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Do Androids Dream of Virtual Museums?

They wandered back to the rooms of fine French and English furniture. It was here that Claudia knew for sure that she had chosen the most elegant place in the world to hide. She wanted to sit on the lounge chair that had been made for Marie Antoinette or at least sit at her writing table. But signs everywhere said not to step on the platform. And some of the chairs had silken ropes strung across the arms to keep you from even trying to sit down. She would have to wait until after lights out to be Marie Antoinette. (Konigsburg 36

In E. L. Konigsburg's novel, From the Mixed-up Files of Mrs. Basil E.

Frankweiler, a rebellious sister and brother run away from home in search of adventure.

They don't run away to an amusement park or a toy store. Instead, they run away to New York's Metropolitan Museum of Art. The museum works throughout the novel as a source of inspiration, mystery and high adventure for the two children and the reader.

This book captures the spirit of entering a museum in an imaginative way, breaking the rules about touching exhibits. Through another medium, internet technologies, museums can offer to visitors an experience as powerful and provocative as the one created by Konigsburg. A revolution is available to museums today, if they wish to have it.

Technologies are now available to create compelling online virtual museum experiences not unlike the adventures in The Mixed-up Files, using digital versions of artifacts while the originals remain safely locked in their cases.

Museum History

The history of museums includes one major dramatic change--the opening of the museum to the public. The modern museum is the evolutionary cousin of the 'cabinet of curiosities,' a collection that was the exclusive property of a king or similarly privileged

person. In The Birth of the Museum, museum studies scholar Tony Bennett describes these cabinets as follows:

Typically comprising a small, windowless room whose location in the palace was often secret, [...] These cupboards and the objects they contained were arranged around a central point of inspection whose occupancy was reserved for the prince. The *studiolo* [or cabinet of curiosity] as Giuseppe Olmi has put it, formed 'an attempt to reappropriate and reassemble all reality in miniature, to constitute a place from the center of which the prince could symbolically reclaim dominion over the entire natural and artificial world' (Olmi in Bennett, 36)

As Bennet notes, the major revolution in museum history came in the eighteenth century when such collections were made open to the public. Bennet argues the objective of this new openness was to render the King's power visible for his people. On one level, visitors to the royal museum were supposed to be impressed by the King's power to collect, but more importantly visitors were expected to find contemporary power structures validated through the lavish display (Bennet 36-38). According to Bennet, museums were implemented as tools to coerce the public into feeling like stakeholders in a power structure that did not actually serve them.

Bennet also points out that the public museum created a "performative environment in which new forms of conduct and behavior could be shaped and practiced" (Bennett 33). In other words, the museum gave people an opportunity to mime the behavior of those in higher class levels and helped create middle class culture. I am not convinced by Bennett that the museum is a coercive environment but I am very interested that he sees something intrinsic in the public museum that is performative and therefore social. I will return to discuss the museum as a social institution in more depth later in the paper.

Primary Research: Museum Websites and Curator Interviews

If a second, digital revolution is available to museums today, are they taking advantage of it? To try to begin to answer this question I have completed a content analysis of five museum websites and followed up with curator interviews. First I will discuss what was interesting from the website content analysis, and then I will discuss the results of the interviews as well as some follow-up research.

The five virtual museums in my sample were chosen for particular reasons. Their selection was deliberate and not at all random or blind. A particular aspect of each website interested me, and originally attracted me to take a closer look at them. They are not top-tier museums that already have a considerable amount of scholarship focused on them, and represent a cross-section of types of museums from the U.S., Canada, and Germany in the genres of Natural History, Cultural History, Science, Contemporary Art, and Pop Culture.

Museum Websites

I chose content analysis in order to take my understanding of current virtual museums beyond a cursory level and to explore a selection of museums in detail. Content analysis was intended to be a useful tool for locating trends, comparisons, and differences in my chosen sample of museums in a systematic way. In other words, content analysis was of particular use to me as it allowed me to look at qualitative information in a quantitative way. However, content analysis cannot answer questions of causality and so I chose to follow up this research with an interview study of the curators.

The categories developed for the content analysis can be broken into two groups. The first group is focused on the background of the various museums, and the second

group is focused on attributes of the websites. The first group includes information about how each museum is funded, and I will return to examine this category later. It is clear that difficulty getting enough funding is a focal point for these museums, but it isn't necessarily a limitation on their creativity. As I will show later, higher end museums aren't creating better or different websites. The first group of content analysis categories also includes each museum's mission statement, which I collected to get a sense of where each institution was situated paradigmatically.

