, 3). Today, as demonstrated in Roberts's comment above about the linguistic changes in educational discourse, museum education is less top down than it has been in the past. Marking this visitor centered educational experience is the linguistic shift to museums as "free-choice

learning environments" (Falk et al. 2007) and the spatial shift creating open environments that lack specific, directed pathways). Theorizing museum experiences through John Dewey's philosophical conception of the term, Hein (1998) advances a constructivist educational model for education that captures the visitor centered nature of free-choice learning environments. With learning—not education—center stage, Hein (1998) uses Dewey to raise the following challenge:

> Dewey's criteria of 'lively, vivid, and "interesting" [experiences],' along with good accessibility and ample amenities, may be sufficient for entertainment. They are necessary, but not sufficient for education. To make them educative represents the fundamental challenge of museum exhibitions and programs: how to transform the obvious enthusiasm of visitors into connected, engaging, integrated activities that lead to growth. (Hein 1998, 3)

Hein (1998)'s constructivist model recognizes the limits and challenges of museum learning, but his theory aims to cultivate a way to understand how visitors make meaning through their interaction with exhibit texts and spaces. Thus, Hein (1998) advances a theory that aims to capture the explicit learning opportunities created through museum experiences.

While museums and exhibits have an explicit educational nature—creating experiences for visitors to make meaning through their interaction with the installations—they are also implicitly educational: through and below their educational exhibits, museums inculcate values and ways of seeing. For example, whether through idiosyncratically organized cabinets of curiosity or dioramas, Conn (1998) argues that in older museums "'the endless glass case' of specimens, modes of representing information in museum space played a functional role in the development of object-based

epistemology" (Conn 1998, 6). These representations resulted in the development of a specific way of knowing, and they relied upon and reified particular literacies for comprehending both the exhibit and the world. Hooper-Greenhill (1992) makes a similar point, demonstrating through her masterful study of the epistemic periods of museum evolution that early museums reinforced hierarchical and political structures, they contributed to the categorization and conceptualization of a scientific worldview, and they controlled the representation of cultures (both exotic cultures and our own). Black's (2000) study of the birth of the modern museum in Victorian Britain further supports this history, describing how early museums reacted to and reinforced the social and cultural events of the day to become a force for asserting imperialistic tendencies and "the nationalistic commitment to improved public taste through mass education" (Black 2000, 9). Conn (1998) reiterates, "In this sense, museums functioned—and continue to function–as places of 'civilizing rituals"' (6; see also Bennett (1995)). While the contemporary museum's educational and civic engagement mandates have acquired a much higher priority and expanded the explicit educational function of exhibits, the museum's implicit and explicit promotion of values and attitudes through its control over content has been with us for much longer.

The final epideictic function of museum exhibits—their ability to not only reinforce but also alter social values and norms—emerges because of and through the implicit and explicit educational functions just described. While there is a concern about the museum's ability to serve as civilizing places (with all the attendant cultural and critical baggage that would entail), there is also a positive facet to the possibility that museums can do more than merely celebrate, entertain, and educate. They can also contribute to the improvement of society. The possibility of this function is best captured by Gates (2001):

> If our society and our communities are seeking ways to bring people together, help them develop trust and reciprocity, and determine the future of our democracy, museums must be part of this effort. Museums are bound by a common goal to create institutions that are successful, relevant, and supportive of their communities. But the conversations they are having now about the relationship to the community are part of a broader question: What role will museums play in the reinvention of our democracy? (Gates 2001, 55)

Gates's question expresses what has become a common concern in the museum world to harness the civic potential through museums, connect them more intimately with their communities, and in the process reinvigorate democracy.

Nowhere is this explicit civic enlightenment goal clearer than in Richard Sandell's recent work. His edited collection *Museums, Society, Inequality* brought together a number of researchers interested in answering the question "What role can museums realistically play in tackling the causes and ameliorating the symptoms of social inequality?" (Sandell 2007, xvii). While the contributers to this volume recognize the limitations of the museum in tackling these challenges, they nevertheless explicitly embrace an active role for the museum in countering social problems. Sandell (2007)'s *Museums, Prejudice and the Reframing of Difference* further explores the power of museums to make these changes by looking at a variety of exhibits that attempt to redress social ills. His focus is on the visitor: how do the exhibits he studies affect how visitors think about the issues on display. He explores the effect of museums that take an active role in changing the public's mind. Thus, on a positive level, the call for museums to embrace their potential to establish an altered, engaged, civic public is a powerful one.

But many continue to advance a different claim, one that is built out of the concern

that the museum's "civilizing rituals" are not benign (Conn 1998). This is the worry that the desire to harness the civic potential of museums is merely an attempt to complete the arc of enlightenment institutions already implicated in mechanisms of social control. Under this reading, the museum's civic role is part of the exhibitionary and disciplinary structures that control an increasingly mediated public. In other words, museums are part of the problem of a disengaged, pacified public, not part of the solution. For example, both Tony Bennett in *Birth of the Museum: History, Theory, Politics* and Eileen Hooper-Greenhill in *Museums and the Shaping of Knowledge* present landmark readings of museums that draw on Foucault's notions of epistemes and power/knowledge in order to identify the disciplinary structures and ideological impact of museums on the formation of the public.

More recently, in *Pasts Beyond Memory: Evolution, Museums, Colonialism*, Bennett (2004) has utilized Foucault's notion of governmentality to explore the ideological implications of presenting "evolutionary principles of classification and exhibition" in museums in the 19th century (Bennett 2004, 2). In particular, he shows how "distinctive relations of power are constituted in and by the exercise of specific forms of knowledge and expertise, and on the ways in which these give rise to specific mechanisms, techniques and technologies for shaping thought, feelings, perceptions and behaviors" (Bennett 2004, 5). This is to uncover the hidden power agendas built into the structure of the museum that affect the way people see the world and themselves. Kate Hill, in her study of British municipal museums of the late 19th and early 20th centuries, builds off on Bennett and Hooper-Greenhill to show that the flourishing of local museums contributed to this "formation of social identities and hierarchies" just as much as the larger national museums of the day (Hill 2005, 143). What these studies have in common is a concern

with the museum as an ideologically charged site of power and control. They argue that the very purpose and structure (both organizational and physical) of museums works to discipline the public, creating docile, impressionable bodies. In their view, developing the museums civic mission is but another step in this process. In Luke (2002)'s view, "Museum exhibitions [have] become culture-writing formations" (3).

Sharon MacDonald, in her introduction to *Politics of Display: Museums, Science, Culture* establishes this situation with regard to science and science museums:

> Museums which deal with science are not simply putting science on display; they are also creating particular kinds of science for the public, and are lending to the science that is displayed their own legitimizing imprimatur. In other words, one effect of science museums is to pronounce certain practices and artefacts as belonging to the proper realm of 'science', and as being science that an educated public ought to know about. (Macdonald 1998, 2)

This fact forces her to ask a series of important questions: "Who decides what should be displayed? How are notions of 'science' and 'objectivity' mobilized to justify particular representations? Who gets to speak in the name of 'science', 'the public' or the 'nation'? . . . What is silenced or ironed out? And how does the content and style of an exhibition inform public understandings?" (Macdonald 1998, 1). These questions raise critical points about what "science" means in the exhibit, and how it impacts public representation. Like history museum exhibits do for "history" or art museums do for "art," the science museum exhibit, over and above its thematic content, constructs and authorizes science for the public. Yet, whether we see museums as explicitly pushing for a larger civic role that empowers visitors politically or as implicitly cultivating in them the values of a particular ideology that is then manifested in other facets of their social and

political lives, the museum is implicated in—and implicates itself in—social reform.

Thus, all together, the museum exhibit's four functions—celebration, entertainment, education, and social and cultural reform—capture both the traditional and expanded functions of epideictic. As we saw earlier, Gross and Fahnestock's assessment of science accommodations as epideictic was a concern with the way that these accommodations represented science for the public. By expanding their conception of epideictic to include education and social reform and by locating those functions within museum exhibits, it becomes possible to think of exhibits occupying a space between Gross's deficit and contextual models. While they have not yet successfully created exhibits that offer authentic contexts for public engagement with science policy, they have begun to recognize in themselves the ability to alter social and cultural conceptions and relationships about science itself. This epideictic role is seen most clearly in the work of Sandell and MacDonald described above: in their explicit and implicit messages about science (whether celebratory or educational or aimed at social change), museum exhibits inculcate conceptions of science and valuations of science that will serve as a foundation for visitors' future actions.

Conclusion

In this chapter, my goal was to survey the literature that positions science museum exhibits as epideictic rhetoric by grounding them in John Dewey's pragmatic philosophy of the public and then pointing to the different representations of science available through various frameworks of science literacy. As instances of epideictic rhetoric, science museum exhibits accommodate science to the public for civic and educational ends. How

these accommodations construct an image of science impinges on the rhetorical work they do. Thus, the joining of PUS to museum exhibits clarifies their epideictic power. This chapter positions the project rhetorically and within the larger conversation of the public understanding of science. Next, I outline my methods and then turn to my analyses of the three individual exhibits, each representing a different approach to the public understanding of science. Along the way, I hope to demonstrate the epideictic character of these exhibits, and point out how their image of science positions the public for civic ends.

Chapter 3

Reading Exhibits: A Qualitative Methodology

This qualitative case study of three exhibits at the Science Museum of Minnesota is driven by the following question: How do science museum exhibits construct and represent science for the public? As I discussed in Chapter Two, this question focuses on the epideictic nature of the exhibits' representations of science for rhetorical ends, which, depending on the framework of PUS employed, promote either basic science literacy or a richer understanding of what science is. In this chapter, I outline my methods for examining these representations by first discussing the larger project as a qualitative case study. Second, I outline the textual nature of the exhibit and then describe the semiotic and rhetorical methods I employed to analyze these texts in the exhibit. Finally, I end with a brief discussion of how I collected my data.

Collective Case Study

This project brings together three exhibits from the Science Museum of Minnesota. Each exhibit in this study constitutes an individual case. According to John Gerring, "A case connotes a spatially delimited phenomenon (or unit) observed at a single point in time or over some period of time" (Gerring 2006, 20). As was described in the introduction, the three exhibits explored here represent different modes of presenting the process of science. They also vary in their exhibit topics, display styles, and educational ends. Because of their variety, the three cases chosen, while inherently interesting in their own rights, are not intrinsic cases calling for study because we need to "learn something about that particular case" (Stake 1995, 3)—what makes it salient or controversial or successful, for example. Instead, the cases here are instrumental, "to be examined to provide insight into an issue or refinement of theory" (Stake 1998, 88)—here a particular rhetorical construction of science in the public sphere. Together, this project aims at understanding something over and above the particular exhibit, which makes this project a "collective case study" (Stake 1995, 4) or what is elsewhere known as a "multiple-case study" (Yin 2002, 46) or more generally as "case study research" (Gerring 2006, 27).

Distinguished from the single case study method, the collective case study looks at one or more cases with the purpose to "—at least in part—shed light on a larger class of cases (population)" (Gerring 2006, 20). In my study, the decision to analyze three cases allows for the study of the rhetoric of museum exhibits across cases, thus providing a richer picture of the various ways that exhibits represent science. The cases have been chosen not only because they represent a variety of scientific themes (racial science, biology, anthropology, genetics, epidemiology, and archaeology) but also because they

collectively serve to present a richer picture of the variety of exhibitions in science museums than any one might provide alone. Thus, in Gerring's terms, the three exhibits have been chosen because they represent a "diverse" range of cases. Where one (*Disease Detectives*) might be studied for its interactivity or another (*Mysteries of Çatalhöyük*) for its unique way of presenting science in action or another (*Race: Are we so different?*) for its engaging a special relationship between science, culture, and political change, the three together offer a wide array of what is possible in the modern science museum.

Exhibits as Coherent Texts

This collective case study is driven by a close reading of each of the exhibits. This is to treat the exhibit as a traditional text. According to Silverstone (1994), "Museums, galleries, exhibitions are texts . . . They are structured according to their own rhetoric, a rhetoric which seeks, as all rhetorics seek, to persuade the visitor that what is being seen and read is important, beautiful, and/or true" (Silverstone 1994, 166). Through its main themes and messages, the exhibit comprises and is comprised of texts. It is this conception of exhibit as text that allows us to read it as a coherent whole. As I discussed in chapter two, the texts comprising the exhibit contribute to specific ways of conceptualizing and representing science. But combined, the exhibit's texts, together with the exhibit's non-linguistic elements, work to construct the exhibit itself as a coherent text.

Treating the exhibit as a text is to first note that the exhibit is constructed, both by exhibit designers and planners and by visitors. The exhibit designers made rhetorical choices about what information to display and how to display it. These messages and meanings are then negotiated as the visitors move through the space. Second, this

negotiation of meaning takes the form of "reading" the exhibit and co-creating meaning. The exhibit as a text is consumed as one might read a book, and the meanings found therein are a product of this collaboration of audience and designer. Foundational to this approach is a conception of narrative that underpins the exhibit as a whole: "Narratives, historical or otherwise, do provide a framework for the display of objects in the museum" (Silverstone 1994, 167). These narratives are read via "organized walking" (Bennett 1995, 179). The audience's role in making meaning out of the exhibit is even more important today, as exhibits have begun to move away from strict, sequential narratives and toward more open floor plans that embody the ideals of free-choice learning. In these settings, visitors are free to roam, allowing for quite different readings of the exhibit by different visitors.

Third, it is helpful to think of museum exhibits as texts because this is how scholars and critics treat them: by analyzing the structure and content of exhibits, scholars read the exhibit as a text, identifying key themes, arguments, and persuasive strategies. Like a poem or a speech, the exhibit is analyzed for latent meanings. Thus, besides the fact that it is constructed like a text and visitors read it like a text, at a very pragmatic level, we treat the exhibit as a text when we analyze it. Since this project "reads" the story the exhibit tells about what science is, I take up the position of critic analyzing the exhibit's text.

Reading Exhibit Texts: Semiotics and Rhetoric

To guide my analyses of the exhibit's texts, this project relies on Louise Ravelli's *Museum Texts: Communication Frameworks* (2006), which provides a semiotic method for pulling the disparate elements in each exhibition into a larger whole. Ravelli adapts M.A.K.

Halliday's social semiotic project in order to explore how meaning is created within and by the museum exhibit. In doing so, she adapts Halliday into three frameworks—organizational, interactional, and representational—which she then deploys in an analysis of museum texts at three levels: texts within the museum, the exhibition as text, and the museum as text, all of which can be 'read' semiotically. The three frameworks can briefly be described as follows:

Organization: The text's structure, genre, internal and external textual relationships, and flow of information.

Interaction: The text's construction of the position of "author" and visitor individually and in relation to each other.

Representation: The text's content and the overall story about the world that gets told—an effect, partly, of the other two frameworks.

When referring to the text of an exhibit panel or the exhibit as text, the organizational framework emphasizes the genre, structural features, and the flow of information. The way that the narrative is told, who/what is given priority, and the salience of certain features of the text all contribute to the organizational meaning of a particular exhibit. At the exhibit level, the organizational framework refers primarily to the physical structure of the exhibit, its salient features, and the arrangement of objects and other elements. The exhibit's pathway (or lack thereof), then, is one of the most important factors. The meanings afforded by the pathway depend on the range of freedom available to the visitor and what this implies about the way that meaning can be made. For example, if an exhibit is directed, with a clear linear flow, then the visitors' freedom is constrained. A specific path must be followed to get to the end point. Exhibits like these typically have separate

entrances and exits. This linear structure, which is guided semiotically by vectors, allows the museum control over the structure of the narrative. Since visitors cannot leap forward or read the exhibit in reverse, the museum's authority is reinforced. While a strict linear pathway can be consistent with a constructivist epistemology, which conceives of museum communication as a two-way, dialogic process where visitors actively construct museum messages, it nevertheless constrains the visitors' freedom to create meaning as well as their range of possible behavior. On the other extreme, exhibits can have an undirected, free-choice structure without vectors guiding movement, allowing visitors to wander as they please. These exhibits are physically constructed to promote a constructivist epistemology and to decenter the authority of the museum voice. Thus, the organizational scheme for an exhibit can have an important impact on the exhibit's messages.

As a result of the exhibit's organizational structure, different interactive roles are created, where "the degree of passivity or interactivity enabled by exhibits, and the degree of control exerted over the navigation pathways, define the authority of the institution, and contribute to the overall roles a visitor can adopt within an exhibition" (Ravelli 2006, 132). The roles afforded by exhibits contribute to the communication that takes place, for in many cases the roles must be taken up for messages to be conveyed. Ravelli's interactional framework points to the textual elements of the exhibit: how they position the visitor and what form visitor participation takes. She also notes that the colors, lighting, font, and other media choices affect the visitor's roles. Yet interactivity refers not only to traditional interactive exhibit elements (the push-me, pull-me, flip-me activities of places like the Exploratorium) but to the linguistic choices that are made throughout. The exhibit's level of formality when dealing with information can also affect an visitor's role, for formality impacts the visitor's emotional response. Consequently, at both the exhibit

level and at the level of the exhibit's text, the question asked is this: Are visitors treated passively or are they given an active role?

Exhibits are inevitably about something, so the most obvious framework for making meaning is the representational—what the exhibit actually says. At the level of exhibit texts, representational meanings are created via relationships between linguistic structures that indicate underlying connections between different displays—the exhibit tells its story by connecting distinct elements to each other (Ravelli 2006, 134). This implies that the organizational and interactional meanings all contribute to the exhibit's representational meanings. At the exhibit level, representational meanings coalesce through a variety of different means: what gets displayed, the relationships between distinct display elements, and the way that knowledge and understanding are framed. The representational framework is critical for this project, for it is through the exhibit's representational practices that the representation of science is most evident (even as it incorporates meanings generated through the other two frameworks). Ravelli's representational framework grants access to not only the "literal representational content"—the exhibit's topic— but also to the exhibit's "*approach to knowledge*," which in the science museum includes the image of science that is generated (Ravelli 2006, 134).

As Ravelli notes, the textual nature of exhibits has changed in recent years. Whereas in the past an object-driven exhibit with labels and an introductory panel may have been sufficient, when museums embraced the educational and civic role (seen clearly in the SMM's mission and in the larger motivation to develop the public's understanding of science), exhibits need "to make use of extended texts, which contextualize an object, and which make explicit the basis for its interpretation" (Ravelli 2006, 3). Once salient objects are removed (as they are in the exhibits in the interactive science center), the nature of

communication and the interactive lessons to be learned need to be guided and explained via even more texts. Ravelli's frameworks provide a handhold for making sense of these different texts across a variety of exhibitionary styles and contexts.

Though the use of these frameworks helps us understand how individual exhibit elements work to construct meaning, Ravelli does not lose sight of the necessity of an overall rhetorical purpose or narrative of the exhibit: "Some notion of narrative design or purpose enables a point of evaluation to be established: it is not necessarily the case that the mere co-presence of different types of displays or sections of an exhibition will make it 'successful'. The different elements need to function cohesively and coherently in relation to some larger whole" (Ravelli 2006, 137). Ravelli's frameworks, then, provide tools for the analysis of the building blocks of that larger whole. However, though Ravelli recognizes the rhetorical implications of resource choices, exhibit purpose, and narrative design in constructing exhibits that aim at altering behavior, she does not develop this effectively. Her interest in museum communication is to help practitioners understand what makes museum texts better or worse and develop better ones. Here the semiotic framework is helpful, because it provides a method for grappling with exhibit texts at different levels in order to see how they work. Because Ravelli's framework ignores the rhetorical implications of exhibits, I augment the semiotic analyses of how each exhibit with a close, rhetorical reading of what the exhibit is doing broadly (in terms of its thematic purposes) and in terms of its epideictic functions as discussed in Chapter Two.

Thus, this dissertation is a collective case study that carries out a close textual reading via semiotic and rhetorical methods aimed at clarifying and assessing the way that science is represented for the public. This methodology allows for a flexible, thorough analysis of each of the exhibits.

Limitations

I wish to acknowledge two limitations of this project. First, though this project inquires into the "image of science" constructed by the exhibit, I do not carry out a robust visual analysis of that "image" across cases. By "image of science," then, I follow Doorman (1989) and Durant (1992) to mean the mental representation of science that gets constructed via the exhibit's resources, not the way the exhibit's visual elements make meaning for the visitor in the first place. The question of visual representation is an important one, as is the question of how the visuals and texts work together to construct meaning, but I leave these questions for a future project.[1] However, at times, I will discuss the visual, spatial, and material elements as they impinge on the exhibit's larger representational meanings (both about science and about the exhibit's main thematic content). I do this particularly in the third case *Mysteries of Çatalhöyük*, because it offers a much more explicit visual representation of the scientists carrying out their archaeological work than the other two cases. Where I do take up the visual representation of scientists and science, I rely on Kress and van Leeuwen (1996)'s *Reading Images: The Grammar of Visual Design* to describe how the images work and traditional content analysis to describe what is in images discussed.

Second, this project carries out a traditional close reading of the exhibit, which means it falls prey to criticisms that it is solipsitic, ignoring the reading and meaning making practices of actual visitors. While these criticisms are valid, I follow Ravelli (2006) when she argues "that close textual analysis will reveal *some* of the meanings which are constructed in, by and from the text/s in question" (Ravelli 2006, 15). These analyses,

[1] Here I follow the precedents of other analyses of exhibits in the rhetorical tradition that focus primarily on the textual and narrative features of the exhibit.

then, are not exhaustive of the possible (or actual) readings available, but they will offer insights into how the exhibit constructs a particular image of science. Whether the visitor walks away with this mental representation of science or not is not the question. Instead, as with any rhetorical or cultural critic, I am interested in the rhetorical possibilities that the text allows.

Collection of Data

Perhaps more than any other site we encounter in our lives, science museum exhibits are suffused with texts. When we walk into an exhibits space, we face the results of design choices regarding the space, pathways, objects, texts, visuals, sounds, films, and computer components. This results in an exhibit overflowing with textual elements, and it challenges any attempt to read a particular message or narrative into the exhibit space. Exhibits in the Science Museum of Minnesota are no different, and in fact they are often on the leading edge of exhibit technologies. To address this challenge, I focused primarily on the written and visual elements in the exhibit that communicated messages about science itself (not just about the science on display). As a rich multimodal space, the variety of meanings created by the other modes are numerous. However, because I wanted to attend to the way that science itself was constructed, I aimed to discern this in the use of language.

Focusing on the written and visual elements yields an abundance of texts, not all of which were useful for this project. To control what needed to be analyzed, my reading of the exhibit honed in on the panels, installations, and text that most contributed to the exhibit's representation of science—those elements of the exhibit that spoke to the historical, methodological, social, and epistemological aspects of science itself. The

exhibits' representation of science, then, emerges through explicit discussions of method, process, and history. But it also emerges through other thematic panels where scientific findings and the scientists themselves are displayed. Thus, the selection process is different for each exhibit. I chose exhibit elements that, after thoroughly analyzing the exhibit as a whole, best capture the way that the exhibit represents science. At times, these elements were more than linguistic, for the exhibit continually reminded me that it was not simply a textual medium, and that the image of science created by the exhibit was found in the other exhibit elements. Thus, while attending to the written textual elements, I also incorporate discussion of visuals, objects, and the space where appropriate.

The study of the exhibits' elements (textual or otherwise) was augmented by planning documents and interviews. The planning documents for each exhibit (including the NSF grant proposal, formative and summative audience analyses) are used to fill out the educational and civic goals of the exhibits. Interviews with the lead designers for each exhibit were also conducted. The purpose of these documents and interviews was two-fold. First, they provided context and background for the different exhibits. Each exhibit had particular stated goals and visitor outcomes, and understanding what the lead designers hoped to achieve helped me better assess the exhibit as a whole. Consequently, the second purpose of these documents was to triangulate my own readings of the exhibit. While the exhibit teams' intentions may not be material to the actual image of science that these exhibits constructed (as, indeed, in at least one case the exhibit team was not concerned with *how* the exhibit was representing science at all), they nevertheless allowed me to see another point of view against which to assess my analyses.

This chapter has outlined the qualitative methods in my collective case study of three exhibits at the Science Museum of Minnesota. In the next three chapters I analyze each

exhibit in turn, applying Ravelli communication framework to the exhibit and then rhetorically analyzing how they represent science. Up first is *Disease Detectives*, which serves as the paradigm case, demonstrating a traditional, deficit model of the public understanding of science through a highly interactive, inquiry-driven exhibit.

Chapter 4

Disease Detectives: The Paradigm Case

Disease Detectives, an exhibit developed by the Science Museum of Minnesota in 2008 that looks specifically at infectious diseases, recognizes the place of ailments in society and enables visitors to experience how diseases work: their transmission, their symptoms, and their treatment and prevention. Via three case studies, *Disease Detectives* not only communicates information about the pathologies of diseases, it also creates an environment in which visitors play the role of physician, lab technician, and epidemiologist. Through these roles, visitors see how the medical and scientific communities work together to understand and discover the cause and source of the illness.

As I will show in the following pages, *Disease Detectives* exemplifies a standard, deficit approach to the public understanding that embraces the traditional epideictic functions of exhibits: its aim is to communicate basic microbiology to the public through an engaging interactive environment. Its focus is on facts rather than on science as a cultural practice. Because it does not challenge visitors with a representation of science as a rich field of inquiry, as a situated practice, or as a developing body of knowledge (as we

will see in the cases of *Race* and *Mysteries of Çatalhöyük*), *Disease Detectives* provides a paradigm case for this project, an example of how an exhibit that aims at communicating basic scientific ideas to the public (without challenging visitor's notions about how science works or attempting to upend any of their conceptual scientific frameworks) represents science for the public. The goal of elucidating the paradigm case is that it helps establish the benchmark against which the other exhibits deviate. To make this case, the chapter begins by briefly describing the features of a deficit model of science literacy. Next, I outline the basic thematic structure of the exhibit. I then apply Ravelli's semiotic framework to determine how the exhibit constructs its representation of science.