The second set of content analysis categories bears more examination. This is the set dedicated to describing attributes of each website. Four of these categories are concerned with user interaction. Interactivity is a complex and disputed term, and I will return to discuss it in more theoretical detail in a later section of the paper. These categories are Human Interaction (can the user interact with other users of the site live online?), Object Interactivity (can the user manipulate the objects in the museum's digital collection?), Access to Experts (can the user interact with museum affiliated experts on the site live?), and Curatorial Power (can the user act creatively as his or her own curator?). It was significant that none of the five virtual museums in the sample provided visitors with any human interaction, access to experts, or curatorial power. In terms of object interaction, one museum site allowed visitors to click an image to see a larger version of the image as well as click links to listen to audio clips, and another museum included video for the visitor to watch, some of which was accompanied by audio.

The final content analysis category was related to aspects of space design, display design, and sound design. The websites each had a different look to them that can be correlated to the look of other kinds of websites, from early 90s text heavy websites,

commercial internet shopping websites, textbook design, and current portfolio websites. Only one website made an attempt to create a three dimensional architectural space with a satirical reproduction of the Pantheon in Rome. None of the websites included a sound design.

Curator Interviews

The interview study was designed as a follow up to the content analysis for a change to find out some of the reasons behind the content analysis findings. I wanted to find out more about what kinds of objectives the curators had when creating their websites, and why the interactivity I had been looking for was missing. Four of the interviews were conducted over email and one over the telephone. The telephone allowed for richer, more complex communication and if I have the chance to expand this research I would attempt to obtain only telephone interviews in the future. The interviews showed that a major reason for the lack of interactivity on these websites is that the museum curators are simply not aware of the technology available today. For example, when asked what is offered online by The Authentic History Center that is not available in person, the curator responded that comic books can be uploaded to the website where visitors can read them in their entirety, whereas this would not be possible in a physical museum. A recent New York Times article reviewing Steve Geppi's Baltimore, Maryland Entertainment Museum shows this is not the case.

Like many of the artifacts on display, most of the comics are valuable and kept safely behind glass. But a video kiosk helps circumvent this drawback. Visitors can view Action Comics No. 1 or Superman No. 1 (1939) on a monitor. People can navigate each page with “back” and “forward” options. The presentation uses Mr. Geppi’s vintage copies, so the experience feels authentic: the pages are

yellowed with age, the original advertisements are included, and the monitor shows the rise and fall of each page as it is “turned.” (Gustines)

My point here is not that a museum curator must be all things to all people. The curator of the Authentic History Center is a high school U.S. history teacher, not a technologist. My point is simply that more is possible, online and in physical museums, and virtual museums need to capitalize on what they can do that physical museums cannot. In order to do this, museum curators need to be aware of the current state of technology either on their own or by communicating with people in that discipline. Another curator in the study was in a similar position of a lack of awareness. The curator of The Bacteria Museum, the only museum that made an attempt at a 3D architectural design, wrote that she wished she could make her museum more visually compelling but was so dedicated to user accessibility that she felt she couldn't. This is another example of a simple lack of awareness about what is available in terms of technology. A website can be engaging, interactive, and compelling and still require no more than a basic dial-up internet access. Text-only chat applications with 2D graphics, such as Palace avatar chat, don't require DSL or fancy graphics cards.

It was interesting to see that none of the curators wrote or spoke about providing online visitors with any kind of interaction with other human beings. It was simply not on these curators' radar to create a virtual museum as a social institution, capable of creating live interactions not possible at discreet physical locations. Only the curator from The Authentic History Center mentioned the idea of visitors uploading information to the museum website, and this feature has not yet been created as the curator has had difficulties in getting computers into his classrooms.

The telephone interview with the curator of The Museum of Jurassic Technology proved to be particularly interesting. This was no surprise as The Museum of Jurassic Technology is likely the most complex and nuanced institution in the sample. In Mr. Wilson's Cabinet of Wonder author Lawrence Weschler creates a provocative biography of the museum and to some degree, its curator as well. As Weschler explores the museum, he is often uncertain if he's looking at a traditional museum exhibit or something more akin to performance art. Many of Weschler's interactions with the curator are similarly tinged with irony. However, upon further research, Weschler finds that some of the most ironic-seeming items in the museum are in fact entirely on the level. In the telephone interview, the curator of The Museum of Jurassic Technology was quick to point out that he didn't have a virtual museum, instead [www. mjt.org](http://www.mjt.org) is just a website made by a museum. The curator went on to explain that having a website at all was somehow antithetical to the core of the museum's values and it had been created "as a necessary evil." The curator said the museum was designed in 1996 and that the look and functionalities of the website have been purposely maintained to have an "antiquated" appearance. When asked to describe his opinion of an ideal virtual museum, the curator responded that it wouldn't be a virtual museum at all, just a well thought out website with an accompanying physical museum location. The curator was strongly pessimistic that a compelling immersive experience can be created online, and therefore the creation of such website was not part of his objectives.

A final point of interest from the interview materials was that for the museums with corresponding physical locations, more people visit the museum online than in person. This does not mean that in-person visits have suffered due to a museum's

online exposure. However, I do think this means that the focus placed by curators on their websites should be strengthened. At the very least, a museum's website is likely to be the first impression a potential visitor has of the institution and a deciding factor in whether or not they choose to make the trek to the actual museum.

Primary Research Follow-Up

After noting that several museums in my sample struggle for funding and lack many of the interactive attributes I was looking for, I decided to examine three higher end museums outside of my sample to find out if a museum with more funding would provide users with a more deeply interactive experience online. The high-end museums I looked at were The Metropolitan Museum of Art in New York City, The Museum of Modern Art in New York City, and The Smithsonian's Museum of Natural History in Washington, D.C. It appears that even these well-funded museums are not leading the way in virtual museum interactivity. None of these three museums offer any human interaction or access to experts. The Metropolitan Museum of Art offers the only attempt at giving the user curatorial power with their 'My Met Gallery' feature. After registering for the use of the service, this allows users to select images of works and save them on a personalized page that resembles an Amazon.com shopping cart. The visitor can then return to the MET website at any time, log into their 'my met gallery' page, and click the saved thumbnails to review their selections. This feature does not allow users to add their own text comments to the saved items or to play with or modify the images in any way. This feature does not allow users to upload anything not found in the MET's online collection. I recognize the 'My Met Gallery' as a basic attempt at providing a user with curatorial

power, but I do not think this feature achieves a truly deep or interesting interactivity in its current incarnation.

The design of two of the high-end museum websites shared an interesting similarity. Both the MET site and the MOMA site reminded me strongly of commercial website design, such as CrateAndBarrel.com. Both websites consistently direct the user to the museum's online store, and it becomes irritatingly clear that these sites really want the user to come online to consume, not to play, interact, or learn. The commercial objective of high-end museum sites was made explicitly clear at the 2006 Museums and the Web conference. Paul Getchell from Boston's Museum of Fine Arts and Allegra Burnette and Lyde Spann from MOMA both presented papers at this conference.

Getchell of the MFA writes:

Perhaps the most exciting leveraging of our on-line collection is the potential for visitors to purchase on-demand prints of the artwork. The print-on-demand feature allows us to offer derivative retail product of potentially the entire collection without the need for inventory. [...] Profit margins are very high, as raw materials are provided as part of an ongoing licensing partnership with Epson. But there is huge potential to expand this commerce to provide cheaper and more varied on demand offerings. (Getchell 3)

I feel there is nothing wrong with museum websites including commercial pages selling products whose profits go toward supporting the museum. I think it is intelligent and necessary for the museum to be proactive in seeking funding for itself. I do not, however, agree with Getchell that the most exciting application of the MFA online collection is that the museum can sell copies of its holdings to online visitors. The MFA, along with other high-end museums, is putting the (shopping) cart before the horse here. The primary function of the online museum should be a museum experience--a shopping experience should be secondary. I also think these museums are underestimating their online visitors,

and mistakenly think users would rather shop online than use the internet to learn, connect with other people, express themselves, or create. Burnett and Spann from MOMA express a viewpoint similar to Getchell's in their paper;

Ideally, visitors moving from one site to the other [from the MoMA.org site to the MoMAstore.org site] would not go to radically shifting pages, but from one set of visual references to another within a similar structure [...] Links to MoMAstore.org are featured throughout MoMA.org via banners, images, and text links on the home page; consistent placement on the left navigational menu; and links on exhibition, collection, and e-card pages. (Burnette 8-13)

Even these high profile museums have missed the point about what is interesting in combining museums and the internet. Jensen articulates it well when he notes that what is compelling about the internet is when users see "the encounter with the Internet change from an experience of a Web of linked 2D documents to an experience of a galaxy of interconnected virtual inhabited three-dimensional worlds; a true cyberspace where people are the killer app" (Jensen 45). When he says "people are the killer app" he means that the best thing about the internet is not what you can read on it or what you can buy through it, but who you can connect with.

The Museum as a Social Institution

The people sit poised at their keyboards, ready and hungry for complex and stimulating Internet experiences, but the museums have not responded. This is particularly troubling since the museum is by nature a social institution. Online museums, which have been in existence for over a decade, are currently far more concerned with getting their collection 'heard' than listening to their visitors, or with seducing their visitors away from the exhibit pages into the museum's online shop. Museums must

embrace the social aspect of their institution in order to take advantage of the distributed network of potential visitors online.