The Deficit Model of Science Literacy

To be a paradigm case within the theoretical framework of this dissertation, *Disease Detectives* requires two things. First, its genre must be primarily epideictic in nature. As an epideictic exhibit, *Disease Detectives* celebrates science and scientists, presents science facts and simple histories, and inculcates an idealized scientific method and inculcates a conservative scientific mindset. Its primary epideictic effects are to encourage us to wash our hands, cover our mouths when we cough and sneeze, and use bug nets and proper anti-malaria medicine in where countries the risk for malaria exists. As such, *Disease Detectives* makes explicit its civilizing functions. The second feature of the paradigm case is that it must be based on the model of science literacy represented by the deficit model. As discussed in Chapter Two, Gross (1994) and Fahnestock (1986) have shown that epideictic and the deficit model are linked. In order to frame this chapter, it is useful to quote Gross's description of the deficit model at length:

> The deficit model explores the ramifications of its particular root metaphor. . . : scientific *su*fficiency and public *de*ficiency. In consequence, the deficit model is asymmetrical: it depicts communication as a one-way flow from science to its publics. Its practitioners do not try to persuade; they assume that the public is already persuaded of the value of science. They do not try to build trust; they assume that the public is already trusting. The deficit model implies a passive public: it requires a rhetoric that acts to accommodate the facts and methods of science to the public's limited experience and cognitive capacities. The goal is better appreciation of science; the genre is epideictic. In this model, in accord with the prevailing ideology of science, communication is solely cognitive: knowledge alone is transferred; ethical and political concerns are ruled out as irrelevant. The preferred methods of the scholars of the deficit model—surveys of the public, content analyses of the media—assume the model's central focus: the state of science, not the state of the public. (Gross 1994, 6, emphasis in original)

The deficit model represents science literacy in its more traditional epideictic mode, where the goal is to increase the public's store of factual knowledge, to promote an idealized scientific method, and to generate appreciation for science as a enterprise. In John Durant (1993)'s terms, this traditional model of science literacy captured in the deficit model embraces the first two parts of his tripartite definition: knowing a lot about science and knowing how science works, both of which are the focus of *Disease Detectives*. Knowing a lot about science consists in "being well-acquainted with the contents of science," and might be called the Trivial Pursuit definition (Durant 1993, 130).

This aspect of the definition is epitomized by Robert M. Hazen and James Trefil in their book *Science Matters* (1991). For them, "scientific literacy constitutes the knowledge you need to understand public issues. It is a mix of facts, vocabulary, concepts, history, and philosophy" (Hazen and Trefil 1991, xvii). Hazen and Trefil's text "present[s] only the constellations of basic facts and concepts that you need to understand the scientific issues of the day" (Hazen and Trefil 1991, xvii). Their goal is to prepare the public to understand the scientific concepts that would enable us to discuss science within our daily life (e.g., following science in the news, following recent trends in science, following public policy on science, etc.). While this area is clearly a very important part of knowing science, Durant (1993) questions whether this aspect alone gives a person real understanding of science. For instance, Durant asks us to look at cutting-edge science: how is the student of science whose understanding is based primarily on concepts and facts able to make sense of controversy, uncertainty in science, or understand science in the making? If we recognize that for the public, most of the really interesting and useful science is cutting edge science, then basing our communication and educational goals on only scientific concepts and facts creates a public unable to make sense of conflicting scientific information (e.g., controversies over stem cell research, hormone replacement therapy, or the value of the Atkins diet). Clearly, scientific understanding requires something more.

The second approach to the definition, knowing how science works, emphasizes the hypothetico-deductive scientific method. Here the public understands science if it grasps the methods and formal processes of science. This view is best represented by the American Association for the Advancement of Sciences Project 2061, which outlines the "recommendations for what all students should know and be able to do in science, mathematics, and technology by the time they graduate from high school" (Project 2061

1993). This project falls under the first approach just discussed and falls prey to those same criticisms, but it also aims to generate knowledge concerning the way science is done, not only the knowing of scientific concepts. While Durant recognizes the importance of understanding the process of science, he remains critical. Drawing his inspiration from Jon Miller (1983) and again looking at novel cases in science, Durant questions whether this approach alone will prepare the public to deal with a very critical question: "whether a citizen knows enough about the process of scientific investigation to be able to distinguish between science and pseudo-science" (Durant 1993, 132). Durant is not optimistic. Setting the processes of science on the twin pillars of the "scientific attitude" and the "scientific method," he first argues that the usefulness of the concept of a scientific attitude is undermined by what we initially noted in the definition of scientific literacy: science's problematic link with economics and politics. This compromises what Durant otherwise considers a false ideal that in practice is as varied as the scientists who are said to advocate it.

The adequacy of the scientific method as an indicator of science literacy has been has been criticized on similar grounds: in its abstract hypothetico-deductive model it too functions primarily as an unobtainable ideal. Durant joins Sir Peter Medawar (1984) in *The Limits of Science* and Henry H. Bauer (1992) in *Scientific Literacy and the Myth of the Scientific Method* to criticize the ideal version of the scientific method, claiming that scientists use no single or logical step-by-step method. Rather, they argue, scientists employ multiple methods to do their work. They reluctantly recognize it as a practical ideal, but forcefully argue that to present the method as systematic, logical, and universal is to misrepresent how science works:

> The myth of the scientific method, then, encourages the laity to have an

> unrealistic view of scientists and therefore to have unrealistic expectations of them and of science; and it encourages scientists themselves to be unrealistic about themselves and about science, and to neglect the importance of cultivating consciously ethical behavior. (Bauer 1992, 40)

For Bauer, a scientifically literate public is a culturally literate public that understand the limits of science and the ideality of the scientific method (Bauer 1992, 146). Thus, for Durant, Medawar, and Bauer there remains something over and above facts and formal methods that the student of science must understand in order to truly grasp science and be deemed scientifically literate. However, the factual and method driven *Disease Detectives* does not get us there. Instead, it serves as a paradigm case, representing science via a traditional deficit model.

Disease Detectives the Exhibit

Topics that emerge out of current events present important opportunities for science museums to engage the public by means of the museum's unique ability to create rich, interactive experiences. Because of their recent impacts on the general public (e.g., swine flu, bird flu, salmonella, and *E. coli* outbreaks), biology and disease are just such topics, making them excellent candidates for museum exhibition. Laurie Fink, lead designer for the *Disease Detectives*, provides the rationale for the exhibit:

> Published newspaper accounts, radio broadcasts or news programs are effective methods for alerting the general population about a new infectious disease, but fail to convey the science behind the outbreaks. (Fink 2008, 90)

Fink argues that the museum is specially placed to unfold this topic for the public and present the many facets of the science surrounding disease. But presenting topics in biological science can be difficult:

> Developing engaging, interactive exhibit components in human biology is a challenging task for institutions and exhibit developers. Topics in the biological sciences are frequently very complicated, require lots of background information for understanding, and sometimes are too obscure for the average public. These limitations can be overcome however, by incorporating hands-on interactive exhibits that empower the visitor to investigate and learn on their own. (Fink 2008, 91)

Identifying the recent outbreaks as an exigence as well as the difficulties attending their representation in the exhibit, *Disease Detectives* sets its aim at cultivating both the basic scientific understanding of disease and a grasp of the research process: "The goal of the project is to use fascinating stories of emerging infectious diseases to engage museum visitors and help them understand the basic science and appreciate current medical research that enables the detection, analysis, treatment, and prevention of these threats" (Fink 2008, 90). This statement firmly establishes the focus of the exhibit on basic understanding and appreciation. Larger concerns about the efficacy of epidemiology, the difficulties facing scientists who try to trace these diseases back to their sources, or the challenges these diseases pose on the social and political fronts are effectively ignored in Fink's proposal.

Yet science is front and center in the project plan in terms not only of information and content, but also as process and interaction. Promoting the possibilities presented by the museum, Fink argues that while websites exist that inform the public about disease, none

"engage[s] the public in physically learning about science by 'doing' science" (Fink 2008, 90). The museum can create opportunities to "do" science, and Fink outlines a few of the possibilities: experiment benches, scientific labs, computer simulations of vaccine creation, and other interactive features complement other didactic displays. Because Fink's arguments here, though informative, came prior to the actual development of the exhibit, they can only present an idealized picture of what the design team hoped the exhibit would would look like when finished. Thus, I next turn to the exhibit as it actually stood in January 2008 in the Human Body Gallery at the Science Museum of Minnesota and describe its structure, content, and interactive components in order to assess how it really represented science for the public.

In terms of its broad structure, *Disease Detectives* is organized into two areas: an introductory section that opens the exhibit and an interactive case study section with three distinct foci. Spread throughout each case study are exhibit elements that enrich the content. Rather than be isolated as most of the premier traveling exhibits at the SMM are, *Disease Detectives* is set within the second floor atrium giving it a very open feel. Yet the exhibit is bounded by its own low walls (rather than those of a room), none of which reach the ceiling and many that you can see over, making the exhibit feel as if it is an island amidst the larger Human Body Gallery (see Figure 4.1) The openness of the space also gives the impression that visitors may wander as they please, but in fact the structure is more controlled. After passing through the introductory section that provides a history of diseases worldwide and basic definitions of different diseases, visitors are given the choice of proceeding to one of three case studies. Each of these cases has a strong narrative structure that further directs visitor engagement. But because the structure is not physically controlling, visitors do not need to follow this order: they are free to skip from

Figure 4.1: Layout of *Disease Detectives*

one portion to the next or even jump from one case study to the next. The organization is the same for each case study: diagnosis of the patient's symptoms (physician), analysis of physical samples (lab technician), and discovery of the source and cause of the disease (epidemiology). These three sections consist of the major interactive experiences the exhibit relies on for communicating both biological knowledge and the process of medical research.

As the title indicates, in each of these three sections the visitor plays the role of Disease Detective. This detective role is divided into three sub-roles of interactive elements in each case study: physician, lab technician, epidemiologist. These sub-roles are introduced in the exhibit's introductory panel, which encourages visitors to "choose a case, meet the patient, analyze the lab results, determine how the infection spread, and check your answer at the answer station." All three roles are the same across the cases, though their instantiation in each case is slightly different. To provide a clearer picture for how these roles work and the kinds of interactive components offered by the exhibit, let's look at the three roles for one case study: The Case of the Birthday Surprise.

Physician The first step in the case is the introduction of the patient and the problem. This case presents Adam: it's his 8th birthday, and he and some of his friends have come down with diarrhea. Visitors meet Adam, played by an interactive dummy, in a mock-clinic (see Figure 4.2). Their first activity is to administer a series of normal tests. Questions and flip panels prompt the visitor through this process, and the patient's body responds to each of the tests: a thermometer reads his temperature and a stethoscope captures his heart rate and lets the visitor listen to the patient's stomach.

Figure 4.2: The Case of the Birthday Surprise

Lab Technician Next, visitors assume the role of lab technician in order to analyze Adam's stool sample (you are provided a plastic stool sample to use). Visitors scrape an inoculating loop into the stool sample and spread it in a petri dish. They then spin a wheel that walks them through the steps a lab technician would take to understand what is causing Adam's disease: after the bacteria grow, visitors compare the results with standard examples to see if Adam does indeed have a strain of *E. coli* that can make him sick. Unfortunately for Adam, the test is positive.

Epidemiologist The final task for the visitor is to determine the "culprit." Using DNA evidence to isolate which particular strain Adam has acquired, epidemiologists then use this information to discover the source of the problem. This brings visitors to a diner where Adam and his friends had lunch to find out which of the foods Adam ate caused his illness. To do this, visitors must analyze a chart that shows who got sick and what they ate and test a burger on the stove to see if it has been cooked thoroughly. From this information (as well as some hints), visitors should be able to determine the source of the outbreak. This information is tested in a kiosk at the end of the case study to reinforce the exhibit's messages about symptoms, cause, and prevention.

Each of the other cases is similar: visitors are introduced to the sick patient, they conduct tests in a physician's office, they analyze those tests results in the lab, and they then discover the ultimate source of the disease. The kiosk at the end of each case evaluates whether the visitor understood the nature of the disease, how it spreads, and how it can be prevented. The prevention portion of the cases gives visitors an interactive experience to see how practical steps can stop the spread of disease. In Adam's case, this

component teaches visitors how to wash their hands properly so that they do not acquire or spread *E. coli*. In other cases, visitors learn why bed nets are needed in places where malaria is present and why covering our mouths when sneezing can help control the spread of the flu.

Along with these cases, perhaps the most salient interactive element in this exhibit is a quiz/dancing game that takes center stage in the introductory section. In order to encourage visitors to learn something about some of the most important diseases, their types, and their prevention (a theme that continues throughout the exhibit), visitors are given the opportunity to play a quiz game about the type, prevention, and treatment of various diseases, some of which are the diseases driving the three case studies. By getting enough answers correct, visitors unlock an adaptation of the popular *Dance Dance Revolution*[1] video game. The game is front and center when visitors approach the exhibit, and as one of the most modern and physically engaging interactive components in the museum, seems to function primarily to entice visitors into the exhibit.

As should be clear, this exhibit is about diseases as well as about the scientists and methods used to test, identify, and discover them. Throughout, the exhibit discusses many of these aspects for each of the following diseases: Lyme disease, *E. coli*, Giardia, head lice, influenza, tuberculosis, noro virus, malaria, mad cow, west nile, cholera, small pox, the plague, and HIV/AIDS. As the exhibit presents these diseases, it does so through three main thematic means.

[1] *Dance Dance Revolution* is a popular video game where players place their feet on a touchpad in an order determined by a set of scrolling colored arrows.

The History and Biology of Disease

Presenting basic microbiology, *Disease Detectives* focuses on generating public understanding about how these diseases work. For example, the exhibit's introductory section, including the time line and *Dance Dance Revolution* game, presents ten diseases and their basic definitions that the rest of the exhibit will rely on and develop more fully. Each of the ten diseases is presented by way of a larger-than-life tactile model and a series of flip panels that answer the following questions: What is it? How do I get it? What are the symptoms? How do I avoid it? (see Figure 4.3). The answers are centered on presenting the visitor with a basic understanding of how the disease works. A large

Figure 4.3: Model and Flip Panel for Tuburculosis

timeline in the introductory section also enriches the visitor's grasp of the evolution and

effects of these diseases aver the past four thousand years. Five diseases are represented in the timeline, seemingly chosen for their social, cultural, and political importance: cholera, smallpox, the plague, HIV/AIDS, and tuberculosis. For each disease, the timeline provides a brief overview, then lists the disease's name, type, means of transmission, symptoms, treatment, whether it is deadly or not, and its current status in the world. The timeline then extends from 2500 BC to the present, noting key events in each of the diseases' history. For example, the timeline for cholera identifies the earliest evidence in 450 BC, the first modern description in 1563, the spread from the Ganges in 1600s, the epidemics in the 1800s, the researchers who helped stem its spread in the late 19th century, and its re-emergence in the 1970s. Overall, the information presented about each disease is treated as factual knowledge to be acquired and applied through modern techniques for prevention and avoidance.

The Process of Science

The interactive focus discussed above makes up the primary means through which the process of science is presented. In many ways, then, the emphasis on the cases and the visitors' roles makes the process of science (as physician, lab technician, and epidemiologist) central. This content is not didactically represented; it must be acquired through action and physical engagement. Visitors must use the tools to measure the patient's temperature and heart rate, they must use the scientific apparatus to analyze the results, and they must think critically like epidemiologists to discover the source of the problem. The manner in which the visitor must participate in order for the messages of this portion of the exhibits to be completed and communicated limit the true interactive nature of the exhibit; as a consequence, it also affects the way that this exhibit represents

science throughout the interactive cases. The process, however, remains a key part of what this exhibit is about.

Current Scientists at Work

The final thematic content found throughout the exhibit is contained in small biographies of physicians, scientists, and public employees who deal with disease in their professions. These accomplish the goal of showing the current state of the field that Fink presented in the exhibit proposal. Spread throughout the exhibit, these brief bios introduce visitors to an expert who is studying disease for some particular reason. An example will provide the general tenor of these biographies (see Figure 4.4):

> **He Looks for Germs in Public Places**
>
> We expect restaurants, casinos, and other public places to be free of germs **Vivek Raman**, an **environmental health specialist** in Las Vegas, makes sure they are. He inspects public facilities to make sure they obey sanitation laws. He also monitors diseases in rodents.
>
> Vivek was inspired to pursue a career in public health by his work in the Peace Corps, where he witnessed the hardships people face when they lack basic health care. He hopes to return to the developing world, where he can use his experience to help impoverished people meet their basic needs.[2]

As descriptions both of the range of problems infectious diseases pose and of the professionals who work to solve them, these short biographies provide visitors a glimpse of real "disease detectives." They also help ground the roles that visitors play in each of

[2]Emphasis here is in the exhibit itself.

Figure 4.4: Biography of Vivek Ramen

the case studies in the real world. These roles model activities that people like Vivek Raman actually do on a daily basis, and in the process, they provide a particular representation of the scientists as people that is an important part of the exhibit's larger representation of science. Together, the representative content of these exhibits covers the facts, processes, and professions surrounding modern understanding of disease.

How does *Disease Detectives* Represent Science?

Now that we have a clearer picture for how the exhibit is structured, the roles it affords visitors, and the information it conveys, we can turn to the question of representation. As visitors engage with this exhibit and acquire the basic biological knowledge that makes them more scientifically literate, what is the picture of science that *Disease Detectives* communicates? In other words, how is science represented as a body of knowledge, as an institution, as a set of professional practices, and as a cultural practice?

Organization, Pathways, and Freedom

As described above, while not formally directive, the organizational structure of *Disease Detectives* nevertheless encourages distinct routes to be followed. Thus, it is not completely linear nor is it completely free choice. After proceeding through the introductory section, visitors can choose one of the three case studies to follow. Within each case study there is a clear order of operations (the three scientific roles), even if that order can be freely ignored by the visitor. The freedom to ignore the pathway is facilitated by a relatively weak degree of semiotic framing in the exhibit: the narrative of each case is initially controlled by a small framing panel introducing the individual and his/her

problem. The narrative thread is continued by the connection of linguistic and interactive elements as the visitor moves from section to section, eventually terminating in the computer kiosk. But the steps here are not physically restraining or controlling: there are few material/physical cues that encourage a certain pathway through the exhibit.

The general, two-part structure of the exhibit represented by the introductory section and the three case studies has two effects. First, it dissociates any historicized or politicized picture of the individual case studies by placing a general "Disease Timeline" in the introductory section. This timeline is itself limited, not representing the cultural history of the diseases represented in the exhibit's three case studies. Dealing with the history of other, non-case diseases implies a certain generality to the history of disease, and it effectively separates the historical, cultural, and political aspects of each of the case diseases from their display as interactive scientific processes. The time line fails to connect the history, politics, and culture of diseases to the work of the disease detective. While an associative link might be made between the introductory section and the three cases, the nature of this link would be only to imply that each of the three diseases has a long history; specifics are lost, and because the historical differences between AIDS and cholera are so vast (AIDS is a recent problem, Cholera ancient), the association can do very little educational work. Thus, the physical and thematic separation here results in an exhibit that does not broach the cultural, social, and historical factors of the three main diseases within the display at all.

Nevertheless, the purpose of the introductory portion of the exhibit is to lay the groundwork for visitor understanding, and while the timeline implies that this history is generalizable, it does raise questions about the historical, social, and cultural impacts of each of the major diseases on display. Unfortunately, these questions go unanswered. The

fact that the timeline does not show the wider social and historical contexts of *E. coli*, malaria, or flu (the three main cases) in the time line (or in the rest of the exhibit) demonstrates that it is being used as simply another opportunity to convey more information about diseases in general. This reinforces the fact that this exhibit is primarily concerned with developing a basic level of science literacy by imparting to visitors as much factual knowledge about diseases and the role of science in conquering them as possible.

Second, the informational narrative in each section creates a simple progression for visitor understanding and promotes a traditional representation of science. The progression helps visitors see the different scientific agents involved in understanding the causes and sources of the disease in question: scientists work together in a step-wise fashion to arrive at different levels of understanding, from grasping the medical needs of an individual patient (physician and lab tech) to understanding the larger effects of the spread of this disease on the public at large (lab tech and epidemiologist). However, there are no feedback loops or confusions or retesting of ideas; there are no misdiagnoses; there are no failed lab results; there are no incorrect epidemiological conclusions. The kiosk at the end of each case study that tests visitors' understanding reinforces this: while *they* might not recall the information, the information was provided as certain in each case. The effect of this is to reinforce a representation of science as factual, correct, and final. The kiosk turns these experiences into an interactive encyclopedia article rather than a rich experience of how science really works and the challenges it faces in understanding cases of disease outbreak on the ground.

In general, the organization of the exhibit contributes to a picture of science that is grounded in facts and that is non-recursive and correct. The organization oversimplifies

the nature of science in order to accomplish its primary aim of generating public understanding of science about the nature of particular diseases rather than the wider place of diseases in the world.

Interaction and Scientific Method

The relatively strong narrative created through the organization of each case, together with the guided, yet free choice space creates an active role for the visitor while at the same time strongly controlling the messages. A closer look at the interactive elements here reinforces this conclusion and demonstrates that the roles afforded visitors continue to implicate them in an authoritative, epistemologically closed representation of science. The three roles afforded visitors as discussed earlier are clearly defined: physician, lab technician, and epidemiologist. What does the interactivity for each of these roles look like and how do they situate the visitor in terms of the exhibit's authority and in terms of the representation of science? To answer these questions, we will look closely at the case of malaria.

The narrative for the malaria case begins with Yolanda: she's an American citizen visiting her family in Africa. While on vacation, she becomes very sick. Visitors meet her in the clinic (See figure 4.5). The panel for the Physician role identifies three tasks for the disease detective: "Take Yolanda's temperature; Measure her heart rate; and Check her general appearance." As in all the clinical scenarios, the visitor is guided through each of these tasks by a rotating message board that instructs on the purpose of the test and then identifies the specific steps to take. For example, to check Yolanda's general appearance, which "may provide clues to the nature and severity" of the illness, the visitor is instructed to "1. Check her arms and face for scars, lumps, rashes or redness; 2. Look for any

discoloration of the skin, eyes, lips or nails." After carrying out this task, the visitor is asked to flip a panel that asks "Is there anything abnormal about Yolanda's appearance?" Underneath is the answer to that question, against which the visitor can check his or her evaluation. The physician exams in the other two cases follow the same format.

Figure 4.5: Yolanda in the Clinic

The lab, the next segment, further demonstrates the controlled narrative of the exhibit and it reinforces the correct answer that the visitor should have discovered in the clinic. In the lab, the visitor is directed in the two tasks to be completed here: analyzing Yolanda's blood and using this information to determine the type of infection that is causing her illness. At this stage, the results of the doctor's visit are reiterated: "She's been complaining of fever, chills and fatigue. The symptoms you found in the clinic suggest

Yolanda might have an infection." Testing the blood and comparing it against a notebook of samples to determine the type of infection structures the interactive experience in a similar way: follow these steps to get the right answer. By following these procedures, visitors will arrive at the correct answer to the question "Does Yolanda have malaria?" The answer is under a flip card. Like her counterpart Adam, Yolanda is indeed quite sick.

When visitors next take on the role of epidemiologist, they learn that Yolanda contracted malaria from a mosquito, which results in a display about proper preventative measures that Yolanda could have taken, none of which speak to the larger social problems that inhibit malaria eradication in affected countries. As an epidemiologist, the visitor is provided information that helps her better understand the role mosquitoes play as vectors in transmitting diseases. As an epidemiologist, the visitor must discover how the mosquito got to Yolanda and why she is the only one in her family to contract the disease. To answer these questions, the epidemiologist returns to the house where Yolanda stayed during her vacation. The visual cues and the exhibit narrative clearly focus the visitor's attention on the bed and the fact that Yolanda did not use a bed net properly. Possible causes that contributed to her sickness, like her lack of immunity, the inadequate use of insect repellants, and lack of antimalarial drugs are briefly treated. The ultimate question, how did she acquire the infection in the first place, is answered by looking at her improper use of a bed net. With the source of her infection discovered, the exhibit reiterates methods of malaria prevention. While the epidemiologist's role most directly involves understanding these social, historical, economic, and political factors influencing the origin and transmission of disease, the treatment here of Yolanda's infection only hints at these things: the causes and origins of her disease are merely factors to be accounted for. They are not explained or presented as the effects of a larger system.

As an interactive exhibit, *Disease Detectives* encourages visitor participation at each step in order to complete the messages offered up by the exhibit. In order to understand and proceed through the various roles, visitors should answer questions, look through microscopes, spin wheels, read text, and think critically. To this degree, the interactive portion of the exhibit is strong and engaging. However, success or failure at any one part of the exhibit does not greatly affect the success or failure at any other, so the necessity of proceeding in order to understand any specific point is not great. Also, there is little sense of what it means to go wrong at each point of the exhibit, and though the visitor can misunderstand or misdiagnose, each case continues to its necessary conclusion. The visitor's participation here does not affect this progression.

Thus, the visitor completes the messages rather than constructs the messages or constructs knowledge. The three interactive roles enables the exhibit as a communicative medium in the first place, but the wider role of the visitor in terms of the exhibit's authority and the knowledge available is quite limited. The knowledge is predetermined, and the role for the visitor is merely as a missing puzzle piece to complete the communication vector. The effect of this limited interaction is to represent science as certain, statically step-wise, and complete: follow these steps, look for these things, arrive at these conclusions. In the process, the visitor comes to understand the nature of these three diseases primarily as a set of facts. Together, the nature of science and the actions of the scientists, and the roles that the visitor occupies and carries out, are limited, static, and noncontroversial. This is an idealized form of the processes that physicians, lab technicians, and epidemiologists carry out. Interactively, the exhibit creates opportunities for visitors to engage in the material with the end of increasing their scientific understanding, but the authoritative, static view of science represented models only a

limited understanding of how science works.

Representing Disease, Scientists, and Science Itself

As seen earlier, the organizational and interactional meanings all help contribute to the representational meanings. For example, the relationship between the introductory content and the individual cases is structural and organizational. In other words, the introductory section precedes the visitors' encounter with the rest of the exhibit and is thus structurally related. But it is also organizationally related in that it provides some of the basic concepts, facts, and ideas that the visitor will rely on and employ as she navigates each case study. Similarly, the specific roles visitors take up are interactional, but they are at the same time inherently representational: the choice of these three roles in the first place is central to the overall picture of science that the exhibit creates. In this section, I will look more closely at the nature of what is displayed and how what is displayed contributes to a particular view of science.

What are the representational meanings related to disease? Disease is narrowly defined in the exhibit as infectious diseases. This is evident in the opening panel, which states (see Figure 4.6):

> **Can you pick the culprit out of the lineup?** For a doctor, every patient is like a detective story. Which disease, out of hundreds in the world, is making this person sick? As a **Disease Detective** you can unravel the mysteries behind three ill patients, using tools and techniques health care workers employ to identify infectious disease.