On some level, all museums are nostalgic institutions that are used as places of collective remembering. In How Societies Remember, social scientist Paul Connerton elaborates on the basic qualities of memory and its social nature. Connerton posits that "the idea of an individual memory, absolutely separate from social memory, is an abstraction almost devoid of meaning" (Connerton 37). This "social memory" is physical for Connerton and is referred to as "bodily social memory" (Connerton 71). Connerton argues that knowledge is transferred through time not primarily in texts or objects, but through the repetitive performance of group physical actions, in other words, through ritual. Connerton writes, "It is in bodily properties that the rules of etiquette and the rules of the court are reproduced and remembered. They are remembered as habit-memories, as habitually observed rules of decorum" (Connerton 84). In terms of museums, Connerton means that memory doesn't happen with a lone user clicking thumbnails and reading text on a website. Instead, memory is created specifically in relation to other people.

Museum studies scholar Judy Rand also brings up the social nature of museums in her book chapter Visitors' Bill of Rights. Rand elaborates on 11 basic 'rights' which all (physical) museums should strive to provide their visitors. Two of these 11 basic rights are explicitly involve more than one person--Socializing and Communication. Rand describes the socializing right as "'I came to spend time with my family and friends.' Visitors came for a social outing with family or friends (or connect with society at large). They expect to talk, interact and share the experience; exhibits can set the stage for this" (Rand 158). Rand describes the communication right as "'Help me to understand, and let

me talk, too.' Visitors need accuracy, honesty and clear communication from labels, programs, and docents. They want to ask questions, and hear and express differing points of view" (Rand 159). Current virtual museums do not provide their visitors with these basic rights. If they are important in physical museums, they are no less important online.

Bennet, Connerton, and Rand have all pointed out in different ways that the museum is by nature a social place and a place for performance. Let me add that the museum's collection and exhibits can also be seen as performers, miming representations of the visitors for the visitors to see. For example, a natural history museum may show its visitors their own evolution through time, or a fine art museum may show its patrons reflections of themselves through expressive painting and sculpture. This opening of the cabinet of curiosity in the eighteenth century can be seen as a revolution because the museum for the first time invites the subjects of its mimicry to watch its performance of them. It is, however, a shallow sort of interaction. The public may come and look. Although the act of looking is complex and does include intricate feedback loops between the performer and the spectator, this particular act of looking in museums is very limited, and does not include more active types of interaction.

Interactivity is a current buzz word that has many different meanings in different disciplines. A museum may advertise that it has 'interactive exhibits.' What is meant by this is increasingly vague, but most likely means visitors are allowed to touch objects as well as look at them. This type of interaction is still relatively shallow. A museum may describe its exhibits as 'digital' or 'virtual.' This most likely means there are computer consoles in the museum and a visitor may point and click at images on the screen with a mouse. If the visitor is lucky, they may even be able to email images or text to

themselves for further enjoyment at home after they have left the museum. For example, "Inside the British Museum there are 50 touch screen consoles that allow a search for similar content [...] kiosks allow users to bookmark objects within the museum's collection, and these are then e-mailed back" (Barry 3). This type of interaction remains relatively shallow and unsatisfactory considering the type of experiences available using current technologies that are deeply interactive.

Some of the most compelling interactive experiences available online today are found in the gaming industry. It is necessary to look across disciplines here, from museum studies and social science to media studies to find the tools needed to create good virtual museums. Interdisciplinary investigation should be no problem for a museum, however. The museum itself encompasses architecture, design, preservation, art, science, and more. Any prejudice that may exist against the game industry as over-commercialized, not academic enough, or frivolous must be shed. It is commonly accepted that important learning takes place within play. Millions of people across the world are engaged in deeply interactive, immersive experiences in Massively Multiplayer Online Games, such as the popular American games World of Warcraft and Second Life. The multiple types of deep interactivity available in these games makes the interactivity touted by museums (and their corresponding websites) seem anemic by comparison. World of Warcraft, made by the game company Blizzard, recently caught the eye of the New York Times due to its large and growing member base, which totals around 7 million. The article describes the game very effectively.

The basic genre that World of Warcraft belongs to is called the massively-multiplayer online game, or M.M.O. The "massive" refers to the fact that in an

M.M.O., thousands of players simultaneously occupy one vast virtual 3-D world. [...] Blizzard runs hundreds of copies of the Worlds of Warcraft universe, known as servers, and there might be a few thousand players on any server at any given time. [...] To begin, a player creates an avatar, or character, customizing its physical appearance as well as race and profession, each of which has different skills and abilities. [...] The player is then set loose in a huge colorful fantasy world with cities, plains, oceans, mountains, forests, rivers, jungles, deserts and of course dungeons. The players can explore on their own or team up with others to conquer more imposing challenges. (Schiesel)

The article goes on to explain that some World of Warcraft players form teams in the game and then choose to have real-world social events as teams as well. This point illustrates that the internet serves its users well as a venue for meaningful interpersonal interaction, even though it is not intended to and is not capable of replacing actual face-to-face interaction. Another popular game, Second Life, is similar to World of Warcraft with several interesting exceptions. The game is open source and as such is constantly being created and re-created by its players, who create, upload, and modify code as they please. The 'game' has no pre-programmed scenarios, and the players themselves create the game as they go, mostly of highly social interactions, such as online performances, commercial transactions, conversations, and many other Second Life versions of 'First Life' or real world activities.

In his book chapter Virtual Inhabited 3D Worlds: Interactivity and Interaction Between Avatars, Autonomous Agents and Users, media scholar Jens F. Jensen develops a useful chart for breaking down and identifying the various types of interaction available in many MMOs.

	Human user	Designer - in- avatar	User - in - avatar	Bot*	Object	Virtual World
Human user	HU/HU					

Designer - in- avatar	D-in-A/HU	D-in-A/D-in-A				
User - in - avatar	U-in-A/HU	U-in-A/D-in-A	U-in-A/U-in-A			
Bot*	Bot/HU	Bot/D-in-A	Bot/U-in-A	Bot/Bot		
Object	Ob/HU	Ob/D-in-A	Ob/U-in-A	Ob/Bot	Ob/Ob	
Virtual World	VW/HU	VW/D-in-A	VW/U-in-A	VW/Bot	VW/Ob	VW/VW

***A bot is a computer generated character that has programming code behind it, not a live person**

This chart should be eye-opening in the context of the primary research I completed.

Here are twenty-one possible types of interaction, clearly delineated. Most MMOs make use of all of them. At this point, virtual museums make use of one of them--

Object/Human User interaction. This is not even one of the most interesting possibilities, since the way museums employ it includes only a basic point and click action. In my opinion, the more compelling interactions for museums to take advantage of in this schematic are the ones that involve actual humans on the other end of all the technology, such as Human User/Human User and User-in-Avatar/User-in-Avatar. These pairings provide the most deeply social interactive experiences. I feel that virtual museum visitors would enjoy to see themselves as Marie Antoinette conversing with another user as King Henry the VIII. Internet technology provides a provocative way for people to experience memory as a community behavior.

The technology required to create deeply interactive experiences online is readily available. This technology comes in many forms and levels of complexity and does not necessarily have to hamper user accessibility to the website. Applications with simpler 2D graphics that are still compelling are available and require only a low-speed dial up

internet connection and no graphics card. This technology is so pervasive, in fact, that it has dramatically altered what people expect to get out of a computer experience today. The technology we have created has in turn, re-created us. Through the creation of mimetic technologies, we have changed ourselves by our interaction with our creations. This has many implications including that internet users come online with very different expectations than they had fifteen years ago. The ancient sacred gift, making the inanimate animate, is no longer the privilege of the shaman or the professional actor. As performance theorist Michael Taussig notes in Mimesis and Alterity,

[...] the power to both double yet double endlessly, to become any Other and engage the image with the reality thus imagined [...] was once in the hands of seers and magicians who worked images to effect other images, who worked spirits to affect other spirits which in turn acted on the real they were the appearance of (Taussig 255).

Today, this power to 'double endlessly' is available more widely. Open source programming, games like Second Life, and the simple text chat application have opened this experience to many. Play, mask, and mimetic play in particular, are important and central to human existence. Media scholars Torunn Kjolner and Niels Lehmann discuss the dispersal of ideas regarding role-play in everyday life articulated by social scientist Erving Goffman as follows:

As [Goffman's] terminology became incorporated into everyday language, the role was no longer *like* the role in the theatre; life *had become* a theatre. [...] Hiding behind masks, playing contradicting roles in various situations of conflict, was what real life felt like. (Kjolner 81)

Viewing the museum as a representation of its visitors performed back at them, it can be seen as a mimetic institution. Taussig writes about the "power of the copy to influence what it is a copy of"(250). Museums need to take advantage of the ways in which they as mimetic institutions have changed us as well as the ways in which contemporary

technology has changed us. Museums must blow the dust off their websites and refashion them into true virtual museums providing visitors not only with information but also with deeply interactive experiences.