The narrowing down of disease to "infectious disease" is reinforced visually by two

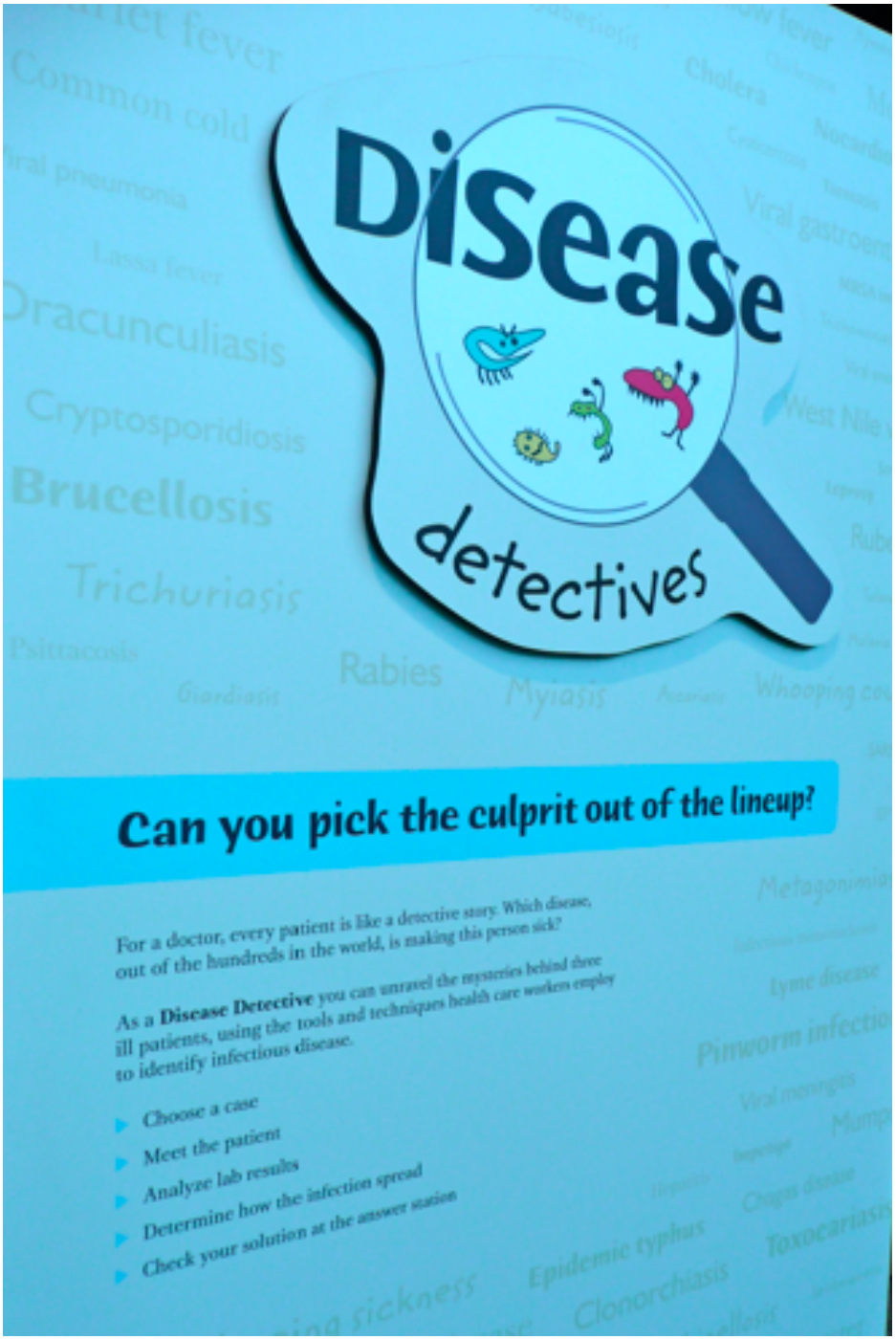


Figure 4.6: *Disease Detectives* Introductory Panel

features on the opening panel: the exhibit's main icon, a magnifying glass and four brightly colored microbes, and a montage of disease names that are displayed in different fonts on the background of the panel (See Figure 4.6). While disease is a large, overarching term for ailments that are not only infectious, the exhibit attempts to narrow it down to a specific subset. This subset of infectious diseases is further broken down into food-bourne, air-bourne, and vector-bourne, with each of the large case studies representing one type.

Yet the title of the exhibit as a whole and the fact that it displays infectious disease rather than all disease creates a tension. This tension is evident because the *Disease Detectives* metaphor that is carried throughout the exhibit necessarily embraces a much larger category of illnesses, including chronic diseases like heart disease, cancer, diabetes, obesity, etc., none of which is dealt with in this exhibit because they are not infectious. This is understandable. But the tension here, in terms of the representation of "disease," is that there is a broader category of diseases which this exhibit threatens to embrace. The slippage risks subtly mapping the narrower features of infectious disease, including the science that makes sense of them, onto cases where they do not apply.

This slippage is a problem because chronic diseases have very different clinical, laboratory, and epidemiological lives. They are caused not by microbes, but by lifestyle choices, genetics, and other factors. Critically, these other diseases are not treated as detective stories in the same way. Yet, because of the general role played throughout, "disease detective" threatens to apply to the work that scientists do in making sense of these other diseases. Thus, the representation of disease, though narrowed to infectious disease, remains slippery, for the category of infectious disease can too easily include diseases which do not fit the same "detective" metaphor. This is especially critical for a

public that internalizes a representation of science as certain and progressive with regard to infectious disease and then attempts to apply that model to diseases that are not transmitted via a discoverable "culprit" responsible for all forms of the disease—the culprits of diseases like cancer, obesity, and Alzheimer's remain elusive.

Furthermore, the narrowing down of disease to infectious diseases also allows the exhibit to promote preventative action that is non-controversial. Unlike the larger debates over chronic diseases, the solutions to preventing *E. coli*, malaria, and the flu are relatively well documented and uninteresting: wash your hands, use bug spray and bug nets, and cover your mouth when you sneeze, respectively. Again, the use of these simple remedies threatens to be transferred to chronic diseases where things are not so clear; the public, however, seeks clarity, and this exhibit reinforces that desire by pointing to the simple preventative action that is possible for particular diseases. But by not clarifying the differences in types of diseases, *Disease Detectives* threatens to confuse the public about the nature and prevention of disease broadly conceived. Thus, in this way, the narrowing down to infectious diseases allows the exhibit to simplify the scientific problem and to ignore the genetic, political, social, and cultural factors that play an important role in these and other diseases.

Completing the metaphor, the disease is represented as a culprit to be discovered and prevented, the representational meanings of the scientists are found through the metaphor of the detective. For a highly interactive exhibit, the metaphor of the disease detective is an especially effective one, for it immediately establishes the role the visitor will be occupying. In fact the exhibit is exemplary in providing visitors the role of the detective. And, in the wider view of science that grounds this study, detectives are surely engaging in inquiry as much as scientists. Yet the metaphor of the detective, which, in Kenneth

Burke's terms, serves as a "device for seeing something *in terms of* something else," creates a tension because the metaphor is at the same time a metonymy (Burke 1952, 503). In Burke's language, metonymy "convey[s] some incorporeal or intangible state in terms of the corporeal or tangible" (Burke 1952, 506). In the exhibit, "detective" attempts to conceptually link the more abstract activity of the scientists with the more familiar one of the detective. As a metaphor and a metonymy, there is an incongruity and an inherent reduction that becomes problematic.

The tension emerges when detective work stands in for the broader set of activities that scientists do: observing, testing hypotheses, and building and evaluating theories. This is a necessarily limiting metaphor of the scientist, who does more than detective work, especially when their work is necessarily (and importantly) situated socially, culturally, politically, and epistemologically. While detectives look for culprits, analyze crime scenes, and use deductive logic to establish the events of the crime scene and to determine suspects, the traditional detective with a magnifying glass rarely conducts experiments to test hypotheses. Similarly, the exhibit's interactive components do not have visitors test hypotheses: they are engaging in the observation, analysis, and deduction of a detective. But this excises an important foundational part of science, a part of science that has already been completed in each of the diseases on display and that makes possible the very detective work in which the visitor is engaged. The process of science is much more elaborate than depicted here (as we will see in Chapter Six).

More importantly, however, the detective metaphor, as a metonymy, excludes important aspects of science: the wider social, historical, and political facts that influence the work of scientists. Following the metaphor for a moment, the exhibit's emphasizes that the detective cares primarily about discovering the culprit for a particular case. As in

the exhibit, the detective relies on techniques, assumptions, and information gleaned from prior cases and prior experiences (in the exhibit, the experimentation that established the viability of the tests in the first place). This makes detectives excellent at inquiry, but it also identifies their myopia. Detectives—especially as depicted here—rarely care about the larger systematic (social, economic, or political) factors that might have created the conditions for the culprit to exist in the first place. They are primarily concerned with solving this one case. It is up to social scientists to analyze the social conditions that promote certain types of crime and then the political establishment to do something about it. The detective is simply not involved in this work. By placing the emphasis on the scientist as detective, the exhibit undermines any attempt to broaden the visitor's understanding to the wider social, political, and economic issues that make these diseases matter in the first place. The detective metaphor makes for a good interactive exhibit that promotes science literacy, but it necessarily limits the public appreciation of the wider context in which these diseases continue to thrive and in which the scientist operates.

The second way that the exhibit represents scientists is through the short biographies scattered throughout the exhibit. Each brief biography identifies the person, what he/she does, why it matters, and why the person chose his/her particular career. The careers on display include:

- State Epidemiologist
- Medical Epidemiologist
- Epidemiologist
- Public Health Technical Officer
- Infectious Disease Outbreak Program Coordinator
- Environmental Health Specialist

- Bacteriologist
- Bacteria Laboratory Specialist
- Vice President of Food Safety
- Clinical Affairs Specialist
- Research and Development Coordinator
- Medical Student

As mentioned earlier, these biographies have two effects. First, when they are directly connected to the task of the visitor (as is the case with the epidemiologists, Bacteriologist, Bacteria Laboratory Specialist, and Medical Student), these biographies help ground the visitor role in a real life individual, which helps show that the activities are not abstractions from some make-believe scientific world. Second, where they describe roles that visitors will not actively take up in the exhibit (as is the case with the Research Development Coordinator, the Public Health Technical Officer, the Vice President of Food Safety, and the Clinical Affairs Specialist), these biographies indicate the wider network of scientists into which the physician, lab technician, and epidemiologist fit. In this way, these small biographies help the exhibit open up the wider world of science in which disease plays an important part. Yet, because their narrative focus is on the person and on the career path—both why they chose the career and why you might want to as well—they do not accomplish the contextualization very effectively.

Perhaps more importantly, each of these short biographies humanizes the science the visitors are engaging in by connecting the visitor with an actual person. They do this through the narrative of each scientist as well as a friendly headshot: each scientist is framed close up, smiling, looking directly at the visitor (see Figure 4.7). These are not photos of scientists at work; they are photographs of scientists as people, and their

Figure 4.7: Biography of Benjamin Ho

narratives bear this emphasis out. For example, the biography of Melissa Kemperman, an epidemiologist for the Minnesota Department of Health, ends this way:

> When Melissa is not fighting disease, she is collecting mosquitoes and ticks for research. She enjoys her career as an epidemiologist because it combines her interests in public health, ecology, and the natural world. The job gives her a wide variety of things to do, something she finds very attractive.

The biography of Benjamin Ho, a medical student at the University of Minnesota, ends in a similar fashion:

> As a child, Benjamin wanted to be an architect. But rewarding experiences with college science courses and volunteering at a free clinic helped him find his true calling. His advice to other budding health professionals is to take your time, volunteer, listen to yourself, and balance work and life. He feels that an effective doctor must be inquisitive and passionate about learning, but at the same time patient and sensitive to all aspects of the human experience.

As representative samples of the other biographical sketches, these place the emphasis on the scientist as a person and not so much on the epidemiologist or medical student as a scientist or how their work fits in the in the wider world (even though some of the careers do hint at this larger context). The biographies humanize the scientists (and the science) by making them much more accessible to the public as individuals. Gone are the lab coats and labs that make up the clichéd image of the scientist. Together, the narratives and photographs encourage the visitor to identify with the scientist as an individual who is employed, just like they are or will be, in a job that they thoroughly enjoy.

The humanization of the scientists and the identification achieved through the images and narratives supports Stella Butler's assessment that "arguments in support of hands-on science exhibitions are often couched in terms of the recruitment benefits which will result. Young visitors will be so enthralled that they will choose to study science, and some will go to university to provide a pool of future investigators" (Butler 1992, 113). This argument is not explicitly made in the exhibit's planning documents nor is it explicit in the exhibit, but one cannot help but see that these short bios of the work being done in epidemiology, public health, food safety, etc., begin to look appealing to those who find the experiences of *Disease Detectives* enjoyable. Either way, the fact that they convey information more appropriate to recruitment posters than information about the nature of science itself is telling.

Consequently, the combined effect of personalizing scientists and the disease detective metaphor provides a limited representation of scientists as practitioners within their wider field, and by ignoring the larger social, political, and cultural forces at work in the science to understand and combat disease worldwide *Disease Detectives* provides a representation of science as a discipline that is narrowly limited to case studies.

The representation of disease and scientists clarifies part of how the *Disease Detectives* represents science, but it leaves us with a final question: how/where does the exhibit represent science itself? Because there are no panels or installations that speak directly to the nature of science, the answer to this question must be constructed from the various panels on display, for arguably together they provide some image of science. In fact, the entire discussion leading up to this section implicitly contributes to what science is according to *Disease Detectives*. The general representation that emerges through the analyses above is one of science as epistemologically certain and disciplinarily narrow,

with little social, political, or cultural influences or effects and with the history disconnected from the case studies. This is evident through the organizational structure created and the interactive roles made possible.

As discussed above, the decision to focus on infectious disease necessarily limits the scope of the exhibit to those ailments over which science has achieved a high degree of understanding. These diseases have specific, identifiable causes, and they are usually cured by preventing those causes from taking root or by using drugs to kill the culprit once it has infected the body. They fit within a particular health/disease paradigm. The inherent representation of science as this narrow notion of disease is straightforward, and the exhibit continues to reinforce this: Science under this model is a series of facts to be learned. For example, throughout the exhibit, different diseases are explained through large plastic models and a series of flip panels, each panel answering one question: What is it? How do I get it? What are the symptoms? How do I avoid it? The answers to these questions are simple factual statements.

This is the case even where the exhibit hints at the wider world in which a disease like malaria fits. Again relying on the lightly interactive flip panels, the exhibit asks the following six questions:

- What is the economic impact of malaria?
- How much does treatment cost?
- How does malaria spread?
- What can help prevent its spread?
- What happens every thirty seconds?
- Who is at risk?

Yet, framing the questions in such a way as to have specific answers undermines any

discussion: these questions have answers and once those answers are attained, visitors will move on. The answer to "Who is at risk?" reads: "Approximately 41% of the world's population—some 2.7 **billion** people—risk acquiring malaria each year. Those at risk live primarily in tropical and sub-tropical regions of Africa, Central and South America and southern Asia." Similarly, the answer to the question "How much does treatment cost?" reads: "The most effective anti-malarial drug available costs a mere $2.40 for an adult dose. Unfortunately, this is still far out of reach for most of the world's poor." These questions raise the social and historical context that surrounds these diseases, but their fact-based answers do not develop the point. These are simply more facts to be learned; their implications are left unstated. Questions and answers like these continue to separate science from the social context in which it is conducted, and the exhibit's use of these questions is a weak attempt to offer visitors a view of science that is critical about the role of science and infectious diseases in the wider world. Instead, the view that science is a series of facts is reinforced throughout.

Thus, the fundamental way that science is represented throughout *Disease Detectives* is as certain, acquirable knowledge. Whereas science is an enterprise built on inherent uncertainty and constant questioning, *Disease Detectives* counters this picture in order to promote scientific understanding of disease. By using the metaphor of the detective to focus on the individual cases, by narrowing the focus to infectious disease while still using the more general term "disease" throughout, by featuring scientists to humanize the science and promote scientific careers, and by treating the diseases themselves as a series of finished and finalized cases to be learned, *Disease Detectives* presents a simple and oversimplified picture of science.

Disease Detectives as Paradigm Case

While the exhibit effectively achieves its aim of increasing the public's understanding of basic microbiology through the study of infectious diseases, the above analysis intends to show how *Disease Detectives* nevertheless falls short of the higher goal of promoting a more robust public understanding of science that was set out by Laurie Fink in the exhibit proposal. In this way, *Disease Detectives* representation of science serves as a paradigm case for museum exhibits that embrace Gross's deficit model of the public understanding of science. Six features help to demonstrate it as a paradigm case for the deficit, epideictic approach to the public understanding of science.

First, though the organization of the exhibit allows for visitor freedom, the real number of available routes is limited, and within each case study the pathway is controlled so that while visitors do not need to follow the path, no matter which route they take the same information will be conveyed. Second, because of the exhibit's guided structure, the interactives have clear, predetermined answers that visitors discover through limited degrees of interaction. Though they take up different roles in each of the three case studies, these roles create one-way communications from the exhibit to the visitor rather than allow for a dialogic experience. In fact, the visitor must take up those roles in order for the communication channel to be completed. Third, the information transferred through this predominantly one-way channel is treated as highly certain: science in this model is a series of facts that the simple interactive processes make available to the visitor. Fourth, where questions are used, they are not used in order to set up a dialogic relationship with the visitor: they are used to establish the external motivation to communicate more information to them. Fifth, the exhibit's primary metaphor of the

detective is a limited, inadequate view of the work scientists do. And finally, by ignoring the social, political, economic, and moral implications of the diseases on display, the exhibit fails to engage the visitor beyond mere accommodation. Where those topics are broached—in the timeline and in a series of flip panels—the exhibit uses them as simply another means to communicate more factual information to the visitor.

In rhetorical terms, the clearest epideictic effect of *Disease Detectives* is for the public to change its habits: to wash their hands longer, use bug nets, bug spray, and antimalarial drugs, and to cover their mouths when they sneeze. This is the practical knowledge end of epideictic education (Sullivan 1993). But the exhibit's interactive nature is also epideictic in Sullivan's sense of promoting "the culture's orthodox form of reasoning," here found in doctor's offices, labs, and epidemiological field studies (Sullivan 1993, 73). Yet, as Gross's characterization of the deficit model implies, by starting with the science rather than with the public yields an exhibit that celebrates the science by pacifying the public and ignoring the wider causes and implications of the science on display. Ironically, the exhibit is pacifying even as it is highly interactive. The implicit rhetorical force of the exhibit is to characterize science as an apolitical, asocial set of practices that are epistemologically certain. The worry from the point of view of this project is that a public persuaded of these views will carry them over to their understanding of other types of diseases as well as other scientific questions. In the next two chapters, we will look in detail at two exhibits that attempt to break from this paradigm in order to better understand the possibilities for how museums might represent science to the public.

Chapter 5

Race: Exhibiting the Dissociation of a "Scientific" Concept

Introduction

If *Disease Detectives* can be faulted for failing to promote a civically engaged public by retaining a narrow focus on the accommodation of scientific information, the exhibit discussed in this chapter cannot be. Jointly developed with the American Anthropological Association (AAA), *RACE: Are we so different?* (hereafter *Race*) uses text, objects, images, and video to clarify for the public the relationship between the scientific and socio-cultural aspects of race. At bottom, *Race* addresses the modern scientific answer to the question "What is race?" It answers this question through a dissociation of the reality of the social perception of race from the failed scientific side, and in the process the exhibit serves as a resource for visitors as they rethink their values and reshape their actions in the face of a message calling for social change. In this it is effective. However,

the exhibit's dissociation also constructs a representation of science that is both sensitive to cultural, social, and historical forces and an oversimplification. In short, the exhibit recognizes the history of failed racial science while at the same time exonerating science and scientists and perpetuating a too simple narrative of scientific progress (a narrative, I argue, that the exhibit itself undermines).

This chapter introduces and explores the exhibit's dissociation and what its representation of science means for the the public's engagement with science and with the broader social issues involved with race. After describing the exhibit, I then discuss Perelman and Olbrechts-Tyteca's notion of dissociation and demonstrate how the exhibit's dissociation of race, even as it functions to productively alter the public's conception of the term, results in a representation of science that fails to adequately embrace the complex relationship between science, history, and race.

Description of *RACE: Are we so different?*

Race, a traveling exhibition commissioned by the American Anthropological Association and developed by the Science Museum of Minnesota, challenges common conceptions of race in America. Covering 7,000 square feet of exhibition space, *Race* draws on numerous scientific, historic, and artistic installations to convey a complex message about the dual existence of race in science and society. It does this through a free-choice exhibit space that relies on a wide array of common exhibition technologies, from panels and videos, to objects and labels, to interactive components and simulations. The primary message, that race is a social construct with intense socio-cultural validity but no scientific validity, is reinforced throughout the exhibit. The general goal of the exhibit, however, is not merely

to present modern scientific views on race; the larger social goal is to use this foundation to alter visitors' everyday actions and beliefs regarding this particularly insidious cultural concept. In other words, this exhibit has a larger social agenda within its educational mission.

Connecting the different exhibit elements and themes is what Robert Garfinkle, the SMM's lead designer for the exhibit, described as the "correct rhetorical reading": visitors first encounter panels communicating the lack of scientific evidence for race and criticisms of biological determinism; they then see how the idea of race has been manipulated by those in power to control and limit us; and finally, once they have been informed of these things, visitors are presented an opportunity to engage with policy issues like affirmative action, Native American mascots, and the treatment of race in the US census (Garfinkle 2008). The exhibit's overall design facilitates a process of learning and informed application. Nothing prevents visitors from voting on the census immediately, but according to the "correct rhetorical reading," an *informed* census vote makes sense only *after* viewing the rest of the exhibit. While this may be the correct rhetorical reading and perhaps even the exhibit designer's preferred pathway, the exhibit is not linear and nothing keeps visitors from wandering as they please. Recognizing this, the exhibit reinforces the main messages about history, science, and the effects on everyday people throughout the exhibit.

Because the exhibit's free choice environment lacks a strong linear structure and confounds a simple narrative description, I organize my description of the exhibit around the exhibit's three major themes: Race and Science, Race and Society, and Race and Personal Experience. As the exhibit develops each theme, objects, videos, and interactive components are used to create a vivid visitor experience. Inevitably, these are not hard and

fast distinctions in the exhibit, especially one with an open structure; because visitors do not read an exhibit like a book and inevitably miss things, exhibits usefully link ideas together so that the main message comes through even via visitors' fragmented experiences.

As is typical for large thematic installations, the structure of the exhibit first presents visitors with an introductory panel which orients them to the general themes in the exhibit. Visitors are also gently guided to watch a brief, five-minute video narrating the history of racial thinking in the United States that again previews the basic themes and primary arguments that the exhibit communicates (i.e., that race is a social construction with no scientific basis). As I show in the analyses of the exhibit below, the orienting panel captures the dissociation of race very succinctly, and thus the representation and characterization of science begins right at the outset. Before turning to that analysis, I first discuss the exhibit's three primary thematic areas.

Race and Science

The representation of science is established most clearly in the panels discussing the historical and current scientific understandings of race. Because it is in a science museum and because the foundations of racism and biological determinism have historically come from science, the exhibit contains numerous panels repudiating outdated views on race and reiterating that it has no biological or scientific validity. Through these installations, the exhibit challenges popular understandings of race in order to undermine notions of genetic determinism, effectively replacing racial assumptions with geographic and genetic realities. A large display on the genetic and geographic explanation for skin colors explains that darker skin color resulted from the evolutionary need for mothers to balance

the production of vitamin D (a necessary nutrient provided by sunlight) with the protection of the body's folate, a necessary nutrient for reproduction that can be damaged by ultraviolet light. A smaller display demonstrates that sickle cell anemia, a disease statistically associated with individuals with black skin, is more accurately associated with the presence of malaria. Another large display uses maps and interactive elements to show the migration of Africans and the resulting genetic diversity. In effect, it makes the argument that we are all African in origin. A large installation mock-up of a pharmacy addresses race and health through a discussion of the FDA approval and efficacy of BiDil (the first race specific drug for preventing and treating heart conditions) and medical research that both undermines other race/health links and demonstrates science's inability to draw sharp biological and performance distinctions based on race. Finally, "Human (Mis)Measure," the first of four timelines, starting with Linnaeus and ending with the controversy surrounding genetic testing of indigenous populations, outlines the key failures in the history of racial science.

Race and Society

Establishing the role of race in society is the first step in the dissociation separating the scientific and social ideas of race. While not scientifically valid, social views of race were both generated and reinforced by racial science over its long history, and a large portion of the exhibit covers the social side of race and racism in America. Three other time lines compliment the one on the history of racial science: "Inventing Racism" tells the story of the development of racial categories, "Inventing Whiteness" shows how whiteness is both a racial and a social construction, and "Separate and Unequal" outlines the effects of scientific thinking in terms of power and control. *Race* is typical of many modern,

thematic exhibitions in science centers in that it does include a lot of objects from the museum's collection, but a few dramatically punctuate the timelines. Most notably, a slave's shackles and a scientist's kit for racing people based upon hair color help make real both the social and scientific sides of race. Another installation on race in society discusses housing segregation and earning potential across the United States, and another addresses (but leaves unresolved) the controversy over the use of American Indian Mascots. The "end" of the exhibit begins to open up two policy questions in earnest. First, a panel on affirmative action presents the history of ameliorative programs and summarizes some typical arguments advanced by their detractors. Second, visitors are given an opportunity to vote on four options for the wording of the "race" question on the US census. In the case of the census, the visitor's votes are tallied, and after voting, the visitor sees what the current consensus is among visitors to the exhibit.

Race and Personal Experience

The third thematic section of the exhibit presents videos and installations of individuals reflecting on their experience with race. Besides the framing video at the entrance to the exhibit, two other videos offer personal reflections about race. Along the rear wall a large video installation presents a series of interviews with individuals discussing their experience with race, racism, and mixed race heritage. This installation offers visitors an opportunity to respond by sharing their own personal stories and experiences with race. A second personal experience video shows a group of students discussing their experience with race in their high school.

A number of art installations also contribute to the personal experience with race. Wing Young Huie's photographs of interaction between different children of different

races are found throughout the exhibit, helping to highlight the verisimilitude of race in society. Kip Fubeck's Hapa Project, which is comprised of photographs of men and women with partial Asian-Pacific Islander heritage, contributed sixteen images. Each image consists of a person photographed naked from the collarbone up, without makeup, jewelry, or glasses, and each image is accompanied by a handwritten answer to the question "What are you?" This installation offers visitors an opportunity to respond to what they are viewing. Here they are asked to describe their own racial identity in their own words, as is modeled in the photographs. Another installation presenting personal experiences with race includes student lockers artistically filled to represent different cultural experiences in school settings.

This overview is inevitably limited in its discussion of the exhibit's elements. *Race* is a complex, rich, and highly textual and visual exhibit that even after multiple visits continued to offer up new information and insights. For my purposes, this overview presents the exhibit's major themes and elements. To give a larger overarching view of the exhibit as a coherent text, I will next rely on Louise Ravelli's three semiotic frameworks to show how the the exhibit functions along organizational, interactional, and representational lines.

Organization, Pathways, and Freedom

As noted above, *Race* is a free choice exhibit: there is no narrative or semiotic pathway, and the structure of the exhibit encourages visitors to move from section to section as they see fit. Because of the lack of a linear, vector-driven pathway, the exhibitors have given up some control over the visitors' experience, allowing them to encounter exhibit elements in

nearly any order. To help clarify what this organizational structure means, for a moment imagine that this exhibit and its three themes (race and science, race and society, race and lived experience) were placed within a linear pathway. What would be its structure? What would be the order? The "correct rhetorical reading" mentioned by Garfinkle assumes that the exhibit would explain the science of race, covering historical and current views; it would then show the effects of race in society, interspersing the artistic and video elements highlighting the lived experience of race; and finally, it would walk visitors through the policy questions, asking, Now that one knows the "real" science and the effects of racial policies, what kinds of decisions will one make?

Comparing these two structures (the imagined, linear narrative and the real, undirected, free choice space) shows two critical implications for the creation of meaning at the organizational level. First, the imagined pathway has a much clearer pedagogical goal, and it more openly constructs a master narrative of race in science and in the United States. While a pedagogical goal still remains in the free-choice environment, it is not so heavy handed: the authority of the museum is minimized in comparison. Thus, there is a connection here between the exhibit's organizational structure and the representation of racial science and race in America. Second, the imagined linear exhibit leaves little room for visitors' personal experience. While it is true that no two people will read a linear exhibit the same way, the range of possible readings is much greater in the free-choice environment. In this way, the emphasis throughout on race and lived experience is reinforced individually by each visitor's experience of the space itself. Rather than narrate a way of understanding the different themes, the exhibit makes possible and encourages a new personal experience with race. Thus, the organizational meaning of a free-choice space affects the interactional meanings that are possible.

The organizational structure of the exhibit, because it lacks a clear pathway, does not offer a linear text for the visitor to read. Instead, the visitor can read the exhibit in a myriad of ways, constructing nuanced meanings and idiosyncratic experiences based on the resources provided by the exhibit as he or she chooses to experience them.

Interactive Possibilities

The open, unstructured space of the exhibit discussed above in terms of the organizational meanings here contribute to the exhibit's interactive meanings. In particular, the exhibit's organization constructs a lower authoritative position for the museum, and grants the visitor a more active role. The experience of *Race* is not one that comes fully formed from the top; it is constructed through individual choices. On a second level, the exhibit gives the visitor a chance to physically interact with the exhibit elements. Whether it is overlaying malaria and skin color distribution slides over a map of earth to see how the two are correlated or if it is pressing buttons to help visitors see that skin color, blood type, and other observable physical characteristics are not easily systematized, visitors are continually given opportunities to complete the message that the museum makes possible.

Most important for the interactive meanings generated in the exhibit, however, are the opportunities provided by the exhibit for feedback: the exhibit offers prompts about visitors' experience with race, prompts their views on the census and use of mascots in sports, and prompts them to write questions for scientists themselves. While the question format of exhibit texts itself allows for a high degree of interactivity and visitor engagement, the fact that the exhibit allows visitors to share their answers and then incorporates those answers into the exhibit space for future visitors to read further shows a

high degree of interactivity. It also helps to minimize the authoritative position of the museum: visitor responses are legitimate ways of understanding race or deciding how problems like Native American mascots and the census should be handled. Thus, visitors not only interact with the exhibit to complete particular messages, they are given the chance to contribute to the exhibit's overall message, in effect creating part of the exhibit as they participate. Consequently, as a framework for understanding the exhibit as a text, the high degree of interactivity in terms of its spatial structure, exhibit elements, and feedback mechanisms allows visitors to come to an understanding of race on their own terms.

Representing Racial Science and Race in the United States

The topic of this exhibit is race, but the presentation of this idea is broken up into three themes: science, society, and personal experience. Also central is the experience of race as a real, social fact. As such, race is not represented as a concept to be understood in traditional ways. Everything that gets displayed feeds into this larger picture of race in the United States. Race as an idea is evident from the kinds of displays used. In the past, exhibits that promoted the science of racial thinking were based upon cultural representations: objects, rituals, and people were displayed and juxtaposed with one another to establish taxonomic and hierarchical relationships. All of this is missing from *Race*. Only a few objects are used for dramatic effect, and these objects represent failed science (tools for 'racing' individuals by cranium measurements or hair type) or immoral social conventions (slave shackles). These objects tell the story of how the idea of race came to be; they do not show us what race "is" in a scientific way. Furthermore, the

exhibit's representations of individuals are used to show the difficulty of organizing types (the installation on physical characteristics) or to relay personal experience (the videos and works of art). These design choices construct a text that represents a shift away from traditional ways of talking about and displaying race in museums. They are modern representations, which place personal experience on equal footing with scientific understanding.

This modern way of representing race in America is supported through the organization of the exhibit. Because the three overarching themes are intermixed and not distinctly organized, the science, sociology/history, and personal experience themes are physically distinct from each other, and none of them is privileged or given clear emphasis. In fact, the myriad of disciplines contributing to our current understanding of race (biology, genetics, history, anthropology, and sociology) are mixed as well, which takes the emphasis off the scientific or academic view of race and places it on the ideas themselves. This is not a genetics exhibit, or a biology exhibit, or an anthropology, or historical exhibit; it is an exhibit representing the fact of race in America, a fact with many facets.

However, while the exhibit does not control the overall explicit messages as tightly as a more linear, narrow exhibit like *Disease Detectives* might, it does have an ameliorative goal. Just like discussions of the exhibit's texts, the exhibit itself can have a genre or main purpose that conveys its primary message. *Race* is attempting to persuade the public to change the way it thinks and acts in relation to race in their lives. This goal gives the exhibit a clear argumentative purpose via dissociation, and I will spend the remainder of the chapter discussing how the exhibit accomplishes this dissociation in order to further fill out the exhibit's representational meanings concerning science.

The Dissociation and Definition of Race

Reading the exhibit via Ravelli's frameworks provides a picture of organizational, interactional, and representational meanings that help us see that race is richly displayed through science, sociology, and lived experience. Furthermore, visitors are provided a large degree of freedom to construct these meanings and to contribute to them on their own terms. Framing the exhibit is the question "What is race?", which allows the exhibit to present all three of its thematic foci. As I will show, this basic question makes possible the exhibit's argumentative strength.

Like all terms, "race" is a concept without an essence. Yet the form of the question, "What is race?" implies a definite answer; it is a question that reinforces metaphysical absolutism, "the belief that the world consists of independent, objective 'real' objects or essences that can be known directly as they 'really are'" (Schiappa 2003, 39). Because there is no definitive answer identifying its essence, asking the question "What is race?" is a trick question. The rhetorical force of raising this question in the exhibit in the first place primes visitors to become conscious of their necessarily partial views, and it prepares them to be challenged by current social and scientific conceptions of race that the exhibit displays. Manifested materially at different points throughout the exhibit, the question "What is race?" serves as a major framing device for the exhibit as a whole (for if we can answer this, we can then show how we should or should not be acting in response to it), encouraging visitors to hold the question in their minds as they engage with modern scientific and social views. Whether the visitors answer the question with what they think is a satisfactory answer or whether they realize that any answer to the question mires them in the same categorical problems that science has been attempting to resolve for centuries,

they have been prepared to engage with the exhibit.

On a deeper level, asking "What is race?" accomplishes something more: it makes way for a definitional dissociation wherein lies the exhibit's true rhetorical force. (Recall that according to Condit (1985) one of the primary functions of epideictic was definition and understanding.) As Edward Schiappa (2003) has shown, questions like "What is race?" are questions of definition. They ask: what *is* race in reality? What is its nature? More specifically, questions like these are definitions that seek the concept's *fact of essence*, which differs from definitional questions that seek to determine the *fact of usage*, or lexical definition (Schiappa 2003, 6). The theoretical bite of the question of essence comes from what Schiappa terms a definitional rupture, a fundamental dispute over the nature of what the word or concept means. Contested for the majority of its theoretical life, race is a concept formed through definitional ruptures. Unlike definitional gaps, which can be bridged by looking the word up, definitional ruptures cannot be so mended: the rupture exists because the very nature of the word is up for grabs, and the rupture matters because it is ideological and it affects important policy decisions.

As Perelman and Olbrechts-Tyteca note in their seminal work *The New Rhetoric*, a definition can be used as "an instrument [for the] dissociation of concepts, more especially whenever it claims to furnish the real, true meaning of the concept as opposed to its customary or apparent usage" (Perelman and Olbrechts-Tyteca 1969, 444). More generally, dissociation involves breaking a concept into two parts: one side, representing the old, false view, is given a negative valence and the other side representing reality is given a positive valence. They define it as "techniques of separation which have the purpose of dissociating, separating, disuniting elements which are regarded as forming a whole" (Perelman and Olbrechts-Tyteca 1969, 190). Theorizing answers to "What is

X?"-type questions are popular philosophical moves, for it is through the definitional clarification of what is the "true" or "real" way to conceptualize something that the foundations of arguments are built. Anyone (or in the case of a museum exhibit, any thing) that raises the question "What is X?" and then attempts to clarify the true nature of X against a false one is in the business of dissociation.

Classically, dissociating reality into the appearance/reality pair is a standard philosophical move that allows the clarification of true experience or knowledge from false versions and illusion. These types of dissociations constitute the basis of Plato's allegory of the cave and indeed his entire metaphysical system, which Kant's distinction between phenomenon and noumenon carries to its fullest extent. Alan Gross's distinction between two models of the public understanding of science is a dissociation: it breaks public understanding into two models, one—the deficit model—which is less valued than the other, and it "modifies the very structure" of the public understanding of science (Perelman and Olbrechts-Tyteca 1969, 412). Perhaps a more relatable example of dissociation can be found in Crocodile Dundees quip: "That's not a knife; This is a knife." More pragmatically, Schiappa has shown with concepts like death, rape, and wetlands, that questions of essence and definitions also have important effects in the realm of public policy.

Historically, "race" has been a particularly popular concept to define and dissociate because, however its essence is defined, it affects and effects social and political realities in profound ways. The continual scientific and social/historical arguments surrounding race demonstrate the definitional ruptures that contextualize our understanding of race. *Race* continues the tradition of dissociating this muddy concept, this time for the public. However, because this dissociation in turn presents a particular representation of science,

the ways the exhibit carries it out rewards analysis and requires discussion.

The general structure of my analysis here follows John Lynch's (2006) discussion of dissociation and stem cells. Here Lynch first demonstrates the dissociation with regard to stem cells within the scientific community, and then shows how this dissociation was mobilized by the political community to make public arguments by arguing that "implicit, unconscious acts of real definition in arenas like the technical sphere [. . .] generate the grounds for strategic decisions in political and policy debates" (Lynch 2006, 144). Consequently, his arguments make the case for the integration of two views of dissociation, one seeing it as an argumentative technique in politics and the other treating it as a means to determine what is real within a particular discourse community. He posits "a continuum that extends from unassuming acts of real definition to intentional, strategic uses of dissociation" (Lynch 2006, 144). I argue that *Race* extends the continuum by showing how dissociations can be mobilized in the public sphere more broadly. By following Lynch, before showing how the exhibit mobilizes this history and what that mobilization does for the representation of science in the exhibit, I must first briefly outline the dissociation that occurred in the history of anthropology and biology.

Dissociating Race: A Brief History

The dissociation that occurs in the exhibit between the viability of race as a scientific concept and its continued use as a social category, has already occurred in the scientific community, hence the exhibit's mandate and main message. Once proudly scientific, today any attempt to define and ground fixed racial categories biologically or genetically from which we can infer moral, psychological, or cultural characteristics is quickly

dismissed as inaccurate, anachronistic, and probably racist. The history of this concept within science and within society demonstrates the close connection between the two: while not all racial science was insidiously racist, today we can see that on the whole, past scientists tended to channel into their work the racial—and racist—ideologies of the day. Yet the question of race remains, on the surface at least, a seemingly real one: we *see* differences between individuals, and because humans are classificatory animals, the impulse is to make sense of these differences scientifically, as scientists have done with other species. The effective communication of the disciplinary dissociation has important implications for the exhibit's public representation of science.

Historically, race is a purely modern, scientific concept (Montagu 1997, 59). According to Hannaford (1996), though peoples in ancient societies encountered individuals from different cultures with different physical characteristics, they did not have a concept of race. The "civilized" Athenians, for example, distinguished themselves from others (the barbarians) not by skin color or other physical differences, but by their political allegiances and tendencies (Hannaford 1996). As both Hannaford (1996) and Smedley (1999b) argue, the term "race" did not enter the English language until the 17th century, where it was used to refer to qualities of particular types of people (either class or inherited disposition) or it was used interchangeably with the term "species" (Smedley 1999b, 38). Only at the height of the colonial period was "race developed as a classificatory term in English similar to, and interchangeable with, 'people,' 'nation,' 'kind,' 'type,' 'variety,' 'stock,' and so forth" (Smedley 1999b, 39). At this time, physical differences were quickly tied to cultural ones, and with the help of science race established itself as an entire ontological, metaphysical, and ethical way of organizing the world. For those in the West in the eighteenth and nineteenth centuries, racial hierarchies

just made sense.

Race was given a scientific foundation by Carolus Linnaeus in his *Systemae Naturae*, which, among other things, established scientific taxonomy and the binomial nomenclature of genus and species that we still apply today. His taxonomy of human types relied on physical, psychological, and cultural characteristics that show how easily biodeterminist and racist judgments were implied and propagated. This taxonomy was expanded by Hans Blumenbach (1752-1840), a student of Linneaus, who reinforced and allowed for a more scientific approach to races. Later, Samuel George Morton, the famous American polygenist[1], published *Crania Americana* and *Crania Aegypticiaca*, which relied on the popular method of craniometry to measure the size of skulls and to rank racial differences. Others, including Louis Agassiz, Cuvier, Galton, Broca, and many more, continued the tradition of measuring heads and judging character. As Gould (1996) demonstrates, these scientists were, in one way or another, ideologically biased, racist, and ultimately, misguided. But, influenced by Blumenbach's taxonomy, they continued to treat race as a real scientific concept, measuring facial angle, "skull shape, hair pile, skin color, temperament, and political belief in order to determine the reality and ranking of dozens or hundreds of stocks" (John S. Haller 1971, 78).

Biologists and anthropologists on the whole now see things differently. Racial distinctions no longer lay claim to biological (or logical) validity, and thus "race" has little to offer as a scientific concept. What remains is a socially valid, socially constructed concept with a rather unfortunate scientific history. This dissociation of race into its scientific (or physical) and its social and cultural dimensions began in the early twentieth

[1]Polygeny refers to the belief that the different races of humans made up different species, and it is countered by monogeny, the belief that all humans are the same species. Morton believed that "races represented 'primoridal' differences and had been created separately in different environments" (Smedley 1999b, 233).

century when scholars like Franz Boas and Ruth Benedict attempted to tease apart the physical aspects of race from the moral and cultural aspects, which had been coupled since the time of Linnaeus and as such had facilitated racist ideologies. Scientists today explain the physical differences between populations through a variety of concepts, the most important of which is variety itself. Instead of viewing race as fixed and determined, scientists now see in what was traditionally called race the results of sets of variations within geographically situated genetic populations or pools. But race is no longer a useful term here, for the genetic differences or similarities between populations depends on what heritable trait is studied, and perhaps more importantly, these traits vary over time. Nothing is static in this evolutionary model. Race cannot be fixed or pinned down. The dissociation of race within the scientific community emphasizes that race is a social construction, a "folk idea" (Smedley 1999b), a "myth" (Montagu 1997), and "the phlogiston of our time" (Montagu 1969, xiii). Hence the exhibit's titular question: "Are we so different?"

This history of racial science tells the story of how modern anthropologists and biologists have continued to clarify their scientific understanding of race. This evolution has been met step by step with a theoretical discussion within anthropology, where the dissociation of race has been carried out most forcefully. Anthropologists understand that the history of their discipline has been a central part of the intellectual force propping up the "racial worldview" (Smedley 1999a), and has led many cultural and physical anthropologists to take the initiative and responsibility to clarify the nature of this concept within their field and in the wider public sphere (Mukhopadhyay and Moses 1997). Noting the "terminological chaos" surrounding race that exists within the field today, Mukhopadhyay and Moses recognize that "anthropologists do not agree on the semantics

of race: what the 'it' is that we are talking about, which elements in the racial worldview and which facets of contemporary approaches we are rejecting or accepting, and what terminology we will use to reference those ideas or concepts on which consensus *does* exist" (521). This morass is due in part to theoretical attempts to dissociate race into its social/cultural form and its biological form.

Yet, however race is clarified and defined, the dissociation is well underway, with perhaps the most important dissociative argument on the place of race in anthropology coming from the AAA Executive Board (1999) and their 1998 *AAA Statement on Race*: Representing a majority of anthropologists, the statement claims that "Historical research has shown that the idea of race has always carried more meanings than mere physical differences; indeed, physical variations in the human species have no meaning except the social ones that humans put on them" (AAA Executive Board 1999, 712). Seven years later, this message has only gotten stronger: Publishing a piece in *American Psychologist* in 2005 entitled "Race as Biology is Fiction, Racism as a Social Problem is Real," Smedley and Smedley (2005) bring their case to psychologists, arguing "The consensus among most scholars in fields such as evolutionary biology, anthropology, and other disciplines is that racial distinctions [. . .] are not genetically discrete, are not reliably measured, and are not scientifically meaningful" (Smedley and Smedley 2005, 16). Together with these disciplinary arguments in anthropology, the 1998 disciplinary statement resulted in the the large scale public dissemination effort called for by Mukhopadhyay (2007); Mukhopadhyay and Moses (1997), Smedley and Smedley (2005), Lieberman and Kirk (2004), and many others, and ultimately it led to the generation of the exhibit *Race: Are we so different?*

The conceptual dissociation of race within the scientific community brings to the fore

a rather unsavory portion of science: through its methods and intentions, science grounded and supported racist ideologies. Anthropology, as a discipline, played a key role in the development of racial thinking. Today, however, anthropologists and the entire discipline itself are working to redress these wrongs. The self-reflective articles published in anthropology journals demonstrate that they recognize their role in the construction of race and they understand they have a responsibility to contribute to new ways of thinking.

However, while the dismantling of the scientific basis for oversimplified racial categorization is all to the social good, as Audrey Smedley (1999b) points out, the process leaves us with a series of questions about the nature of science itself:

> If the field that had the most to do with the identification and definition of human races is relinquishing its activities and related conceptual apparatuses in this area, what does this mean for other sciences that have focused on racial differences? What does this convey to us about the nature of anthropology or science in general? Are scientific discoveries or conclusions so ephemeral or arbitrary that such a crucial concept can be so easily discarded? More importantly, what possible meanings or implications might there be for society at large? How can a scientific discipline overtly contradict a reality that so many of us daily experience? (Smedley 1999b, 3)

The remainder of this chapter attempts to understand how an exhibit that necessarily, yet implicitly, raises these questions represents science for the public.

Race's Dissociation of Science

In order to show how the exhibit's dissociation of race creates a particular representation of science in the exhibit, I will explore the panels that are focused primarily on presenting the science of race. This first takes us to the opening panel (Figure 5.1), which accomplishes three things: (1) it introduces the visitor to the exhibit's primary arguments; (2) it introduces visitors to the exhibit's main themes; and (3) it serves as a warning, preparing visitors for a potentially challenging exhibition. Each paragraph in this panel does one of these three things. The first paragraph introduces the scientific theme and emphasizes what essentially becomes the exhibit's two take-away arguments: race is a social, not a scientific, construct, and all humans are similar both in their origins and in the fact that they are all genetically different. The second paragraph introduces the social side of the concept of race, which corresponds to the second theme in the exhibit: how American society has developed racial categories and stereotypes that systematically limit the opportunities of others. In other words, even though the social basis on which discrimination is justified has been undermined by, as the museum will claim, science, racism remains a pervasive problem in the United States. The third paragraph in the panel becomes reflective, alerting visitors to the power of the exhibit to challenge visitors and "hopefully" improve society. This, too, has a correlate in the exhibit, for the last theme explores not the historical ramifications of race, but what is and what should be happening right now. It is here in the exhibit that the betterment of relations is the most hopeful, and it is at this point in the text that the exhibit recognizes its persuasive potential.

The final textual feature of the introductory panel, the attribution to the American Anthropological Association (AAA), effectively turns the text into a direct address by the

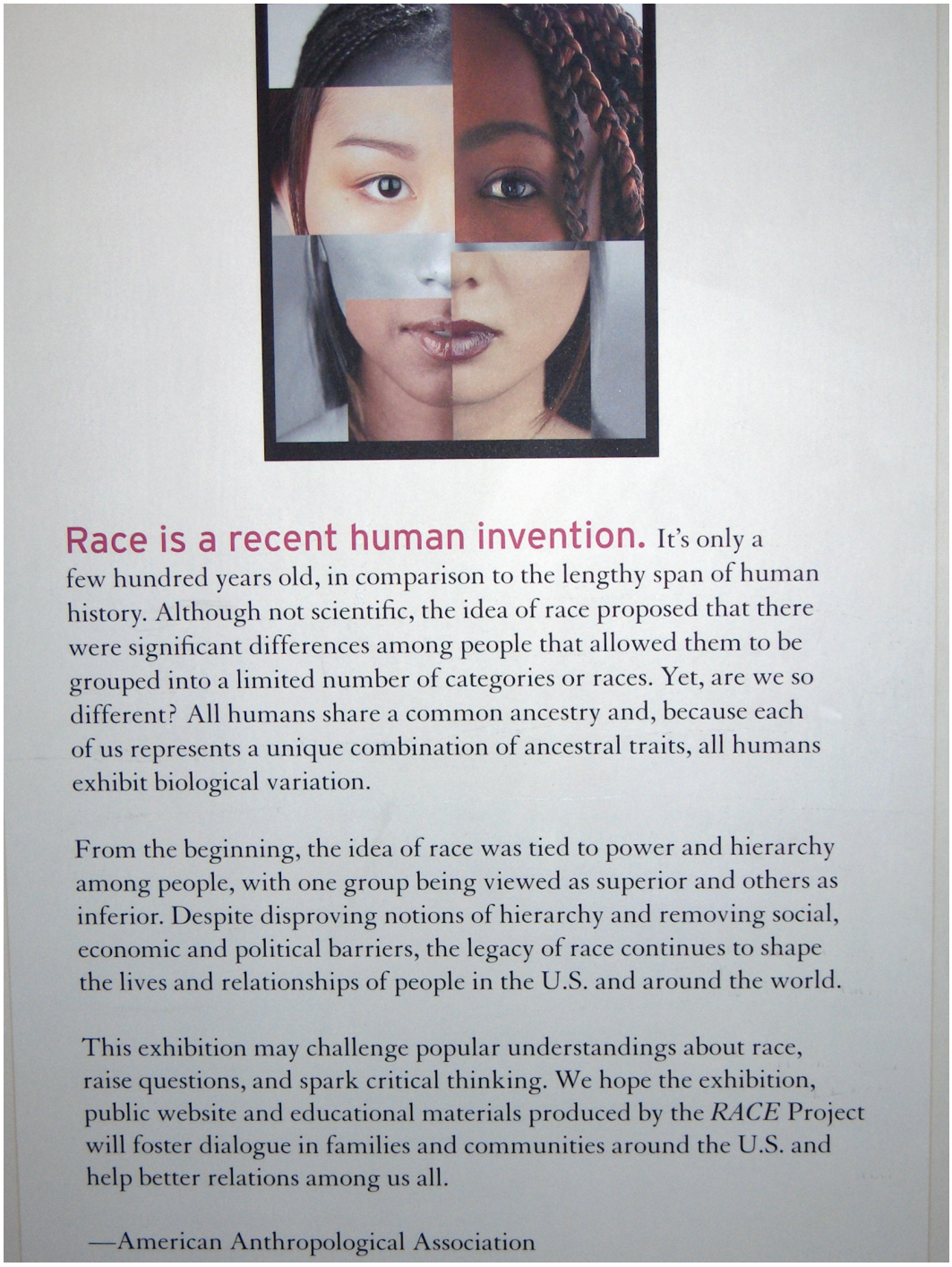


Figure 5.1: *Race* Introductory Panel

AAA to museum visitors. This is a statement not by the museum or by the exhibit designers but by the entire discipline of anthropology telling viewers how they should understand race. Together with the third paragraph, the attribution rounds out a reflective comment on the power of the exhibit in general, a comment that is a level above those made by the rest of the exhibit, which is in the museum's voice. Remove the attribution, and the text is naturalized as part of regular museum communication. Though the text would still have an implicit author and authority, the assertions would not be as strongly argumentative or as forcefully felt. They would, in one sense, be disembodied. The attribution not only allows for the "we" of the third paragraph to make sense, it also clearly identifies the positions in the first two paragraphs *as* positions; though they might be true, the attribution reminds us that they are beliefs held by a particular group of people.

Together, then, the structural features of the introductory panel's text give this panel the shape of a letter or email or other direct address by the AAA to the museum visitors. This is evident by the breaks between paragraphs and the attribution to the AAA. Unlike other exhibit panels, which tend to include more font sizes, more colors, and more labels to break up and organize the message(s), this panel needs to be read all the way through to get a full sense of its organization. If it is true that museum "text is intended not only to be *read*, but, first of all, to be *seen*," then the structure of this panel facilitates the visual assessment of the overall structure as a direct textual address to visitors (Jacobi and Poli 1995, 51).