Future Applications

In conclusion I plan to elaborate not on possibilities for a museum of the future, but instead present a re-imagined museum of today. Just as with a physical museum, every aspect of a virtual museum site is an exciting design opportunity. The museum can show its visitors not only the exhibits within its walls, but the museum itself can also be an artifact. Architects can design the three dimensional exteriors and interiors of a virtual museum, and landscape designers can add 'outdoor' spaces such as a sculpture garden. The architecture of the museum proper could be static, but visitors could design and add their own rooms, galleries and gardens, populating them with works from the museum or uploading their own items.

A museum café online allows museum visitors to connect no matter where they are physically located. The café could resemble a three dimensional physical café, or be as simple as a Palace chat room. A café could facilitate live talk-backs with artists, designers, curators, and other museum experts. These talk-backs could be archived in the café for later as well. A sidebar in the café could house thumbnails of all the museum's holdings that can be dragged into chat balloons to further illuminate discussion. This type of sidebar could be present throughout the museum and highlight and date for each user which items have been visited and when.

Like lunchtime string quartet concerts in physical museums, sound design opportunities should not be passed over online. There is room for visitors to experience both jukebox-style sound design as well as live musical performances. Performances of any kind, including films, could be screened online as well, and archived for future viewing. The museum store can also become a place for creativity and interaction, selling not only museum-created wares but also digital items created by museum patrons. Schools could access the virtual museum and create custom "school tours" of the collection focusing on age appropriate or thematically appropriate items. Students could return to the museum, create their own galleries and upload their own materials, and then get live feedback on their work from remotely located artists and experts. As in MMOs with role playing servers, students studying the Renaissance could come online to the virtual museum to actually inhabit a Brueghel painting, learning through deeply interactive mimetic play with avatars and computer run bots. These exciting ideas only scratch the surface of what is really possible. I plan to use them and what I have learned from this study as I go on to build my own virtual museum.

Appendix A
Content Analysis Charts

Museum	URL	Physical location	Type	Funding	Mission Statement	Target Audience
Authentic History Center	www.authentichistory.com	No, hosted in USA	Cultural History, Pop Culture	independently owned and operated by Michael S. Barnes, a secondary public school teacher of American history.	history website that would not be just a collection of links, but an archive and teaching tool of American history primary sources based on popular culture.	history students, collectors of US memorabilia, general public
The Bacteria Museum	www.bacteriamuseum.org	No, hosted in Germany	Science	The Foundation for Bacteriology is responsible for the site, which is currently static and has no funding	the purpose of the Foundation for Bacteriologies is to promote, advance and advocate the common interest of the scientific community and the general public in scientific research and education related to bacteria, diseases caused by bacteria, and the utilization of bacteria to solve specific problems of humankind.	High school children and their educators.
MOCA Georgia	www.mocaga.org	Yes, in Atlanta, GA USA	Contemporary Art	Began as the opening of David golden real estate mogul's private collection. Privately funded by Golden and	MOCA GA's collection features more than 300 works by Georgia artists and includes a variety of mediums --	Adults

				others.	paintings, prints, sculpture, photography, and installation pieces. The museum will continue to collect, document and archive significant works of contemporary visual art by Georgia artists.	
Mosaica	www.mosaica.ca	No, hosted in Canada	Cultural History	York University	is dedicated to the positive aspects of diaspora based on the fact that Jews have always lived in diaspora - freely or enforced	students and professors of Jewish studies
Museum of Jurassic Technology	www.mjt.org	Yes, in Los Angeles, CA USA	Natural History, Cabinet of Curiosities	independently owned by Mr. Wilson and his wife, the founders and curators, and funded by grant making orgs as a nonprofit	The Museum of Jurassic Technology in Los Angeles, California is an educational institution dedicated to the advancement of knowledge and the public appreciation of the Lower Jurassic.	General audience

Appendix A, Continued
Content Analysis Charts Continued

Museum	Code	Human Interaction	Object Interaction	Access to Experts	Curatorial Power	Display, Space, and Sound Design
Authentic History Center	HTML	None	You can click an image to see an enlarged version. Some pages have audio links.	None	None	Not very designed space at all. design resembles a mid 90s personal website most. No 3D design. In terms of sound design, there are exhibits that include links to sounds from their time period, such as popular songs related to historical events.
The Bacteria Museum	HTML, Server Side Includes (SSI), Common Gateway Interface (CGI)	none-but there is an area of the page that has been closed due to lack of funding called "The Student Hall" I wonder if it was human interactive	None	None	None	the main page is a satirical reproduction of the Pantheon in Rome. This spatial design is not carried out on the following pages, which are designed like a

						hyperlinked textbook. No sound design.
MOCA Georgia	ASP	None	None	None	None	Design resembles a commercial site. No 3D design or sound design. Some videos include sound.
Mosaica	Macromedia Flash	None	You can watch a collection of videos, some with audio.	None	None	Design resembles most a personal or corporate portfolio site. No 3D space design. No sound design, although some videos include sound.
Museum of Jurassic Technology	HTML	None	None	None	None	Design is most like a textbook. No 3D space, no sound design.