Besides the use of color to emphasize the opening line in the panel, the only other visual feature on the introductory panel is the image at the top, which effectively creates a powerful visual experience that communicates the exhibit's three themes. This image serves as the logo for the larger "Understanding Race" project, and it brands the exhibit,

claiming it as a part of the larger anthropological project. It also creates an experience for the visitor that as the exhibit's three themes. First, it captures the non-scientific nature of race by presenting it as a very real human phenomenon. This is perhaps a negative point: had the image been of anything scientific (DNA, scientists, an historical image), the emphasis would have been clearly on the science. By fronting the human/social aspect of race, it reinforces the main message that this is a social/historical phenomenon. That being said, the image does reinforce key parts of the exhibit's second theme: "All humans share a common ancestry, and because each of us represents a unique combination of ancestral traits, all humans exhibit biological variation." In effect, the mosaic reinforces the current scientific view that we are all similar even accounting for all our physical differences. Finally, the image's gaze creates a traditional demand on visitors (a new personal experience), and who, by viewing the image, encounter the exhibit's first "challenge": the viewer must come to terms with the exhibit's answer to the titular question, "Are we all so different?" By answering this question in the negative, the image and its demand gaze makes claims about the nature of race and it creates an experience wherein visitors visually grapple with these claims.

While the exhibit's main purpose—to clarify what race *is* by answering the question "What is race?"—emerges as the exhibit is experienced, the exhibit's initial and most succinct answer to its dissociative question "What is race?" comes from the first line of the introductory panel (Figure 5.1) where it locates race squarely in the realm of the social: "Race is a recent human invention. Its only a few hundred years old, in comparison to the lengthy span of human history." This is an odd answer to the exhibit's question, for it demonstrates to what extent the initial question is a trick question. It is like responding to the question "What is a chair?" with the answer, "it is a recent human invention." While

accurate, this answer does not tell us anything specific about the nature of the chair or how to distinguish it from the myriad of other human inventions, like tables or bicycles or windows. Of course the case of race is different. While the abstract meta-answer might elicit a frustrated, "Hey, that does not tell me anything about what race is!", it does actually say something interesting: it tells us that race is not like gravity or genes or the speed of light, which are scientific ideas and not, at least in the minds of the scientists displayed here, human inventions. Thus, the first sentence of the opening panel fundamentally undermines any realist definition of race that visitors might bring with them by denying any biological, scientific, or objective basis to it: race cannot be defined as anything other than a conceptual tool developed by humans to organize their experience; it has no basis in science. The panel seems to imply that it is meaningless to say that a person belongs to any one race because that simply says that we have been taught to categorize people not via any scientifically determined set of criteria, but by a human invention, like their astrological sign or the bumps on their head or the lines on their hand.

The third line of the introductory panel situates race even more strongly in the social rather than the scientific realm of ideas: "Although not scientific, the idea of race proposed that there were significant differences among people that allowed them to be grouped into a limited number of categories or races." From the brief history above, the statement that race is "not scientific" might be seen as contemporarily accurate: the majority of anthropologists no longer believe the explanatory power of racial categories to distinguish types (and especially qualities) of people. But that history also shows that for most of its three hundred year history race *was* very much scientific. Yet the opening panel does not adequately recognize the role of science, especially anthropology, in the scientific construction of race. It is anachronistic and irresponsible, then, to categorically say that

race is “not scientific.”

The result of this fundamental dissociation at the start of the exhibit is that it forces (or allows) the exhibit to grapple with historical change: today scientists no longer think of race as having a biological foundation, but for most of its three hundred year history race was very much scientific. The exhibit deals with this paradox by funneling the history of failed racial science into a timeline titled “Human (Mis)Measure” (Figure 5.2) and by displaying the current, correct view of race in larger thematic panels and installations on skin color, human migration, and sickle cell anemia along the walls. The effect of this

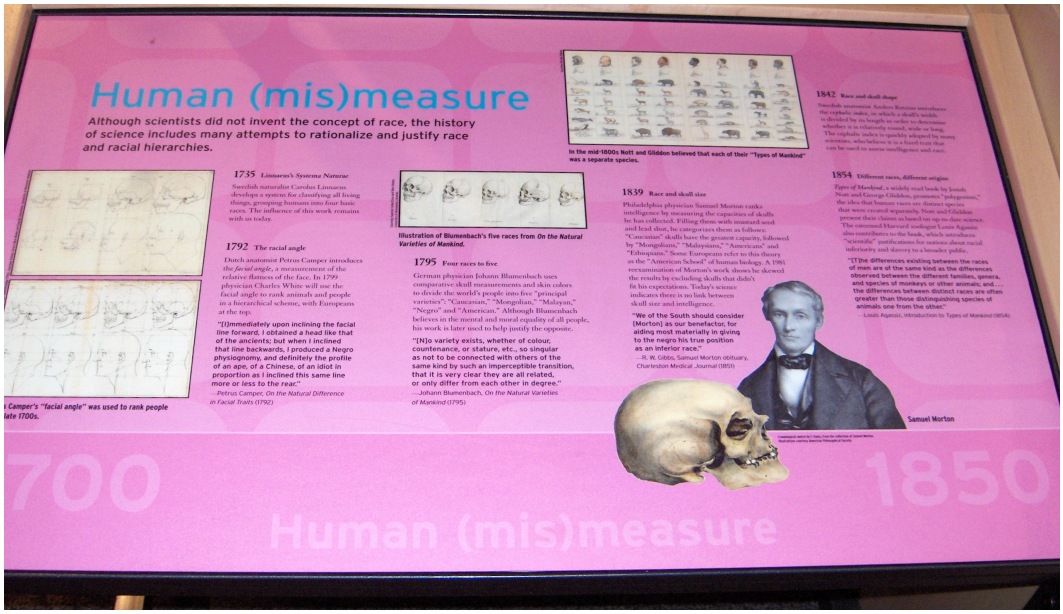


Figure 5.2: The first section of the “Human (Mis)Measure” timeline

structure is twofold. On the one hand, setting the history of failed science in a timeline is an epideictic move allowing the exhibit to accommodate and celebrate the current science on race, which relies on genetic variation, the distinction between phenotype and genotype, and clines to explain diversity and freeze as historically inaccurate everything

else. Here the exhibit reinforces the more standard deficit approach to the public understanding. On the other hand, if one looks closely, the exhibit not only characterizes the history of racial science as a narrative of progress, it also conveys the image of science that Smedley (1999b) was concerned with above: it displays the discipline of science historically and sociologically by acknowledging that the science could be fundamentally wrong about the nature of a relatively central concept for three hundred years because of an ideological link between power and knowledge. Unfortunately, the exhibit does not embrace the opportunity to discuss this history in detail.

This is a problem of responsibility and ethos, and it is compounded by other language in the opening panel. While anthropologists today recognize their role in the "scientific" construction of race, the opening panel does not mirror this. Agency is leached out. Anthropology is absolved of any responsibility: it is the "idea of race" that proposes, not any individual or group of individuals. Similarly, the second paragraph further suppresses any mention of a human agent in the construction and propagation of race: "From the beginning, race was tied to power and hierarchy among people, with one group being viewed as superior and others as inferior." "Race," it seems, has a life of its own. This sentence further distances anthropology from the idea of race by poorly historicizing it. "From the beginning…" is vague. Though the opening line places race in "recent" human history, the opening clause of this sentence does not, as it should, necessarily place "race" in human history. "From the beginning" is the language of inevitability, and in the process it absolves science, and anthropology in particular, of any clear role in the development of race. It effectively makes race an inevitable part of the human condition.

At the outset, then, the exhibit's dissociation of race into its social and scientific concepts is coupled with a distortion of responsibility. By removing human agency from

the discussion of race (especially after asserting in the first sentence that it is a specifically "human" invention), the opening panel conceals the primary actors (science and anthropology), reinforcing race as a naturalistic category that works as an idea without any human or institutional agent or agency. In terms of race, these statements leach responsibility for racism from actors and institutions: though race is a human invention, it is the idea (or legacy) of race itself that is responsible and not human choices that have caused the problem. And just for good measure, the panel exonerates science itself—race is "not scientific" and the historical comments are vague enough to let it off the hook. Thus, what is concealed below these sentences is the role science (and in fact museums) has played in constituting race as a means of classification in the first place.

The exhibit carries out the dissociation between race as a social idea and race as a scientific idea at other points in the exhibit. One such panel (Figure 5.3) makes the analogy that people are like avocados. Focusing on the comparison between the two, the argument is starkly framed (Figure 5.4). The point, here, is to bring home the argument that racial categories vary by society. However, in making this argument, the exhibit draws an odd distinction, one that reflects back on its representation of science and, I argue, threatens to undermine its main point. The case made in the exhibit is that the *use* of avocados differs from culture to culture, therefore classifying it as a fruit or vegetable is impossible: it depends too much on cultural variability. Similarly, racial categories vary from culture to culture demonstrating that they are culture bound and not scientific. But science *can* classify avocados: botanically speaking, they are fruits and not vegetables, no matter their use. The distinction between fruits and vegetables is, on an important level, arbitrary and socially constructed. Yet science does have a way to define fruits that is not based upon the use to which humans put them: they consist of the ripened ovary and seeds

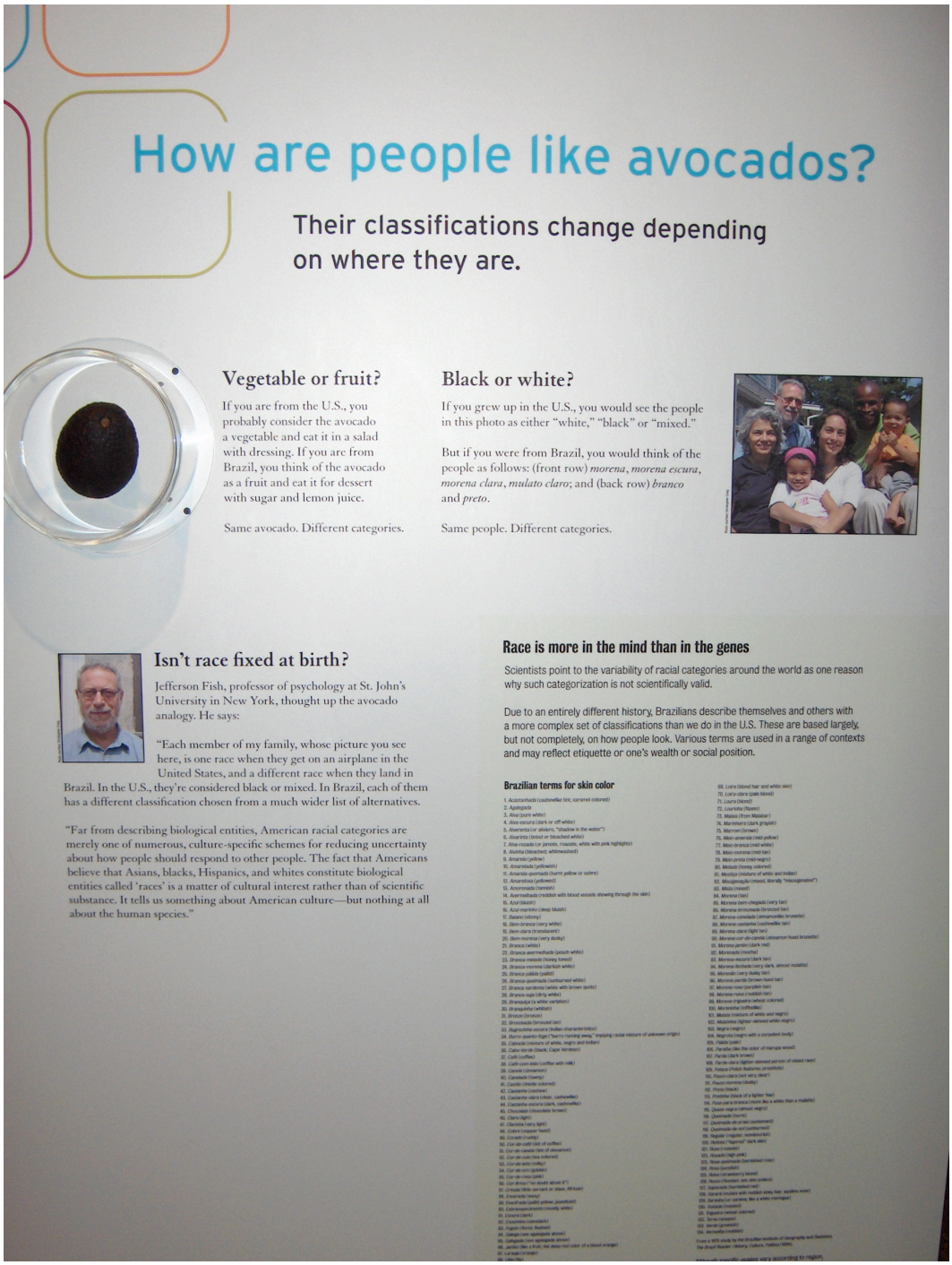


Figure 5.3: How Are People Like Avocados?

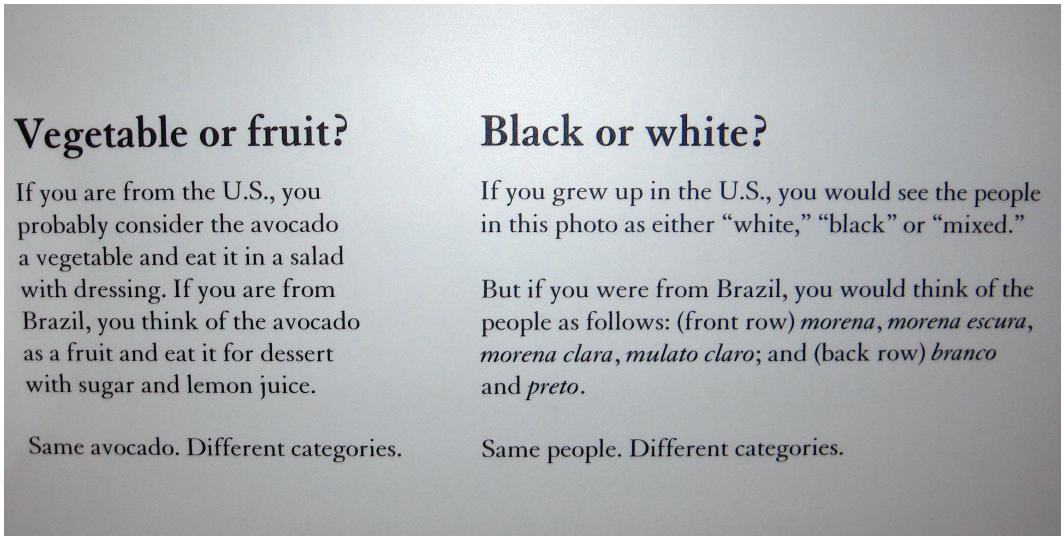


Figure 5.4: Avocados and Racial Categories

of a flowering plant. In the case of race, the problems of classification are a bit different. Scientists recognize that the fact that the *use* of racial markers vary from culture to culture does indicate a fundamental problem in the classificatory scheme of racial scientists. However, our model for this cannot be a problem with cultural uses of various fruits and vegetables. Because fruits have formal definitions and botanical criteria, this seems to be a win for science. The implication is that if science can come up with a vocabulary and a formal definition of fruit that distinguishes it from vegetables, then perhaps we have not given science enough of an opportunity to clarify racial distinctions. This is not to suggest that this is true; rather, it is to show to what extent the exhibit's argumentative analogy tries to dissociate the science of race from its social side by comparing racial distinctions to problems classifying fruits and vegetables oversimplifies the situation, and, perhaps, presents an inaccurate picture of scientific taxonomic efforts. In dissociating race as a scientific idea from race as a social idea, science as a discipline is oversimplified: it

implies that pragmatic *use* can easily upend scientific classificatory schemes, and in so doing, it contributes to the exhibit's oversimplification of science. After all, what does it mean for an exhibit on the science of race that relies on scientists and scientific ideas to say that race is not a scientific idea?

Overall, the dissociation that the exhibit effects highlights the historically biased and necessarily revisable nature of science, while at the same time reinforcing that process as a progress narrative. It repudiates old, racist scientific ideas while at the same time exonerating the very scientists and disciplines that contributed to those racist views in the first place. These aspects of the exhibit's representation of science reinforces aspects of the deficit model: the science is treated factually, with little no discussion of the processes of science; historical, political, and ethical concerns *of the science* are flattened out; and the visitor once again largely positioned to look up to science as the ultimate, unfailing authority on all matters scientific.

However, *Race* is also accomplishing something else. Instead of focusing on the nature of science (as *Mysteries of Çatalhöyük* will), the *Race* focuses primarily on using the scientific side of the argument to drive its social agenda: at least one-third of the exhibit grapples with the social life of race through topics like Native American sports mascots, affirmative action, the census, and housing and income disparities. The exhibit's unasked question is: Now that you understand that race has no scientific foundation, how are you going to rethink your own personal relationship with race as well as your stances on these political/policy issues? It asks: Will you change? In the visitor's answer to this question lies the exhibit's radical epideictic goal: the current science is celebrated in order to provide the ground for a revised notion of what race is (and is not).

Many facets of the exhibit reinforce this epideictic end, many of which rely on the

celebration of model behavior. For example, each of the sixteen art pieces from Kip Fubeck's Hapa Project (see Figure 5.5) describes multi-racial individuals' responses to the question "What are you?" The responses here not only counter traditional percentages of racial heritage (thinking of themselves in terms of half and half), they also openly mock, criticize, or undermine the very notion of racial categories. For example, the woman's description in Figure 5.6 powerfully embraces the designation of "other." Similarly, the man in Figure 5.7 writes, "What am I? I am exactly the same as every other person in 2500." Together these images provide templates not only for how mixed race individuals might think of themselves; they also undermine a simplistic racial framework for categorizing people. By celebrating these individuals and their self-conceptions, *Race* forces visitors to rethink their own racial categories. The celebration of people reflecting on their own experience with race is also found in videos and images throughout the exhibit. While the these installations do not require the scientific arguments seen earlier in the exhibit, their power for affecting the public's understanding of race is only reinforced by the removal any biological and scientific justification for racial categories in the first place.

Through its dissociation, *Race* ends up celebrating and accommodating the current racial science—its panels on skin color, genetic migration, and sickle cell anemia—in such a way that it continues to reinforce aspects of the deficit model. However, the exhibit also broaches a more complex picture of science that is not typically celebrated: that science can be greatly influenced by ideological and sociological factors that result in a failed science. We might argue that this more complex picture facilitates a richer and more accurate view of science by showing that science is robust and self-revising. Surely these are strengths to be lauded. Unfortunately, the exhibit does not take this route, and leaves

Figure 5.5: Kip Fubeck's Hapa Project

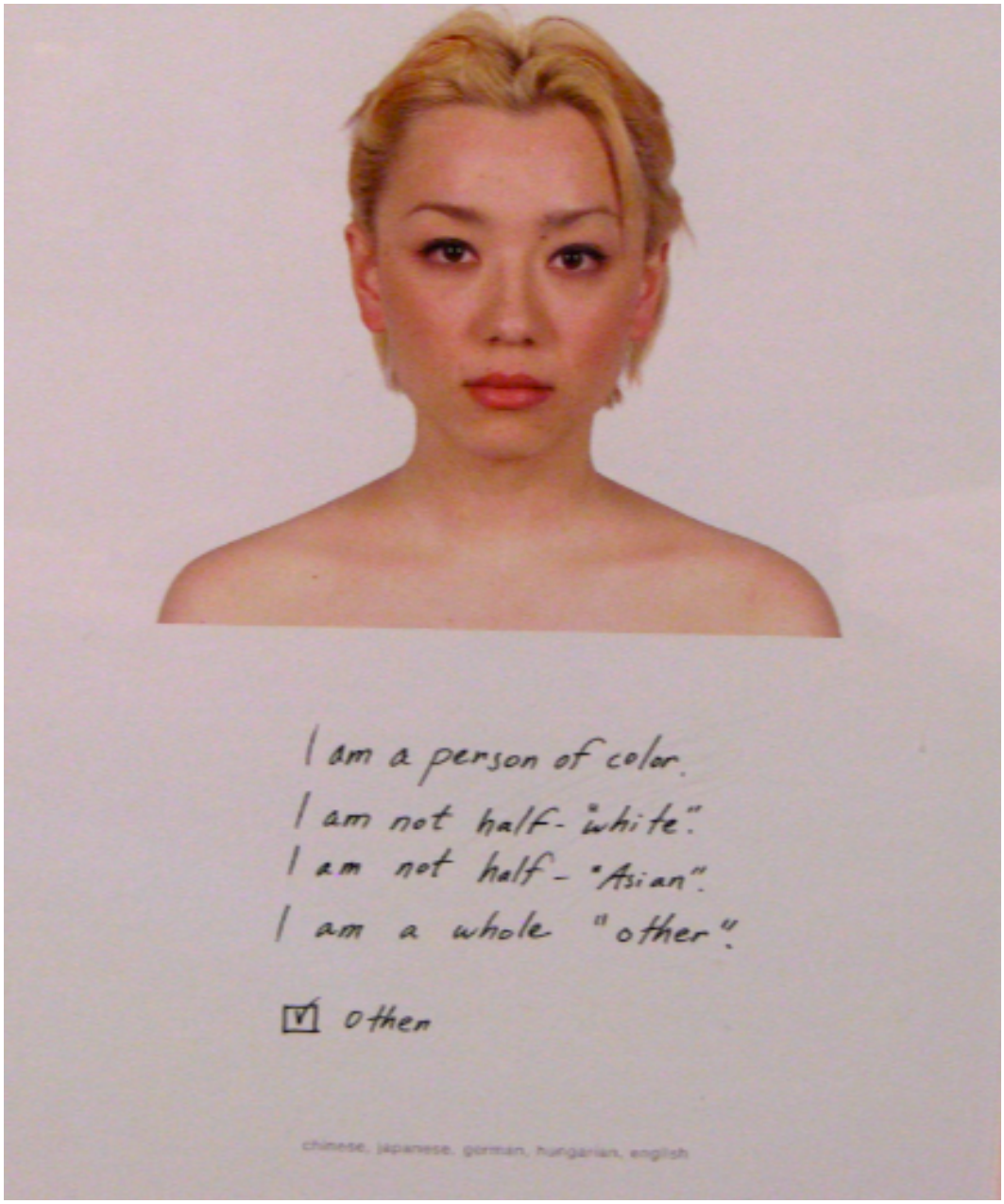


Figure 5.6: One image from Kip Fubeck's Hapa Project

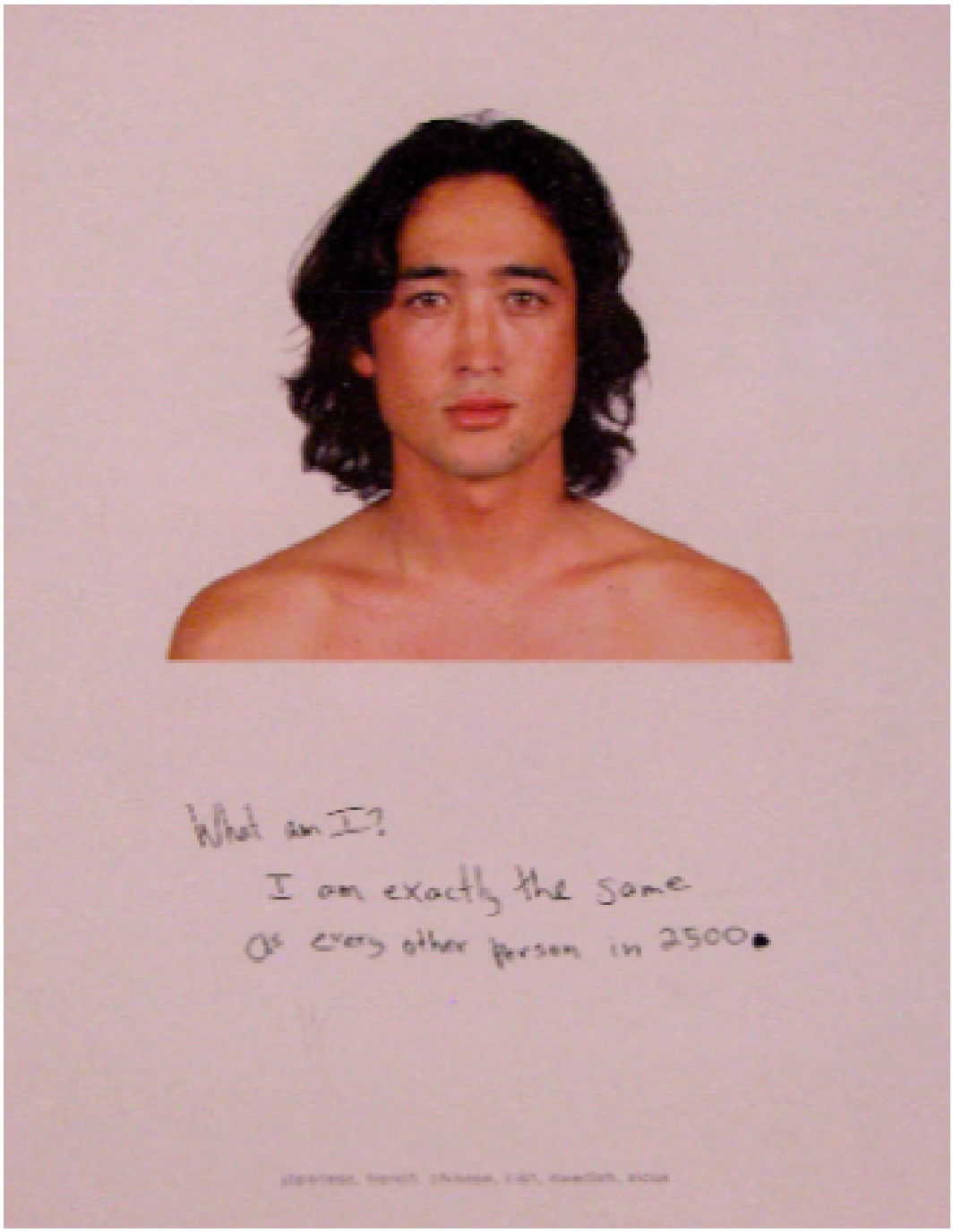


Figure 5.7: A second image from Kip Fubeck's Hapa Project

questions of authority, responsibility largely unexplored. Yet, for its failures representing the historical, political, and social aspects of science, *Race* as an exhibit moves past a purely deficit model of accommodation. It accomplishes this through the effective marshaling of scientific ideas to do political and ideological work in the public sphere: changing the way visitors think about and act regarding race. Thus, the exhibit cannot be characterized as simply addressing the public deficiency of scientific knowledge and increasing its appreciation of science (ends of the deficit model). While *Race* falls short of creating a truly contextual exhibit that truly puts science and the public on even terms, it does much more then merely educate and celebrate: it functions as a powerful epideictic text that achieves important social ends. Though not deliberative, *Race* makes way for deliberation by providing visitors a new way to think about and act on race in their every day lives outside of the exhibit walls.

Chapter 6

Mysteries of Çatalhöyük: Representing Science as a Social Process

The previous two chapters have explored the image of science constructed in exhibits not *explicitly* about science itself. In the first case, *Disease Detectives* celebrated science to promote an understanding of infectious diseases in order to encourage different hygiene practices, among other things. The image of science constructed through this interactive, audience driven exhibit captured a traditional view of science literacy. In the second case, *Race* celebrated the current scientific understanding of race in order to promote a set of new social values and actions. Yet in so doing, the image of science that it promoted covers over the complicity of science in the initial construction of race. This reinforces a traditional, positivist, and progressive picture of science and ignores critical political and historical aspects of the science of race. Both of these exhibits threaten to turn science into what Steven Shapin calls a "fairy-tale" (Shapin 1992, 28). Both of them, then, continued to reinforce aspects of the deficit model of scientific literacy, even as they increased

visitor's scientific understanding and encouraged them to think and act in new ways.

The exhibit studied in this chapter, *Mysteries of Çatalhöyük*, is different. More than either of the exhibits studied so far, *Mysteries of Çatalhöyük* embraced its role of constructing an image of science itself. It celebrates science as a social process in order to alter the public's conception of how science works broadly. Yet, I will argue that the nature of this exhibit's representation of science is put in tension in three ways. First, while the textual and visual representations of this particular archaeological site document the process and some of its social aspects, these images are largely distinct, dealt with and represented separately. Through this separation, what "science as a social process" means is oversimplified at best and unclear at worst. Second, the very features that made the science on display (post-processual archaeology) ideal for a Public Understanding of Research (PUR) exhibit—showing science as an ongoing, revisable process of interpretation and critique—also make it idiosyncratic amongst the sciences. This limits the extension of the exhibit's image of science to science broadly. Finally, as a paragon of a PUR program, *Mysteries of Çatalhöyük* necessarily traffics in the upper dimensions of civic engagement—it promotes a view of science that intends to reposition the public's ability to understand, assess, and contribute to public science. Yet for all that, its civic effect is implicit: neither the archaeology nor the larger "social process" it displays are explicitly tied to any civic goals. In this way, *Mysteries of Çatalhöyük*, even though it is perhaps the most radical in its representational goals, is nevertheless the most traditional of the three exhibits in its epideictic ends. Unlike *Race* and *Disease Detectives* it celebrates science without any explicit attempt to generate specific social action. Yet the exhibit retains an important and implicit epideictic effect: altering the public's very conception of science itself.

Museums and the Public Understanding of Research

For many in the Public Understanding of Research movement, *Mysteries of Çatalhöyük* is credited with being one of the most advanced attempts to convey abstract and complex feature of science itself. Indeed, Martin Storksdieck and John H. Falk place *Mysteries of Çatalhöyük* at highest level of PUR museum experiences, their level five: "*Level 5: Understanding what science is, could be, or should be as part of the human endeavor (philosophy of science, history of science). How does scientific understanding of the world progress?*" (Storksdieck and Falk 2004, 101, emphasis in original). They note that "the exhibition was successful in conveying not only the structure and process of science but also the daily routine and social context of scientific research" (Storksdieck and Falk 2004, 102). Thus, *Mysteries of Çatalhöyük* has been cited as an instance of a highly successful PUR exhibition.

Creating Connections: Museums and the Public Understanding of Research, the collection of essays that grew out of the first PUR conference, also contains other references to this exhibit. David A. Ucko, writing in the same volume, comments on *Mysteries of Çatalhöyük* as well, noting that it effectively captured the "actual day-to-day process [and] personal aspects" of science (Ucko 2004, 216). Finally, an article by Don Pohlman, lead designer for *Mysteries of Çatalhöyük*, highlights it as an exemplar of what he calls "catching science in the act" (Pohlman 2004, 267). Pohlman's narrative of his experience with the exhibit points up the challenges of representing unfinished science through an exhibition, but he is confident that in the end it succeeds in conveying some of the elusive social features of science.

However, while PUR seeks to advance the goal of communicating and displaying

science-in-the-making through exhibits and other public programs, *Creating Connections*, the movement's programmatic statement, does not fully flesh out the philosophical rationale for the project in the first place. An early statement of these goals can be found in Stephen Shapin's "Why the Public Ought to Understand Science-in-the-Making" (1992), which was published in the inaugural issue of the journal *Public Understanding of Science*, and provides one of the first statements to ground what became known as the Public Understanding of Research. Historically, Shapin argues, the public and the activities of science were not as distinct as they are today. Scientific developments were made in private labs and discussed by private individuals (that is, by members of the public): "When you paid a call on [Robert] Boyle, you visited the place where technicians cranked the piston of the air-pump up and down and where knowledge of the physical properties of the air was produced" (Shapin 1992, 27). Today the sites of scientific development are no longer accessible to the public, and because of this, Shapin argues that the public has lost an understanding of how scientific knowledge develops. With the loss of access to the richness of the scientific process, the enterprise of science has become "opaque" (Shapin 1992, 28). Consequently, faced with competing scientific claims to truth, Shapin argues that the public must either assume that one faction is "incompetent, or lying, or in the pay of special interest groups" or that the issue is not scientific at all (Shapin 1992, 29). These options encourage a passive or disengaged public, for they are built on the "fairy-tale" that "there is a universal efficacious scientific method which sorts out good from bad data and confirms or disconfirms scientific theories" (Shapin 1992, 28). In either case, the fairy-tale does not allow the public the confidence or the conceptual means to think through scientific issues, let alone scientific controversies.

Understanding "science-in-the-making," however, does afford the public this role by

generating a richer understanding of the complex processes of science. Drawing on his background in the history and sociology of science, Shapin argues that the "fairy-tale" of science should be jettisoned in favor of an image of science that presents the following features:

> [. . .]the collective basis of science, which implies that no single scientist knows all of the knowledge that belongs to his or her field; the ineradicable role of trust in scientific work, and the consequent vulnerability of good science to bad practices; the contingency and revisability of scientific judgment, and thus the likelihood that what is pronounced true today may, without culpability, be judged wrong tomorrow; the interpretative flexibility of scientific evidence, and the normalcy of situations in which different good-faith and competent practitioners may come to different assessments of the same evidence. (Shapin 1992, 28)

These features would provide the public with an accurate picture of science, one that would allow them the tools to weigh scientific information. But Shapin notes an important concern: that presenting science in this way might be seen as anti-science—understanding the complexity and partiality of the scientific process may undermine the public's faith in scientific knowledge in general.[1] Yet Shapin's argument is ultimately for transparency in the service of democracy: "Inconvenience to scientists would be regretted. But public ignorance, and public idealizations, of science-in-action also have costs. And these costs, I suggest, will ultimately be paid by the scientists whose support and credibility in democratic societies depends upon public understanding" (Shapin 1992, 29). Thus,

[1]These are the arguments leveled against the Smithsonian's *Science in American Life* exhibit discussed in the Introduction.

communicating science-in-the-making—what Shapin refers to as science, "warts-and-all" (Shapin 1992, 28)—would counter the idealizations of science that promotes the cultural authority of science and instead would position the public to grapple with Durant (1993)'s view of science as it *really* exists.

Shapin's arguments are valuable for positioning science museum exhibits as sites for the display of science-in-the-making. First, like Boyle's lab, museums—in their early instantiations as cabinets of curiosities—played an important role in the the proto-scientific public's engagement with science as a process. In the early museums where collectors brought together a myriad of objects and organized and analyzed them, the meanings they communicated were being established by the collectors and those that visited their collections. Thus, those meanings remained fluid. Objects, removed from their context and thrust into an incomplete and at times incoherent organizational scheme, acquired meanings through the forms of interaction that occurred between collectors and within the museum between collectors and their visitors. Both of these relationships took the form of an inquiry into establishing a systematic understanding of the natural world. For example, "when the natural collection had functioned as a professional instrument, most physicians and pharmacists had exchanged lists of their possessions among themselves with a view to close scientific collaboration" (Olmi 1985, 138). This was not an esoteric process, but one open to any individual interested in contributing to scientific understanding.

The result of these interactions was that they constituted the museum as a creative, "conversable" information space (Bennett (1998), Findlen (1994)). Within the museum, curators and collectors knew the objects in their collection and spoke about them at length, and the lack of a scientific system for understanding what the objects were and how they

were related (even though this was the goal) led to even more talk:

> Organizing ideas around objects, naturalists increasingly saw philosophical inquiry as the product of a continuous engagement with material culture. The decision to display the fruits of the collection led naturalists gradually to define knowledge as consensual, shaped in relation to the audience that entered the museum and therefore participated in the peculiar discursive practices that emerged within that context. (Findlen 1994, 5)

The early museum, then, was a civic space: individuals came together to talk about natural history, forge civic bonds, and advance science (Bennett 1998). In the process, they were intimately involved in seeing the development of scientific understanding.

Of course, science museums today occupy a much different role, and yet, as Shapin's arguments suggest, they are again well-positioned to represent the complex, developing, and in-the-making nature of scientific knowledge. These are the goals of the museum community's Public Understanding of Research movement. As discussed briefly in Chapter Two, PUR embraces two representational themes, both of which encompass Shapin's "science-in-the-making:" current science (science in the news) and the process of science. As Lewenstein and Bonney (2004) note, these two themes result in different museum experiences: "Focusing on *current research* is different than focusing on *process of research*. Focusing on bodies of knowledge is different than focusing on social and ethical implications. Focusing on the people who conduct research is different than focusing on the products of research" (Lewenstein and Bonney 2004, 69). Because of these differences, PUR remains a controversial guiding framework. Yet a few features seem to capture its general spirit.

Generally, the goals of PUR promote a complex view of science, one that celebrates

the strength of the scientific process while at the same time "show[ing] the twists and turns that were taken along the way, and present[ing] the scientists who made the findings as mortal humans" (Bonney 2004, 204). On the one hand, PUR is seen as the latest effort to promote public understanding of scientific research in order to increase public support for current projects. On the other hand, PUR provides the public the tools to assess and criticize the scientific enterprise more broadly. Both of these effects reposition the public's relationship to science, either through understanding and support or through understanding and critical appraisal.

Second, the means for promoting PUR run the gamut of communication options. Einseidel and Einseidel (2004) promote a myriad of approaches, ranging from lectures and television programs to observing scientists to expeditions and consensus conferences. Each of these options aims at putting the public in closer proximity to the science and scientists, thus cultivating what they see as a truly interactive approach where the public serves as "inquiring experts" (Einseidel and Einseidel 2004, 75). Others promote more traditional exhibits or public programs, and others, emphasizing the "current" part of PUR, have created programs around science in the news. Each of these approaches creates different challenges for museums.

Finally, the audiences for those where PUR can be cultivated range from children to adults. As we saw earlier, Storksdieck and Falk (2004) place *Mysteries of Çatalhöyük* at the pinnacle of their hierarchy of PUR projects. In their scheme, there are four other levels. At the lowest one, museums offer experiences like those in *Disease Detectives*, where all audiences can be engaged with "the thrill of collecting and interpreting data" (Storksdieck and Falk 2004, 96). The higher levels become more abstract and complex and are intended for "science and policy attentive audiences" (Storksdieck and Falk 2004,

96). For example, level four is defined as "Understanding the forces that act on science in the real world (science and society): Who pays for science? Who sets the scientific agenda? Who benefits from science? Etc." (Storksdieck and Falk 2004, 96). At these higher levels, Shapin's more sociologically informed view of "science-in-the-making" come into view. These levels indicate that the broad goal of promoting PUR can be attuned to a wide range of audiences.

Before turning to the exhibit, it is useful to locate the PUR goals of an exhibit like *Mysteries of Çatalhöyük* in the larger conversation about science literacy. The epideictic and civic goals of PUR involve altering and filling out the public's conception of science as a process so, as Bonney argues in *Creating Connections*, "citizens would be better able to keep appropriate perspective as they evaluate scientific information and how it affects their lives" (Bonney 2004, 199). Here Bonney is expressing the traditional civic goals of science literacy, which was effectively stated in 1975 by Benjamin S.P. Shen. Shen identified three types of science literacy: practical, which includes the knowledge to solve practical problems; civic, which enables citizens to "participate more fully in the democratic processes of an increasingly technological society" (Shen 1975, 48); and cultural, which promotes the public's understanding of science as a "major human achievement" (Shen 1975, 49). PUR works between Shen's last two types: it communicates an image of science as a social process and as a human achievement—one embedded in society, history, politics, and carried out by regular people—in order to move the public into a new relationship with science. This new relationship is not about training future scientists, it is about training future citizens. It is here that PUR has the potential to, as Shen says, "exert a significant influence on human affairs" (Shen 1975, 50). As one of the most cited exemplars of this attempt, I next explore the image of science that gets

constructed by *Mysteries of Çatalhöyük*.

Mysteries of Çatalhöyük: The Exhibit

Exhibited in the great hall of the Science Museum of Minnesota in late 2001, *Mysteries of Çatalhöyük* attempted to capture the ongoing processes of an international team of archaeologists excavating one of the most famous neolithic cities in the world. Located in central Turkey, Çatalhöyük was originally discovered and made famous in the 1960s by James Mellaart. In 1965, after rumors of theft and because poor conservation techniques had damaged artwork, the Turkish government forced Mellaart to end his project. Ian Hodder, a Stanford archaeologist and one of Mellaart's students, returned to the site in 1993 to begin digging again and to develop a new, post-processual archaeological methodology. When the SMM exhibit team visited the site in 2000, work was well underway, and it was expected to go for another eight years. As of this writing, Çatalhöyük remains an active archaeological site.

Because of the nature of archaeology and the fact that they were granted access to the dig site in the middle of the process, in the SMM's eyes, Çatalhöyük was an ideal case for an exhibit that displayed science-in-the-making and promoted the public's understanding of scientific research. These goals and the features of this particular excavation allowed them to secure funding through the NSF's Communication of Research to Public Audiences program, a part of the Informal Science Education (ISE) division. The goals of this program are civically oriented, though in a more traditional sense of science literacy for national security: "The outcome of all ISE projects is an informed citizenry that has access to ideas and tools of science and engineering to enhance their quality of life and the

health, prosperity, welfare, and security of the nation" (National Science Foundation 2004). *Mysteries of Çatalhöyük*, however, aimed to achieve these ends by promoting a richer understanding of the processes of science.

The exhibit team's argument for putting on the exhibit began by noting that archaeology, like most scientific research, is often told after the fact, when the story of discovery can be easily captured:

> Archaeological research usually makes its way to the public long after the work is done. The story comes out years later, processed and neatly packaged, often with little remaining of the questions, problems, and technical difficulties that beset the researchers along the way, and even less of the ongoing dialogue among those researchers and their peers that led to the tidy conclusions in the end. (Pohlman 1998, C-1)

This, of course, is a description of what makes most exhibits and most accommodations of science epideictic: they report on and celebrate the conclusions of scientific research (as *Disease Detectives* and *Race* did). What makes Çatalhöyük's focus different is that it is accommodating a process, not just the final product. This is exactly what the project rationale argues:

> Focusing on Çatalhöyük as [a] work-in-progress rather than as a completed investigation, this project will provide visitors, web users, and school audiences with a view of archaeology as a dynamic and social process of constructing knowledge, and with an understanding of the tools and perspectives on which that process depends. (Pohlman 1998, C-1)

Like all attempts to generate science literacy, the presentation of this process is all focused

toward a "real public understanding of science" (Pohlman 1998, C-2). While the project's civic goals are not explicitly stated in the grant proposal, it does channel Shapin's arguments against promoting a "fairy-tale" image of science:

> The fact that science is done by people working together to exchange and critically examine each other's ideas is often obscured or altogether absent in [science exhibits and programs]. Although the causes of this problem may result as much from the difficulties of presenting these more ephemeral aspects of science as from oversight or intentional exclusion, the result is the mystification of science by the very institutions that are seeking to explain it. (Pohlman 1998, C-2)

These statements from the grant proposal explaining the need and rationale for the project make clear why this exhibit would later serve to epitomize the public understanding of research.

Organized with a circular pathway with a large open center, *Mysteries of Çatalhöyük* provides a more directed experience than *Race* but is less directed than *Disease Detectives*. The pathway follows eight thematic areas, each flowing into the next, but with free access that allows visitors to deviate from this path. As visitors proceed through these areas, there are opportunities to enter the central space and from there move more quickly to another section of the exhibit. However, the exhibit seems to be structured so that visitors follow along the perimeter of the space and are, in the end, gently led into a central space before exiting. While this is perhaps the preferred order, the space is tentatively open, allowing visitors freedom to create their own pathways as they see fit.

The exhibit's representational content is conveyed through eight areas:

- About the Mounds

- Human Remains
- Murals
- Sampling, Micromorphology, and Endochronology
- Plants, Animals and Food
- Finds
- Turkish Resource Center
- Dig Life

Generally, these eight areas can be grouped into four larger categories, which tell the representational story of Çatalhöyük and its science: Archaeological Context, Finds and Methods, Turkish Culture, and Social Life of Scientists.

The Archaeological Context: Why Care About the Past?

The context for the exhibit is established in the opening section of the exhibit, which orients visitors to the dig site. A three-dimensional model of the two mounds that constitute Çatalhöyük conveys a visual sense of the place, and a series of reading rails surrounding the model explain the importance of the site archaeologically. These exhibit elements raise a series of critical questions about how the mounds were formed and explain, via timeline, how the city fits into human history. A third rail tells the story of the two excavation teams that have excavated the site and briefly outlines Ian Hodder's archaeological philosophy. This section also includes a schematic of the dwellings at Çatalhöyük and how they were built. Most salient in the opening section of the exhibit is a large diorama that depicts a number of archaeologists excavating a section of the mound. They work under a large tent. The reading rail accompanying the diorama addresses the question "What's Happening Here?", and it outlines the steps required for excavating a

site like Çatalhöyük. By situating the place and the people and by introducing the process, this section of the exhibit prepares visitors for the display of finds and methods that follow.

Finds and Methods: What and How They Excavate

The largest section of the exhibit comprises an intermingling of research techniques and findings. First, visitors are introduced to the human remains of the residents of Çatalhöyük and encouraged to compare themselves with them. A series of displays and videos depict the excavation of bodies at Çatalhöyük as well as the culture's strange burial practices. These discoveries raised a series of mysteries for the archaeologists: the skeleton in the garbage, the missing cavities, the woman buried too straight. Visitors are also encouraged to compare their height with that of the mounds' inhabitants. The most salient area of the first discovery section is a mock-dentist's office, complete with chair and magnifying lamp. This installation serves to provide a familiar context for explaining the importance of looking at dental records and data to infer conclusions about how the people at Çatalhöyük lived. Following upon the human remains section, the exhibit next covers the paintings found on the walls of some of the dwellings. Here the wall paintings are situated within history of art more broadly, and the accompanying reading rail chooses one particularly iconic image from the site and, by contrasting two interpretations of it, asks visitors to interpret what they see. This technique of acknowledging uncertainty and asking visitors to interpret for themselves is taken up throughout the exhibit.

Next, the exhibit turns from an emphasis on findings to techniques. Through a series of interactive kiosks, visitors are introduced to and given the chance to practice endochronology, micromorphology, and dendrochronology. These displays follow a similar style: visitors are introduced to a scientist specializing in the technique; the

technique is described in steps, then visitors are given a chance to practice. The results of these different techniques are displayed in the next two sections, one on plant and animal remains and another on findings more generally. The plant and animal remains look like a more traditional archaeological exhibit, where the information and discoveries are accommodated to improve the visitor's understanding of neolithic culture at Çatalhöyük. In particular, a large, elaborate kitchen (similar to the dentist's office) places the findings of plants and animals—essentially what the inhabitants ate—within a familiar context. Visitors look in cupboards and a refrigerator to see what the archaeologists have learned so far about the inhabitants' diet.

The last section of the exhibit dedicated to findings and techniques focuses on other objects found at the site. Here epistemological aspects of science-in-the-making are evident, because many of the objects discovered are not yet understood and they are displayed that way, with multiple interpretations and questions for the visitors about what they mean or how they functioned. The findings section, which is already atypical because it does not contain any *real* objects, is further atypical due to the lack of conclusions. Where meanings remain uncertain, visitors are encouraged to offer their own interpretations. Here, too, however, any findings are contextualized, with controversies over goddess figurines and the general confounding nature of the objects related to how everyday objects in our own lives might be understood—or misunderstood—if we dug them up in a few thousand years.

Culture: Modern Turkey and the Politics of Display

The two sections that wrap up the exhibit are rather brief, but they remain important to the overall picture of archaeology that the exhibit intended to convey. First, the penultimate

section of the exhibit provides a glimpse into the modern culture of Turkey. This includes a jukebox that plays current Turkish pop music, a flag, and other cultural trappings. It is filled out by a panel that documents the SMM team's trip to Konya, a large city near Çatalhöyük. The cultural section of the exhibit is also augmented by a few panels describing the Turkish authority that has influenced the team's work, and the delicate question of who owns the objects that are found at Çatalhöyük. Because of the controversial nature of Mellaart's initial dig—where objects were reportedly stolen or damaged—the Turkish government's position over how these objects are preserved and who has access to them profoundly affects the work that occurs on the site, and these panels document the cultural and political influences on the science (as well as its display in this exhibit).

Social Life: The Veranda

Finally, the exhibit ends in the large open space that serves as a replica of the veranda where the archaeologists at Çatalhöyük live. This is a social space, representing that of the scientists and providing one for the visitors to the exhibit. Here visitors are introduced to the scientist's living space, but also to the social practices that occur there: what the workers eat, how they live, how they socialize, and the general rules of etiquette. More than any other section of the exhibit, this one emphasizes the social aspects of a team of archaeologists working and living together in an isolated community.

Interacting at and with Çatalhöyük

The organization and representational content of the exhibit afford an interactive experience that is a middle ground between the content heavy *Race* exhibit and the interactive-focused *Disease Detectives* exhibit. While there are no elaborate inquiry-based interactive features, visitors are still presented with opportunities to test out some techniques associated with the science at the site, in particular, micromorphology and endochronology. These kiosks provide the most explicit form of interactivity. But two other features of *Mysteries of Çatalhöyük* promote interactivity through more intellectual, rather than physical, engagement.

First, *Mysteries of Çatalhöyük* relies on a series of open questions to guide the visitor through the space. Leading questions hang over the exhibit itself, inquiring about what they're finding, why it matters, and what it means. These questions function similarly to the "What is race?" question in the *Race* exhibit, but the questions here are more attuned to the science of archaeology. The use of questions is also found throughout the exhibit to engage visitors in the struggles for meaning that the archaeologists themselves are working through. This is most notable in the "Finds" section of the gallery, where pictures of objects are presented with competing interpretations, and then the visitor is encouraged to weigh in, choosing one or offering another viewpoint.

Second, the exhibit conveys an informal feel to the exhibition as a whole. This comes across through the use of dialogue and thought balloons—akin to thought balloons in comic books—that give the scientists a friendlier, less stilted voice. The balloons also work to convey some comic relief (e.g., where one archaeologist in the dig tent diorama is displayed thinking "I love this trowel!"). The informal nature of the exhibit and its more implicit interactivity is also conveyed through the dentist's office and kitchen installations,

which are playful, interactive features that allow visitors to learn about the people at Çatalhöyük. Together, the interactive meanings conveyed through this exhibit are less active than other exhibits, but the use of questions and the playful nature of parts of the exhibit create a space that promotes intellectual as well as physical interaction.

As a whole, the organizational, representational, and interactive aspects of the exhibit are clearly aimed at what the exhibit proposal sought to achieve: the public's understanding of science as a social process. Because this exhibit prioritizes the accommodation of process over conclusions, before turning to how the exhibit depicts what Ravelli refers to as the exhibit's "approach to knowledge"—I first briefly outline the science that is on display.

Ian Hodder and Post-Processual Archaeology

The SMM's goal of completing an exhibition highlighting science as a social process was greatly aided by the science they chose to display. At Çatalhöyük, Ian Hodder, the Stanford archaeologist leading the dig team, was implementing, testing, and refining a new and somewhat controversial archaeological methodology: Post-processualism. The goals of this reflective and reflexive method required the dig team to focus on and record their own scientific processes, thus making them easily available to the exhibit staff. According to Pohlman, "[Hodder's] theoretical stance made the research team's social process much easier to discern and encouraged team members to share access to it with us" (Pohlman 2004, 270). Thus, Post-processual archaeology's methodological and theoretical commitments made it ideally suited for an exhibit on process. Because the facets of this archaeological approach will be important later in the assessment of the

exhibit as a whole, the remainder of this section briefly describes the features of Hodder's controversial methodology.

Hodder's Post-processual archaeology is a theoretical and methodological response to the archaeological approach termed Processual Archaeology (or New Archaeology), so called "because of its emphasis on processual interpretations or the study of the different processes at work within a society" (Bahn 1996, 68). The method of Processual archaeology is based on a philosophy of science developed by Carl Hempel. Through the hypothetico-deductive model of confirmation and the deductive-nomological model of explanation, archaeologists following Hempel set about making hypotheses, testing them through excavation, and setting out laws based upon their conclusions (Salmon 2000, 395). Processual archaeologists are not interested in the belief or cultural systems of the people they studied except insofar as the structural elements of the buildings and objects pointed to conclusions of this sort. "Acutely cognizant of cultural variation, [Processual] Archaeologists doubted that they could find laws concerning beliefs, desires, symbolic meanings, or ritual behavior for humans" (Salmon 2000, 395). Instead, processual archaeologists focus on "functional and social aspects of human behavior" which are the "the processes that produced the (static) materials that they study, and they believe that a proper analysis of the archaeological record will reveal information about these processes" (Salmon 2000, 398).