Appendix B
Interview Chart

	Authentic History Center , Founder and Curator Michael Barnes <i>(Email)</i>	The Bacteria Museum , Curator Terry Wassenaar <i>(Email)</i>	MOCA Georgia , Manager of Exhibitions and Collections, Lisa Thrower <i>(Email)</i>	Mosaica , co-Founder and co-Curator Shelley Hornstein <i>(Email)</i>	Museum of Jurassic Technology , co- Founder and co-Curator David Wilson <i>(Telephone)</i>
1. What was the mission in creating this virtual museum?	To create an interactive history resource of American popular culture that can be used for teaching, and for individual study of American history. In particular, it is designed to be used by students who have access to technology. It was also created to allow for some student contribution to the museum.	To inform the general public on the wonderful world of bacteria, which for many people mean dirt, disease and death, but which in reality represent a world and micro-cosmos with wonderful properties.	Greater visibility across the country and the world. People who can't visit us physically can at least learn about the art we support through our exhibitions and programming.	To create an experimental virtual Jewish museum unlike any physical Jewish museum or its website so as to permit new ways of creating and disseminating Jewish contemporary culture.	We don't think of our site as a virtual museum. Our website is a necessary evil. We're so keen on the physicality of the space--the way it smells, the temperature, the uniqueness. There's no images of the museum itself on the website. We instinctively gravitated toward that. We don't believe it's possible to recreate the uniqueness of a physical space online-- although websites can be extraordinary. Our purpose in creating the website was to fulfill our responsibility to provide people with as much information as we could.
2. Does the virtual museum as it exists today fulfill all the goals stated	It's a very long process to create new sections of the site. I'm achieving the state goals, but the site gets better	I think within the limitations of my time available, I have	We have not yet scratched the surface of our goals for the website. As a museum	Except for scale, yes.	We are not goal oriented. In terms of information sharing, yes, the website is

for it?	with time as new section are created and added. Student contributions have been limited mostly because of the difficulty in getting the proper technology in the classroom needed for creating sections, which is different than the technology needed for using the site.	succeeded. I receive regular questions from people who found the museum useful and then contacted me for more information. The numbers of visitors, especially numbers of reloads, also suggest that the museum is used as a source of information.	dedicated to collecting and archiving art and information from artists around our state, we will eventually digitize artist information and images for storage on our website. We will eventually ask for visitors to subscribe to our website in order to access this information.		successful. There have been so many unanticipated results as well. For example, the website has given us another perspective on our collection.
3. When was the virtual museum constructed?	The domain name authetichistory.com was first registered and the site first went online in March 1999.	I started with this in 1998 and we went online in 1999, thus it is an 'oldie.'	In 2000-2001 while the actual physical space was being built out.	Launched 2004	We put it up in 1996 when it was first possible to make this kind of website. We don't want to change it too much. We like how the site seems antiquated. It's small, the images are small. Now we're going back in and adding all our publications available for free on the website. We just put up new images of our microminiatures collection. However, the experience of looking at these works of art through the microscope eyepiece in the physical

					<p>museum cannot be replicated online. The online experience is similar to reading the paper catalog of the exhibit.</p>
<p>4. Who designed and built the virtual museum?</p>	<p>Michael Barnes.</p>	<p>Trudy Wassenaar.</p>	<p>Our co-founder, Director, President/CEO Annette Cone-Skelton along with web designers and one assistant and a graphic designer as a design consultant.</p>	<p>The design precepts emerged from a York University advanced research seminar and were implemented, in consultation with the designer, Greg Goralski, at the time, a York design student and now a graphic designer.</p>	<p>David Wilson, with the help of a friend in a remote location who tutored him in html. David did the original design, and now his 21 year old daughter is doing the current redesign.</p>
<p>5. How were design decisions made?</p>	<p>Design decisions were driven by need, and my ability to teach myself new technology skills in order to meet those needs. My background is in history and education, not technology. Sources are organized by historical era, and by subject within those eras. The content should be accessible with a minimum amount of clicks or intuition needed. The decision was to focus on functionality over appearance.</p>	<p>I used three criteria for design: I wanted to give the impression of visiting a building (which a museum always is) and thus used photos of an existing building (actually the Pantheon in Rome) as background figures. My second criterion was liberty of content, thus being able to extend as</p>	<p>Based on the aesthetic taste of Ms. Cone-Skelton while considering ease of use, clarity, etc.</p>	<p>Big decisions were made in consultation with members of the seminar: smaller decisions were made by the directors and designer.</p>	<p>I don't even know how to answer that. It was an intuitive design process, taking into account a mix of utility and aesthetics. It was highly collaborative.</p>