Consequently, Processual archaeologists are primarily interested in interpreting the structural features of the culture (e.g., what the layout of a house implies about the relationship between male and female roles in that society; they ignore, however, what those roles imply about the psychology or beliefs of that culture). They believe that these findings, grounded as they are in hypotheses, inductive reasoning, and the historic record

provide laws which allow archaeologists to definitively conclude something not only about the people and the culture they study but about other cultures generally. Thus, processual archaeology seeks to understand "how different aspects of society worked and how they fitted together to help explain developments through time, and from there help[s] to establish 'regularities' of general applicability in the archaeological record" (Bahn 1996, 69). It was against this generalizability and the disregard of cultural interpretations that Hodder rebelled.

In light of historical, sociological, and philosophical critiques of science, the archaeology that Hodder is developing and practicing at Çatalhöyük moves away from this view in significant ways. Drawing on post-structuralism, literary studies, philosophy, and history, Hodder's Post-processual archaeology understands that processual archaeology's structural interpretations are fraught with social and cultural facets of their own that cannot be ignored. Instead of seeking the inherent structural forces that give meaning to material culture and which can be determined as law-like forces, Post-processualism recognizes that history is created by the culture and its objects. Thus there are no extra-historical structures organizing culture.

By treating all material objects within the cultural moment, Post-processual archaeologists "arrive at the realization that no single meaning can ever be guaranteed for a text that is situated within social practice" (Barrett 1996, 577). Instead of seeing archaeology as a purely scientific task, Post-processual archaeology sees it as a hermeneutic one. Where processual archaeology sought an objective understanding, post-processual archaeology seeks a diversity of interpretations. This new methodology sets out to highlight the archaeological and scientific process, foster discussion, and put into play all interpretations (even those that are not done by trained archaeologists or

anthropologists). Post-processual archaeology argues that even if processual interpretations are highly self-aware of the cultural and ideological situation, their positivistic assumptions prove their interpretations ultimately untenable: "The interpretive challenge [of post-processual archaeology] demands a self critical control over archaeological analysis, regarding as arrogant claims to have discovered some truth about the lives of other people, even those long dead" (Barrett 1996, 578). Thus, Post-processual archaeology modestly recognizes that any understanding of an ancient culture is inherently tenuous and open to future revision.

This leaves archaeological 'truth' and 'knowledge' teetering on relativism, and though all post-processual archaeologists repudiate relativism, the development of this new vision of archaeology has understandably been controversial. What Hodder and his crew have undertaken at Çatalhöyük is not simply an archaeological study of a very important Neolithic site, they have undertaken a reflexive archaeological task that they hope will show the practicality, tenability, and success of their methods, even as the theory remains in development. The Science Museum of Minnesota team notes that "while [Hodder's] goal may be to create an archaeology that is stronger for its greater openness and self-awareness, his team's efforts to communicate its methods and assumptions to the fullest offer our audiences a much better look at the process of science than might be gleaned from a typical project's data" (Pohlman 1998, C-2). Thus, in many ways, for an exhibition interested in displaying the processes of science, a current research project could not have been more ideally formed. In the next section, I discuss how this exhibit harnessed the science of post-processual archaeology to attempt a depiction of science as a social process.

How *Mysteries of Çatalhöyük* Represents Science: Capturing the Elusive Social Process

Because of its use of post-processual archaeology, *Mysteries of Çatalhöyük* was well positioned to convey something about the nature of science itself by celebrating the process. This was central to the project's viability, and the success of the exhibit was assessed based upon the visitor's uptake of that broader message. Writing after the project was completed, Don Pohlman, the SMM's lead designer for the exhibit, offered a reflection on his experience:

> The *Mysteries of Çatalhöyük* project left me with two strong impressions: one was what a struggle it had been to try telling a current and unfinished story; the other was how little of the results of that struggle showed up in what we finally produced. I think we did do an exhibit about the process of scientific research and one that even captures some of that elusive social process that we sought. (Pohlman 2004, 274-5)

What Pohlman's reflection demonstrates—and what the multiple references to the exhibit in *Creating Connections* support—is the fact that this exhibit was ultimately viewed as a successful PUR program. The draw of most archaeological exhibits, including many parts of this one, is the novelty of encountering an alien culture. The cities, lives, and objects of long lost peoples have uncanny ways of shedding light on who we are as human beings. Here, however, the alien culture is that of the scientists themselves. In its attempt to display the work of archaeologists at Çatalhöyük, then, the SMM had to shoulder a double burden. Knowing that what they wanted to highlight was the scientific

process, they also recognized that they could not leave out the fascinating features of the culture and people that were being excavated. Somewhat fortuitously, with the Turkish government's refusal to allow artifacts to leave the country—making the SMM team "very nervous" (Pohlman 2004, 271)—process truly became central. Where one might expect a diorama recreating the ancient dwellings of Çatalhöyük, visitors encounter a diorama of the dig team excavating those dwellings. Where one might expect didactic panels narrating the lives of the ancient inhabitants of Çatalhöyük, visitors instead encounter panels narrating the daily lives of the scientists. Even the facts and findings about Çatalhöyük were embedded in displays linked with the archaeological process. Yet, while the archaeological processes and the scientists who carry them out are clearly on display, the social aspects of those processes (and of the dig as a whole) are harder to discern. Harder still is the relationship between the two. Consequently, the exhibit struggles to connect the display of processes to the social features of the life at the dig. As a result, the relationship seems to limit the exhibit's ability to successfully communicate science as a social process.

The display of the archaeological process is everywhere in the exhibit, but it is perhaps best epitomized in a number of step-by-step panels like the one of Wendy Matthews's working as a micromorphologist (Figure 6.1). This panel introduces Matthews and micromorphology, and it depicts the five steps that Matthews follows as she prepares her excavated samples for study, from cutting out a section of wall to analyzing it through a microscope. The process of micromorphology is clearly put on display in this panel, not conclusions or interesting facts about Çatalhöyük, its people, or its dwellings. Visitors are shown all the steps leading up to the actual analysis which is usually where most exhibits begin. Rather than simply offer visitors a microscope and grant them access to the

Figure 6.1: Slices of the Past with Wendy Matthews

conclusions reached, visitors also get to see a much more elaborate picture of the process of science. However, while the panel does not communicate information about Çatalhöyük itself, an interactive component accompanying this panel does. Like most interactive exhibits that only display the final step in the process, this interactive component allows visitors to take up the fifth and final step in the Matthews' process by providing them a microscope and sample slides to analyze. Each slide is annotated with information about what the visitor is seeing. Thus, whereas the panel enriches the process in positive ways, the interactive once again reduces the work of a micromorphologist down to its final step in order to accommodate scientific information.

With this panel's clear depiction of process, in an exhibit that prides itself on demonstrating the social nature of science—however elusive that is—we must ask: what is social about what Matthews is doing? She is displayed alone, and her work is disconnected from the work of others. There is nothing in this panel that indicates a social process. This makes sense, in fact, for the work she is doing is setting up the groundwork for the social processes to occur. For if "social" is to mean anything of importance in the work that Matthews is doing, then it occurs between step five and the slides that the visitor is encouraged to analyze. What is social is not the activity of cutting, freezing, slicing, and studying; what is social about micromorphology—if anything is—is the process of negotiating meaning from the slides once they have been put under the microscope. It is the process whereby Matthews goes from the microscope to the conclusions that the interactive component communicates to the visitor. In this way, "Slices of the Past" enriches visitor understanding of the process of micromorphology, but it falls short of documenting the true processes of science, especially "archaeology as a dynamic and social process of constructing knowledge" (Pohlman 1998, C-2). All this panel has

done—and it is useful as far as it goes—is to elaborate on what is typically displayed much more simply.

Other panels follow the stepwise format of "Slices of the Past" and similarly offer a limited sense of what is "social" about the archaeological process. Some, however, display multiple workers, thus adding a modicum of sociality to the activities at Çatalhöyük. Yet these panels still fail to elucidate what is social about archaeological work. For example, Figure 6.2 does an effective job depicting a team of excavators, implying that more than one person works together to unearth the skeletons. Contributing to this team image is the fact that at least four different individuals are displayed working at different stages of the dig. Multiple workers are also displayed in Figure 6.3, which takes us through the six steps in the life of a newly uncovered object. Rather than be introduced to a single researcher, these two panels display different, anonymous scientists and workers. While these two panels further elaborate on the the process of excavation and the finding, cataloguing, and storing the finds at the site, they nevertheless leave out what is social about the process.

Perhaps most tellingly, the large dig site diorama that greets visitors in the first section captures this tension of a process devoid of a meaningful social component. The diorama offers a three-dimensional representation of a team working. Yet their work is decidedly asocial, evidenced by the the individual thought bubbles of the workers as they dig. These internal thoughts indicate that these individuals are thinking and reflecting on their own during the dig process, not talking to each other or discussing their work. The reading rail accompanying the diorama (Figures 6.4 and 6.5) answers the question "What's happening here?", yet as it answers this question by filling out the archaeological process at its most general, nothing social is indicated. Like the other panels, multiple people are involved at

Excavating Çatalhöyük's Human Burials

The people of Çatalhöyük buried their dead beneath the plaster floors of their buildings. Uncovering a skeleton within a building can take as long as two weeks—particularly if several bodies were buried together.

The excavators gently pick and brush away the dirt around the bones.

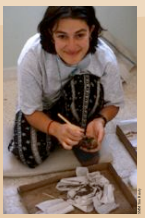
1 Revealing a Burial
Excavators look for the edges of a burial hole—these were cut into the plaster floors to accommodate the burials. When they find this outline, they dig carefully until they reach the uppermost layer of bones.

Archaeologist's drawing of an adult male skeleton from Building 3, North Area, excavated 2000

The excavators use a "skeleton sheet" to record information about the burial.

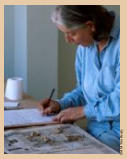
2 Recording the Find
The excavators record each skeleton's position within the burial hole. This information may prove useful later—researchers can refer to it after the bones have been removed and the original context destroyed.

3 Removal
The excavators lift each bone from the ground, put it in a plastic box, and take it to the lab.



4 Cleaning
The human remains team uses tiny brushes and picks to clean the bones. Sometimes they gently wash them with water.

5 Analyzing the Skeletons
Each excavated skeleton goes to the human remains lab for detailed study. The team attempts to determine age, sex, and height as well as bone abnormalities that could indicate disease or cause of death.



The human remains specialists prepare a skeleton chart for each set of remains—these are especially helpful in cases where two or more skeletons have been uncovered together.

"When you're dealing with fragmented bones that have been in the ground this long, analysis isn't easy."

—Theya Molleson, human remains team

6 Storing the Bones
After analysis, the bones are boxed for storage. Some go to the nearby Konya Archaeological Museum. Extracts of bone material may go to labs outside Turkey for further study. For example, DNA testing and chemical analysis might reveal more about the people's diet and their genetic relationships to one another.

Figure 6.2: Excavating Çatalhöyük's Human Burials

Figure 6.3: What happens to the objects found at this site?

Figure 6.4: What's happening here? (Part 1)

Figure 6.5: What's happening here? (Part 2)

different stages, thus countering the idea that this project is being carried out by a lone scientist. However, depicting the archaeological process as a team activity remains a weak notion of science as a social process, especially if at each stage each scientist is working alone.

Consequently, in the panels most indicative of the archaeological process and in the panels that best expand on processes that typically remain hidden in archaeological (as well as most scientific) exhibits, these panels nevertheless fail to offer a meaning of "social" that goes beyond multiple people working at different stages of the archaeological process. However, if the social aspects of the archaeological process are missing from the panels that represent process, they are not altogether absent. In fact, the exhibit's representation of the archaeologist's social life captures important features of the epistemological and philosophical foundation on which built post-processual archaeology is built.

The interactions of scientists and workers at Çatalhöyük is mainly displayed in the large open space created by the exhibit's replica of the veranda and courtyard. At Çatalhöyük, the veranda consists of the porches, where workers and scientists meet to chat, work, and interact out of the hot sun. The exhibit has modeled this space, by recreating the porches and allowing for an open space where visitors can congregate. Along the walls, scientists and workers are displayed sitting and chatting. Two main panels expand on and give context for the veranda. Figure 6.6 welcomes visitors to the veranda, and introduces them, via images, to the space and the variety of activities that occur there. The scientists and workers are pictured in deep discussion, enjoying a concert, and picking through debris to find tiny shards of important artifacts and evidence. Along with these images, the panel outlines the general function of the buildings and gives

Figure 6.6: Welcome to the Veranda of the Çatalhöyük Dig House

visual proof of people at Çatalhöyük do more than work. This basic picture of the social life at Çatalhöyük is filled out in Figure 6.7. Four activities are emphasized: eating, working hard, relaxing, and partying. These documents show how the scientists live, what they eat, and the general arc of the day. Other images outline the rules on site etiquette and drying laundry, which enriches our understanding of dig life.

While the process-oriented panels depicted people working, on these panels visitors finally see scientists interacting and talking to each other. This talk is central to science as a social process. The epistemological and methodological value of talk at Çatalhöyük is critical to understanding the work that is going on at the site, and it is critical for understanding what is meant by science as a social process in the first place. In fact, Hodder's reflexive Post-processual archaeological methodology requires it:

> The archaeologists watch themselves; they even have anthropologists watching them and studying how they are perceived by nearby villagers who are also, presumably, watching . . . Hodder says all this watching is necessary because objective archeological facts—bones, seeds, stone tools—can never be separated from the subjective meanings that archeologists assign to them based on the context in which they are found. Because the context is destroyed by digging, interpretation has to begin 'at the trowel's edge'—and so Hodder wants a lot of people looking over the shoulder of the person with the trowel. Hodder's archeology involves a lot of talking. (Kunzig 1999, 89-90)

This talk involves not only discussion of what the archaeologists and scientists are discovering, but also discussion of what they are doing, how they are doing it, and how to better study the site.

Figure 6.7: Life at the Dig

Yet because it is embedded in other photos of socializing, the two are difficult to separate here. The former has epistemological purchase, helping visitors understand the philosophical, methodological, and epistemological nature of archaeology. The latter merely offers us access to the life of scientists. The talk of the scientists and archeologists is constitutive of knowledge at the site. What they had for breakfast or what hats they wear during costume parties is not (though the contexts of these events do afford opportunities to talk).

In this way, the images on the veranda that depict scientists talking, actually do capture an important methodological feature, not only of archeology, but of science generally: scientists talk to each other, refine theories, develop ideas, persuade each other, change course, and make decisions that have ramifications for the entire project. And this talk happens in the lab, in the lunch room, under the excavation tent, and in any context where the scientists are given to space to talk shop. But because these images are decontextualized and grouped with images of pure social interaction, the importance of talk to the process of science is lost. Social process, if it is to mean anything about knowledge construction, cannot be merely about hanging out and sharing living quarters, which is what the primary social aspects of this exhibit depict. It must be about negotiation and discussion. Evidently this is going on and it is pictured, but without commentary, without a discussion of the value of this talk to the process of archaeological work, the veranda section merely depicts the archaeologists in a social space, not the central social nature of their work or the conclusions they were reaching.

Post-Processual Archaeology as Model: Ideal, Idiosyncratic, Ironic

Successful or not, as a PUR exhibit with the intention of communicating some facets of the nature of science as a social process, *Mysteries of Çatalhöyük* did in fact display science in a way that sets it apart from many other science exhibits. In this, Hodder's Post-processual archaeological framework served the SMM well. The exhibit team was granted access to a highly reflective team of archaeologists in the middle of their work, and Hodder's own theoretical and methodological commitments aided the kind of science the museum sought to display. Because the exhibit hoped to use the work at Çatalhöyük as a representative of science generally, I next turn to an evaluation of how *Mysteries of Çatalhöyük* conveyed the historical, philosophical, social, cultural, and epistemological features of Post-processual archaeology.

Early in the exhibit, in a reading rail that offered general information about the site itself (how to pronounce the name, how old it is, etc.), visitors are introduced to the two teams that have excavated the site (See Figures 6.8, 6.9, 6.10, and 6.11 for the complete reading rail.).

The reading rail uses gradations of color to shift between introductory themes, descriptions of each of the dig teams, and a statement by Hodder about his post-processual archaeology, which ends this particular panel. The two teams are depicted quite differently, highlighting both the shift in methodological focus and the focus on process (a result of a dig in process). Mellaart's section (Figure 6.9) highlights Mellaart himself, and then depicts the mounds and paintings found there. These images are devoid of people. The text highlights the importance of the artifacts Mellaart's team discovered as well as

Figure 6.8: Çatalhöyük (Part 1)

Figure 6.9: Çatalhöyük (Part 2)

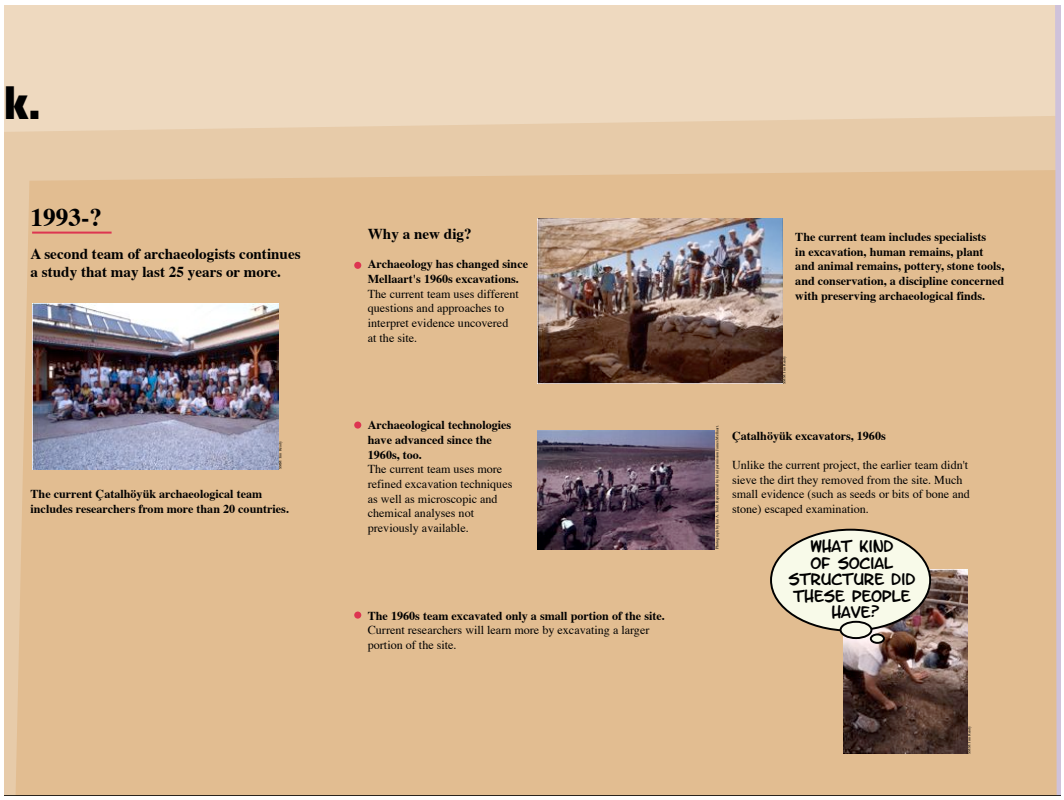


Figure 6.10: Çatalhöyük (Part 3)

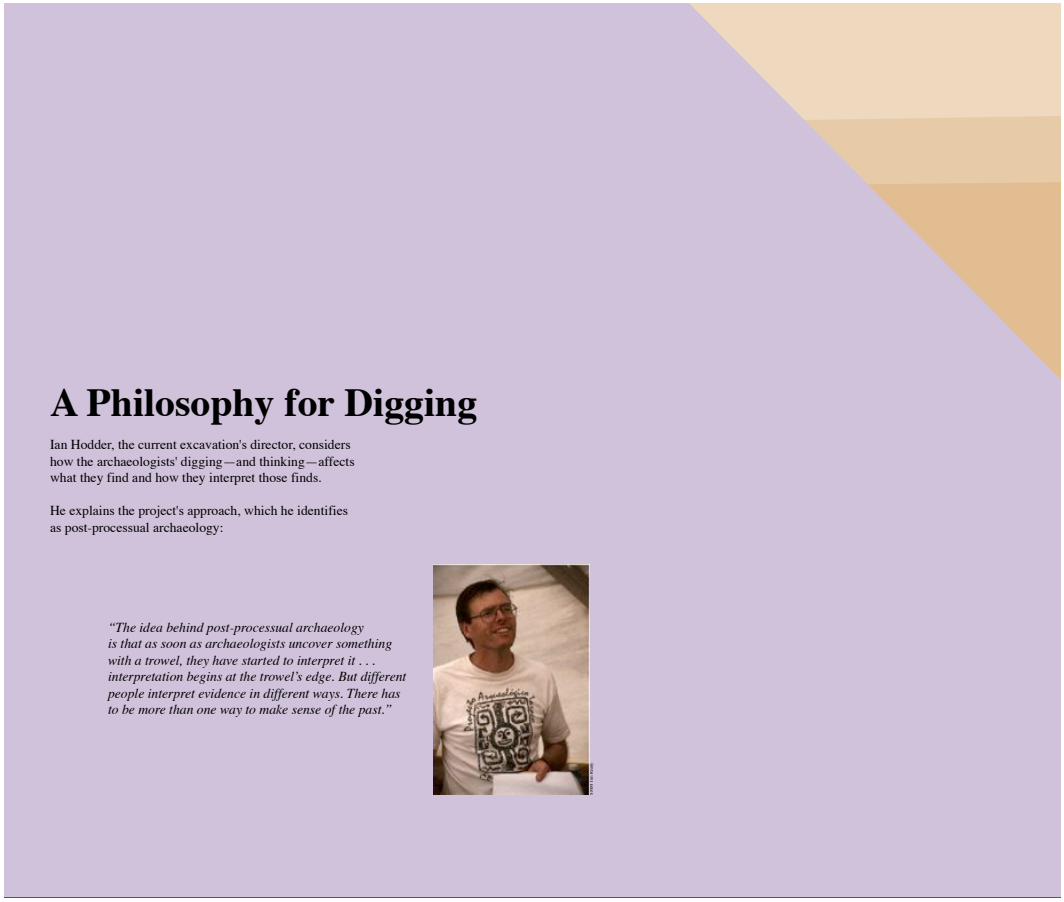


Figure 6.11: Çatalhöyük (Part 4)

some of Mellaart's conclusions regarding the social system at Çatalhöyük.

The depiction of the current dig team is quite different (Figure 6.10). Visually, the images clearly emphasize the scientists and workers, not the site itself. While Mellaart was the face of the 1960s dig team, here the team—displayed as anonymous workers—is central. The textual focus also makes a similar shift. The focus is not on Çatalhöyük itself but on the archaeological team and the rationale for a new dig. Two features are emphasized. First, the new dig team's work is justified and explained against the work done by Mellaart in the 1960s. Three reasons are given: archaeology has changed, technologies have changed, and more of the site will be excavated. These three reasons introduce historical and methodological shifts that show that a scientific discipline changes, both technologically and philosophically. The second feature is the emphasis on the team's diversity: they come from twenty countries and include many specialists from a number of disciplines. This diversity and the images that document the large number of people working at the dig site contribute to the exhibit's methodological, process focus. Together, this panel facilitates visitors' understanding of the way that a science might change over time and the reason why those changes are important. Science—or at least archaeology—is not static.

While the historical comparison throws into relief the development of archaeology and contributes to the public's understanding of the growth of science, the final section of the reading rail, which briefly outlines the basic premise of Hodder's post-processual philosophy of digging, attempts to provide visitors with the basic premise that drives the project as a whole (see Figure 6.11):

> The idea behind post-processual archaeology is that as soon as archaeologists uncover something with a trowel, they have started to interpret it

> . . . interpretation begins at the trowel's edge. But different people interpret evidence in different ways. There has to be more than one way to make sense of the past.

Including the statement of Hodder's post-processual philosophy takes a bold step toward giving visitors the conceptual tools to evaluate the project as a whole, thus contributing to a robust public understanding of research. For instance, the visual and textual comparison of the two dig projects, together with the stated post-processual assumption, allow visitors to join in the implicit evaluation of Mellaart's earlier work. The exhibit (and by extension the visitor) celebrates the method, conclusions, and philosophy of the current dig team. Hodder's abstract, theoretical statement on archaeological philosophy is visually represented by his upward glance, a traditional image of the thinker (contrast it, for instance, with the working archaeologist who is, literally, digging in the dirt). The quotation and image depict a scientist who is aware of the complex, fluid nature of interpretation that would ground the team's conclusions. The emphasis on the idiosyncratic interpretations possible "at the trowel's edge" explains the diversity of the scientists at the dig site presented in the previous section of the panel: joining scientists from a variety of cultural and disciplinary backgrounds provides the project with the myriad of opinions or approaches that might best counterbalance a narrow, culturally select set of interpretations.

Hodder's quotation is ideal for an exhibit about scientific processes—and about Durant (1993)'s notion of how science *really* works—because it highlights a clear reflection on the process itself. It captures, however subtly, many of the radical sociological critiques of scientific knowledge. Hodder recognizes that scientific objectivity is culturally compromised, and to compensate, he has constructed a culturally diverse

team. Yet, the reflective, postmodern, and culturally aware nature of Hodder's archaeology is unusual for its hard stance on objectivity. The language of the quotation seems to retain a narrow focus that social and cultural influences are clearly evident in the hermeneutic processes of anthropology, but they are not necessarily a feature of science broadly, and the exhibit misses an opportunity to clarify this. Thus, we can see how the history of the two teams and Hodder's modern post-processual archaeological methodology facilitate an exhibit that wants to highlight the processes and nature of the science on display. But the generalizability of these conclusions is not easily made for exactly the same reasons.

This initial reading rail documenting the history and philosophy of the current dig lines up with the exhibit's display of some of the cultural and political features that influence the science. The two are related. In the reading rail pictured in Figure 6.9 Mellaart's initial project ended because "the Turkish government revoked permission to dig." The ramifications of this are felt in the lack of physical objects in the exhibit. But the question of politics and exhibition only hints at the larger question of cultural influences already recognized in Hodder's philosophy of archaeology.

"Who owns the past?" (Figure 6.12) takes up the question of culture and politics, which again makes Çatalhöyük an ideal site for demonstrating these intersections with science. This panel builds three levels around the ownership of the objects found at Çatalhöyük: lay visitor, scientific, and cultural. Each level is accompanied by an image of a representative with a dialogue balloon carrying the thread of the text along. The images in the first two examples are close up face shots, creating intimacy. The visitor reinforces that moving or removing an artifact would be a "serious criminal offense." The scientist argues that she is no different from the lay visitor, and she emphasizes that the work and any traffic of objects requires the permission of the Turkish government. The final

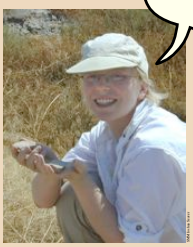
Who owns the past?

Knowledge of the past can be shared, but the ownership of archaeological finds is not so simple.

Finders Keepers?

The old adage says that if you find something lying on the ground, you can keep it. But what if it belongs to someone else? What if it means something to someone else?

When artifacts, specimens, and other objects are removed without proper study—or if they disappear into private collections—the scientific information they contain is lost, possibly forever.



"I visited Çatalhöyük as part of my work for this exhibit. I found a small piece of broken pottery on the mound. But I left it where I found it. I knew that moving it would have destroyed its context—important scientific information—and that taking it out of the country would be a serious criminal offense."

—Rachel Moritz, Science Museum exhibit developer

Can archaeologists claim objects in the name of science?

No. Scientists must follow the same rules as anyone else. At some dig sites, including Çatalhöyük, the government strictly controls the removal of objects from the country. This is done to prevent looting, but also to protect their national heritage.

For Turkish citizens, national identity—what it means to be a Turk—arises partly from people's pride in sites like Çatalhöyük. So they believe ancient objects should stay in Turkey for preservation and study.

"In order to dig at Çatalhöyük, we need permission from the Turkish Ministry of Culture. Government officials ensure that we work within the guidelines for excavations in Turkey. No project may remove any archaeological material from the country, but sometimes, with special permission, we can send some soil, plant, and bone samples abroad for analysis."

—Shahina Farid, site director

This land is *our* land!

In many parts of the world, governments and courts determine the ownership of items found on government property. In the U. S., for example, artifacts, fossils, minerals, and specimens—even fallen leaves—cannot legally be taken from public lands without permission.

"Our job is to protect the site, and to make sure the excavation is carried out in accordance with the law."

—Vahob Bay, Turkish Ministry of Culture

Why are there no artifacts from Çatalhöyük in this exhibit?

To protect their ancient heritage, the Turkish government strictly limits the removal of objects from the country. Most of the Çatalhöyük finds go to Turkish museums. A few go to British museums for study. All were deemed too valuable to travel to the United States.

Figure 6.12: Who Owns the Past?

representative is a member of the Turkish Ministry of Culture, and he is depicted in a less friendly pose—a full body shot creates more distance, his hands in his pockets seem defensive, and the tilt of his face and squint convey skepticism. This is reinforced by his authoritative statement that "Our job is to protect the site, and to make sure the excavation is carried out in accordance with the law." The cultural value of the objects gives the Turkish government a stake in the process, and it expresses a national concern for the safety of these objects and their transportability for scientific or educational purposes.

Finally, by catching Hodder's post-processual archaeological team in the act, the SMM was able to serve two epistemological purposes, both captured by the word "Mysteries" in the exhibit's title. First, since the work was still ongoing, the team had few conclusions to offer to the mysteries of what they were uncovering. The second type of mystery is more fundamental. Hodder's theoretical approach embraces postmodernism, which recognizes not only culturally contingent knowledge, but also high degrees of uncertainty and possibility. Hodder argues that "postmodernism is much less optimistic, less certain. It focuses on the 'multivocality': there are many different voices in the world and different perspectives, not just the Western one" (Kunzig 1999, 88) . This view influences his team's work, and it manifested itself throughout the exhibit. These mysteries were conveyed through the use of questions throughout the exhibit. Some of these questions were mere enticements to learn. "Who owns the past?", for example, had a rather elaborate answer. As did questions like "How does Çatalhöyük fit into Human History?" and "How tall were the residents of Çatalhöyük?", among others. However, other questions seemed more genuine, representing the kind of mysteries that the archaeological team was actually working to understand. A section of the "Early Painters" panel asks "What do you see in this painting?" It pits Mellaart's interpretation of a wall

painting against that of a chipped stone specialist currently working at the site. Mellaart's view, representing the old archaeological framework, is clearly challenged by the newer interpretation, but no conclusion is given. The visitor is encouraged to contribute a voice to the debate, thus adding to the multivocality surrounding this important painting. Other parts of the exhibit ask similar questions, and in so doing, the exhibit both represents the fundamental uncertainty inherent in the archaeological and interpretive process, and it encourages and empowers visitors to think through questions that do not yet—and perhaps may never—have final answers.

Hodder's philosophy for digging, then, provides an ideal case for an exhibit that communicates the philosophical, historical, cultural, political, and epistemological elements of science. Yet the very nature of Post-processual archaeology that facilitates these successful didactic and interactive displays about science also limits its potential generalizability. The exhibit's status as representative of science in general is implicit in its very existence in a science museum. The science museum legitimizes the science it displays; it says, this counts as an example of what science is. Thus, *Mysteries of Çatalhöyük* stands in for science, at the very least as an instance of the scientific enterprise. This is why any exhibit's representation of science matters. But the exhibit is also explicitly representative in the sense that the project's rationale was driven by the goal to capture the nature of science as a social process. The exhibit team intended for the archaeology on display to communicate features of the scientific endeavor more generally.

Throughout, the exhibit's goal of encouraging visitors to understand science as a social process is left implicit. While science as a social process is clearly on display, it seems narrowly limited to the science that it actually displays—post-processual archaeology. Nowhere does the exhibit extrapolate from post-processual archaeology to

another scientific discipline or to science generally or even invite visitors to do so. This lack of explicit extension undercuts the real representative nature of the science on display. Can post-processual archaeology serve as a representative of all science? Clearly, it served as an ideal subject for such an exhibit, but unless the exhibit connects the features of science on display here to the larger discipline of science—or even this exhibit to other exhibits in the SMM—it threatens to come across as *sui generis*. The nature of post-processual archaeology, its postmodern learnings, its reflexivity, its multivocality, and its hermeneutic questions about neolithic art and culture seem to separate it from traditional hard sciences like biology and physics.

To say that this exhibit does not effectively offer any indication of the relationship between archaeology and science generally is to be critical of how well it serves as what Kenneth Burke calls a representative anecdote (Burke 1952, 510). If *Mysteries of Çatalhöyük* is to function as entry to a better understanding of science as a social process (and not merely of archaeology) then the representation of science must be transferable to other sciences. If not, then its value as a representative anecdote—the image or terminology developed—fails to cover the ground it is meant to cover. *Mysteries of Çatalhöyük's* ability to function as a representative anecdote is rather weak, primarily because the exhibit fails "to transfer (to 'metaphor')" its image of science to other case (Burke 1952, 510). Consequently, it fails as a representative anecdote in the first place. This failed attempt at a representative anecdote leads visitors to one of two conclusions: 1) the features of post-processsual archaeology on display represent all science; and 2) the features of post-processual archaeology on display are not representative. Neither of these conclusions is true, of course, yet the exhibit provides visitors with no way of negotiating them. The science on display is both unique among the sciences *and* the exhibition of it

depicts important aspects of the nature of science as a discipline. The exhibit could have raised precisely this concern for visitors. Unfortunately, the ideal nature of the science on display, together with the myopic treatment of archaeology amongst the sciences, results in a confusion about how far visitors can apply the image of science constructed in *Mysteries of Catalhoyuik*.

Celebrating Social Process: *Mysteries of Çatalhöyük* as Epideictic

Unlike the other two exhibits discussed earlier, the epideictic goal of *Mysteries of Çatalhöyük* is less about changing behavior (*Disease Detectives*) or reflecting on the effects of conceptual changes within the space of the exhibit (*Race*) than about building the public's basic conception of science itself. To that end, it put science and scientists on display, a fact that is evident from the moment visitors enter the exhibit's halls.

In many ways, *Mysteries of Çatalhöyük* is the most traditional of the three epideictic exhibits. It celebrates without ever taking up the larger social, civic, or scientific goals evident in the general end of promoting the public understanding of science. The power of epideictic to reinforce or alter social values is, at its most basic, an implicit effect of celebrating or damning a person or event. There need not be an explicit call to action or statement of cultural mores for those values to be reinforced. In *Mysteries of Çatalhöyük*, the nature of science as a social process is depicted and celebrated without any discussion of what depicting science in this way means or provides for the visitor. This is true especially at the civic level. While it stands as the pinnacle of the PUR movement, itself the most recent iteration of the goal of improving science literacy, compared to the other

two exhibits, *Mysteries of Çatalhöyük* fails to openly engage the civic ends of understanding science as a social process. If promoting an image of science is at all concerned with cultivating citizens who can think more critically about the nature of science, then this exhibit could have done more to link up the social process of post-processual archaeology to science more broadly as well as to openly encourage a change in the relationship between science and the public.

For all these criticisms, however, *Mysteries of Çatalhöyük* remains a courageous, powerful, and effective exhibition. The criticisms I have voiced are possible because of the promise this exhibit offered in cultivating a radical image of science for the public. It does not completely succeed, but it also does not fail. In the end, *Mysteries of Çatalhöyük* captured science and scientists in the act along with the epistemological uncertainty with which they were grappling; it displayed parts of the scientific process that are typically erased in other exhibits, and it displayed them in the same way as traditional archaeological people and artifacts; it related some of the social aspects of what it means to be an active scientist working on a team for a joint end; and it acknowledged the historical developments of archaeology, as well as some of the political and cultural factors that influence how archaeology works in the real world. These features set it apart from other, more traditional exhibitions and provide examples that future exhibits could build from.

Finally, the SMM and the design team took a large risk in creating an exhibition that lacked artifacts and that attempted to convey complex abstract principles about science as an epistemological and social process. That they generated an exciting, fun, interactive, and engaging exhibition is a testament to their hard work and vision. For all this, Ian Hodder and his team should be grateful that their work has been so wonderfully captured

for the public. More exhibits should embrace these risks.

Chapter 7

Conclusion

In this dissertation, I have explored the range of representations of science available through three exhibits at the Science Museum of Minnesota, an arguably representative public science museum in the United States. I have intended to show how the celebrations of particular scientific ideas, practices, and theories depict different images of science for the public, and in so doing, promote or inhibit that public's civic potential. In none of the cases is the exhibit's contribution to the public's understanding of science largely in question. That science museums promote, in one way or another, the public's understanding of science is central to their mission and assumed as a given in this dissertation. Rather, I have focused on a particular approach to the promotion of science literacy: those social and cultural aspects of science that, once the public understands them, afford the public a new relationship with science. These features include not the facts and theories of science—the exciting conclusions of traditional accommodations of science—but the social, political, historical, and philosophical aspects that describe, in John Durant (1993)'s view, how science *really* works.

I have endeavored throughout this project to steer clear of defining exactly how the public should understand science. Instead, I have worked to identify the image of science that the exhibit constructs in order to point up their implications. To approach each of the exhibits with a sharply defined set of criteria and then judge each them against it, would be to simply argue for one ideologically charged image of science over another. And it would have been too easy as well, for museum exhibits, like all texts, are limited by space and resources, and they must meet audience expectations along side their educational goals. To expect public science exhibitions to offer a highly academic image of science for the public is too much. Each exhibit would necessarily fall short.

And yet the image of science that science museum exhibits construct is of critical importance to *any* level of the public's understanding of science. No matter their thematic content or goal, museums communicate cultural knowledge. Theirs is a powerful cultural authority. Once exhibited in a public science museum, a science or set of practices or set of ideas is canonized. It receives the imprimatur of scientific fact. This is exactly why one of the battles in the culture war between evolution and creationism occurs in science museums. Putting up a public exhibition in a large, impressive museum necessarily draws on and benefits from the cultural authority museums have acquired over hundreds of years. Staging exhibitions on creationism lends those ideas a modicum of cultural credibility. While the exhibits I have examined have tended to be less self-conscious about what they imply about science than exhibits in publicly-contested areas of science would be, these exhibits nevertheless both draw on the authority that museums lend their presentations and shape the public's understanding of what science is.

As an inquiry into the science museum exhibit's civic potential, I have explored whether the exhibit's representation of science empowers the public. The argument, coming from

many sides, is that if the public was able to understand the social, historical, political, economic, and philosophical facets of science, then the public would be in a better position to engage and grapple with the continually growing influence of scientific ideas in their daily lives. In other words, if the public understood how science *really* works, then it would recognize the contingent revisability of scientific knowledge as a strength rather than as a frustrating weakness. The public would, then, recognize science as a sophisticated and effective knowledge-making system, and yet not grant it a status beyond their ken: they would understand the limitations of science and see the ways that those limitations in fact embody powerful mechanisms for democratic and pragmatic growth. Idealistic as these arguments may be, they nevertheless capture the spirit of much scientific communication, from blogs and newspaper articles, to documentaries, television shows, and science exhibits. In many of these cases, scientific knowledge is promoted for its own sake; but just as often their ends are grounded—as I have shown in Chapter Two—in arguments over science literacy for civic engagement.

In the specific context of the literature on the rhetoric of science, this dissertation draws on the work of Alan Gross, Jeanne Fahnestock, and Greg Myers especially. Gross and Fahnestock have both faulted public accommodations of science, including those in museums, for the effects of failing to present an accurate view of science as an ongoing process of knowledge production. Myers distinguishes between narratives of science and narratives of nature. In his *Writing Biology*. Myers argues that the former "function to integrate researchers and their findings into the work of the research community," and the latter "support an equally coherent and definite view of scientific practices, but one that is inconsistent with the view embodied by the scientists in their articles" (Myers 1990, 189). Thus, in translations of science for the public—like those in museums—Myers identi-

fies a difference in the representation of science itself. Though he does not make the link between these narrative and their civic potential, his work reinforces the fact that accommodations tend to misrepresent the work that scientists do.

These assessments of most popular accommodations of science served as a starting point for thinking of exhibits and the image of science they construct from the perspective of epideictic. In their analyses, Gross and Fahnestock showed how epideictic captured what accommodations of science did well (celebrating and promoting particular scientific information effectively) and what they did poorly (pacifying the public and capturing the nature of science itself). But epideictic rhetoric does more than celebrate. In Chapter Two, drawing on the work of Chaim Perelman and Lucie Olbrechts-Tyteca among others, I expanded on the nature of epideictic in an attempt to show that accommodations also have the potential to shape values, making museum exhibits potential agents for change. Exhibits could offer a valuable civic dimension by constructing a more robust image of what science is. While my analysis of each exhibit is largely critical of these attempts—thus reinforcing Gross's ultimate criticism of the civic failure of accommodations following the deficit model—I also point up the ways each exhibit had the potential to empower the public by effectively depicting the processes of science. Pulling together the implications of the exhibits discussed here will show that science exhibits do have the potential to positively influence a civic public.

Epideictic Exhibits and the Deficit Model

According to Gross (1994), Doorman (1989), Durant (1993), Shapin (1992), and others, the deficit model of science literacy reflects the traditional approach to science accom-

modation. Its faults are many: the deficit model accommodates facts, not processes; it promotes appreciation over critical appraisal; it offers methodological oversimplification; it ignores the ethical, political, economic, social, and historical facets of science; it aims for educational recruitment, not civic engagement; and it relies on a monologic flow of information. All of these criticisms point toward two important generalizations. First, the deficit model fails to present science as the on-going, sometimes tentative, always contingent, self-critical process of knowledge production and assessment that characterizes the narrative of science that scientists tell each other. Second, it fails to position the public as citizens capable of effectively assessing scientific information. Accordingly, it is the model against which any civic minded exhibit must be assessed.

The first exhibit, *Disease Detectives*, represents a paradigm case of science literacy because it embodied most of the features of the deficit model. First, though the organization of the exhibit allows for visitor freedom, the real number of available, meaningful routes is limited. Within each disease case study the pathway is controlled so that while visitors do not need to follow the path, no matter which route they take the same information will be conveyed. Second, because of the exhibit's guided structure, the interactive components have clear, predetermined answers that visitors discover through a limited model of inquiry. Though they take up different roles in each of the three case studies, these roles really recreate one-way communications from the exhibit to the visitor rather than allowing for a dialogic experience. Third, the information transferred through this predominantly one-way channel is treated as highly certain: science in this model is a series of facts that the simple interactive processes make available to the visitor. Fourth, where questions are used, they are not used in order to set up a dialogic relationship with the visitor; they are intended merely to communicate more information to them. Fifth, the

exhibit's primary metaphor of the detective is a limited, inadequate view of the work scientists do. And finally, the exhibit fails to engage the visitor because it ignores the social, political, economic, and moral implications of the diseases on display. Where hints of these topics exist—in the timeline and in a series of flip panels on Malaria—they become simply another means to communicate more factual information to the visitor.

In many ways, this is an ironic claim, for *Disease Detectives* is a highly interactive exhibit (easily the most interactive of the three cases studied here), and its alignment with the deficit model seems to cut against this interactivity. However, in almost every other way, *Disease Detectives* is anything but traditional. It incorporates video games, computer kiosks, and visitor driven interactive components. Unlike most traditional exhibits, many of the its main messages are not didactic; they are collaborative: visitors must interact and participate for the exhibit to make sense. And yet, through all of this interactivity, the exhibit nevertheless promotes a traditional image of science, one that pacifies the public even as it affords them opportunities for action within the exhibit space.

Though the next two exhibits I analyzed moved away from the image of science depicted in *Disease Detectives* in important ways, they nevertheless continued to reinforce many features of the deficit model. Unlike *Disease Detectives*, the facets of *Race* that depict a traditional image of science make sense: since it is not highly interactive, *Race* incorporates many more didactic panels to communicate its messages. This results in a much stronger one-way flow of information that places the visitor in a more passive position. With few interactive components, *Race* also ignores the process of science almost entirely, which results in a fact-heavy exhibit that celebrates the current scientific view of race without showing how that view has been developed. A timeline, which does broach the history of racial science, reinforces a progress narrative, where the current view of

race is largely distinct (both conceptually and physically in the exhibit) from its own history. This timeline, along with other panels, effectively absolves science, especially anthropology, in the construction of concepts of racial identities, resulting in an image of science that elides important political and ethical facets of racial science. These facets of racial science are different in important ways from the political and ethical concerns of the social side of race, which the exhibit does present. None of the exhibit's powerful discussions of the social and political disparities created by racial thinking speaks to the role played by science itself.

Mysteries of Çatalhöyük's concern with science as a social process facilitates a move away from the deficit model. Nonetheless, for an exhibit that attempts to self-consciously present science as hermeneutic and social, the exhibit oversimplifies the meaning of science as a social process. What is social about archaeological work is oversimplified to "socializing" and the process, though much more elaborate than usual, remains the result of a team of individual efforts. Finally, the ethical, political, epistemological, and cultural facets of archaeology that are displayed are not easily applied to other sciences. The exhibit does not invite, much less enable, the viewer to raise and answer the question of the exhibit's generalizability.

Epideictic Exhibits Beyond the Deficit Model

For all the criticisms just voiced about how each exhibit continued to reinforce a traditional view of science and continued—at least in part—to pacify visitors and fail to afford them a true civic role, each exhibit also demonstrated that another approach is possible. This is as true of *Disease Detectives*, the paradigm case, as it is of the other two exhibits

that attempted to move beyond features of the deficit model. One of the facets of *Disease Detectives* with the potential to promote a different view of science was its inquiry-based structure, which gave visitors the chance to carry out a real process of inquiry. While the inquiry experience was compromised because the right answers were always a kiosk away, the different roles afforded visitors the opportunity to get closer to thinking like a scientist than most didactic exhibits achieve. The display of these different roles also had the potential to enrich the public's view of how different parts of the scientific community work together to solve problems. Finally, while the three featured diseases (e. coli, flu, and malaria) were not explicitly tied to the visitors' lives, if visitors had been paying attention to the news, they would have recognized them from recent current events. Each case study also began with the most accessible scientific problem: the sick patient in the doctor's office. Though they did so primarily to better accommodate the information available and not to empower them as citizens, these features contributed to strong audience-centered approach.

Disease Detectives not only celebrated the current science surrounding infectious diseases in an epideictic fashion, it also attempted to alter social behavior: it sought to improve basic hygienic practices, not simply celebrate a particular set of scientific ideas. Furthermore, *Disease Detectives* is educationally epideictic in the sense that it promotes a modern, scientific way of thinking. While the process may be perhaps a bit limited and too controlled, this highly interactive exhibit encouraged visitors to take up the roles of physician, lab technician, and epidemiologist. In the process, visitors were afforded opportunities to practice a culturally valued mode of rationality. In terms of epideictic, then, *Disease Detectives* not only celebrates science, it has clear educational and social outcomes that aim at improving the visitor.

The epideictic end of altering social behavior finds its most obvious expression in *Race*, which sought the wholesale transformation the visitors' concept of race. To accomplish this redefinition, *Race* displayed science as a historical, socially embedded process that distanced it from the deficit model. Though I argued that the display of these historical aspects had a few negative effects, they nevertheless implicated science within the bigoted and racist culture where it evolved. In this way, the exhibit shows that science (and anthropology especially) is not free from systemic bias, important facets of the way science has evolved. Furthermore, by transitioning from the history and social development of science to the place of race in the United States, *Race* quickly moved from an exhibit about science to an exhibit promoting reflection on appropriate ethical behavior. In this way, the epideictic celebration of the current scientific views on race made possible the public's radical reappraisal their basic conception of race. While its representation of science left something to be desired, its epideictic use of science to change the way the public thinks and acts created the most civically conscious exhibit studied here. As a powerful exhibit that forces the public to confront their views on race, *Race* showed that science exhibits, through accommodation, can achieve much more than the mere celebration of scientific ideas.

Compared with the previous two exhibits, *Mysteries of Çatalhöyük* is neither the most radically epideictic nor the one with the most obvious civic dimension, but it did produce the representation of science that moves furthest from the deficit model. Because it drew on a the public understanding of research as well as displaying a methodologically aware approach to archaeology, *Mysteries of Çatalhöyük* was able to effectively become an exhibit on the process of science. This exhibit nevertheless elaborated what is usually a simplified process of science, it then placed that process front and center for the visitor, and

finally it contextualized it historically, politically, and culturally. Through its display of the process of science, the epideictic dimension of this exhibit was the most traditional: its primary outward goal was that of celebration, of the archaeology, of the dig team, and also of science generally. If traditional epideictic had educational and social effects mainly through the values that were promoted in the epideictic speech or text itself, then the *Mysteries of Çatalhöyük* helps us see that texts that merely accommodate or celebrate can at the same time, and without explicitly calling for it, not only reinforce an audience's current views, but also alter them. For where *Disease Detectives* sought to celebrate science for hygienic effect and *Race* sought to celebrate science in order to change the public's idea of race, *Mysteries of Çatalhöyük* celebrated science in order to alter the public's very conception of science itself. Thus, even exhibits that do not explicitly promote a social or civic goal can nevertheless aim at fundamentally altering a cultural concept that can have important effects on the public's role as engaged citizens.

Future Research Questions

This analysis of the way these exhibits present science raises a number of future research questions. Most obvious are further questions about the nature of accommodations of science in science museums. Since none of the exhibits here fully escaped the pull of the deficit model (and perhaps they should not have), is it impossible for accommodations of science in science exhibits to eschew this model completely? Furthermore, augmenting these textual analyses with a wider array of interviews with the curators and exhibit teams might explore the value they place on facets of the deficit model when they construct exhibits. Does the deficit model in particular facilitate a successful exhibit, at least from the

museum's point of view? Another valuable extension of this project would include interviewing and observing visitors, exploring how they respond to exhibits that offer different images of science. Future projects addressing these questions must incorporate interviews of both exhibit staff and visitors to better determine how their views influence what exhibits do. Furthermore, the question of a science museum's image of science is just one of the meta-narratives that museums in America tell. This project might be profitably extended to incorporate studies of the image of art, history, and technology available in these museum exhibits.

As I carried out my analyses, I endeavored to treat the museum exhibit as a traditional text for a close, rhetorical analysis. However, more and more the exhibit flouted these textual conventions. As Alan Gross has commented, the multimodality of the museum exhibit "seems to stretch the machinery of classical rhetoric beyond the breaking point" (Gross 2005, 5). My experiences reaffirm this comment, and they open up a series of research questions about the nature of exhibits as texts and the ability of rhetorical theory to assess them. In particular, any full analysis of an exhibit's narrative or message must incorporate the exhibit's visual, spatial, material, video, and aural elements all need to be accounted for. The way these elements all work in exhibits without strict linear pathways makes this work more difficult. While many continue to study and evaluate museum exhibits, how these scholars integrate this variety of media into a coherent text will continue to pose interesting theoretical and methodological challenges into the future.

Fundamentally, this project is interested in exploring how the science museum exhibit's image of science might empower the public by encouraging them to see science differently. In this lies a civic goal in mind, hence my criticisms of exhibits that reinforce the deficit model science literacy. Revising the public's image of science to include the

historical, political, cultural, and epistemological realities of science as a social process is not to promote an anti-scientific point of view. Instead, it seeks to encourage the public to see the contingency, revisability, and sociality of science not as weaknesses but as strengths. Unfortunately, no matter how much these civic ends are championed by those in the museum community, the ability of museums and exhibits to empower the public remains a challenge. The challenge for exhibits, in particular, remains great, for they continue to struggle to break free of a monologic, mainly didactic mode of communication. Gross (1994), Einseidel and Einseidel (2004), and others who promote models of science literacy that empower the public, tend to suggest other modes of communication besides the traditional exhibit. Gross (1994) calls for consensus conferences, where the public and institutionalized science come together for real communication, and Einseidel and Einseidel (2004) champion consensus conferences, too, along with multimedia programs, expeditions, and workshops. Exhibits, it seems, are no longer popular means for generating a civic public. In light of this, alternate museum contexts and experiences for promoting scientific understanding should be analyzed.

Nevertheless, science museum exhibits, perhaps because of their tendency to be monologic, didactic texts, will continue to be important and popular sites accommodating science for the public and contributing to their understanding of science itself. Thus, the most obvious future research question involves expanding the number of exhibits and museums studied here to acquire a better picture of how museums—both in the United States and internationally—represent science for the public. And finally, so as not to lose sight of the civic potential of the public's understanding of scientific research, exhibits that endeavor to distance themselves away from the deficit model (exhibits like *Mysteries of Çatalhöyük*, *Science in American Life*, among others) should especially be explored.

For if museum exhibits are to serve as spaces for the empowerment of citizens, then their more radical instantiations will most clearly point the way forward.

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