		<p>much as I wanted. Therefore the actual displays (the content of the museum) were text-only, without further design features, so that I could extend as much as I liked (thus I left the analogy of a building or rooms in a building for the actual displays). The third criterion for design was that visiting and loading the site should be easy, without requiring modern software: users in developing countries and school kids using their fathers' old computers should be able to visit my site. This decision limited the use of fashionable gags, but I still support this philosophy. By the way, I will do a complete face lift of the museum this year, so that it</p>			
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		may get a new look soon.			
6. (If applicable) What can a visitor get from the virtual museum that they cannot get from the physical museum?	A multimedia experience. The site focuses on pop culture, and there is an emphasis on music and other sounds. The focus right now is on developing new sections showing how American history is reflected in comic books. In a physical museum a visitor would be limited to viewing a few comic book covers. In the online museum, the stories themselves will be accessible. Content can be revised quickly and easily. Multimedia essays can be revised based on reader input.	There is no physical museum about bacteria. The founder of our virtual museum, Prof. Martin Blaser, has this dream about starting a museum after he retires. As that would require a lot of laboratory work (unless you want to look at dead preparations) I don't think this is realistic. Besides, looking at bacteria is rather dull. Reading about their little lives is far more interesting.	They can see the bulk of our permanent collection which we do not have space to exhibit throughout the year. They can also search through a database of Georgia artists and get information on the core collection by viewing a video lecture by Georgia art historian John Howett.	One can visit a museum only when visiting a specific city or place. The virtual concept allows anyone with a computer, or computer access, to visit anytime, anyplace. In other words, the restrictions or limitations of a physical site are eliminated with a virtual site. This also means that dissemination of material is far broader, to a potentially far greater audience and across many symbolic, physical, and nation-state borders.	The online visitor can download almost every piece of text in the physical museum for free, and can also download images.
7. How many people visit your virtual museum each year?	There were 1.2 million unique visitors to the site last year.	150,000	15,000 on average	Since September 2005 to August 2006 we've had 1104 visits and 17,721 hits.	I don't know. I have never looked. I am curious to know now that you bring it up, though.
8. (If applicable) How many people visit your physical museum each year?	Not applicable. Though the AHC has a physical collection, it is not available to the public in a museum setting.	Not applicable.	11,000 on average	Not applicable.	About 20,000 which is a small miracle.
9. In your opinion, what is the	How the site is designed to show young people that	There are other sites on bacteria but	It gives a sense of our design aesthetic	A non-traditional navigation	The information that is available to people.

best feature of your virtual museum?	popular culture, even their current culture, reflects history. This engages students in analyzing their own world around them.	ours is the only one with so many deep links, dealing with so many different aspects, and in absence of commercials.	throughout. It "matches" all of our published materials, signage, etc.	pattern that echoes that content and diverse, dynamic and provocative art projects.	
10. How would you describe the ideal virtual museum?	One that provides both content and analysis in an interactive experience.	I wish I could introduce a 3D sense, where you actually move through rooms and can browse the displays (e.g. as thumbnails) before clicking on details. This clashes with my third criterion on design above, so at present it is not feasible.	One that has artist information as well as images of collected work. This I the goal we are working towards before 2008, but we need a grant in order to start the digitization process and the website expansion.	Stimulating visually and challenging the haptic (which is becoming more and more apparent), and the audio possibilities (again, much more will be developing).	My ideal would not be a virtual museum. It would be a coherent website designed by a museum. The world wide web cannot replace physical realities. The web works best when it does things you can't do otherwise.
11. Is there anything else you would like to add?	A good virtual museum is never static. It continues to grow, expand, and be revised.	The one limitation with initiatives like mine is the finance. It is hard to find sponsors, as I want to remain non-commercial and don't want to restrict myself to, say, medical bacteriology, or applied bacteriology only. The diversity of the museum is its strongest point but also the Achilles	Our website is a very essential key segment of our mission as we move forward.		I don't think you can have an immersive experience truly with a monitor, but thoughtful, useful, careful audio design could be helpful. I've seen a moderate amount of high end virtual reality projects, but all of what I've seen kind of just misses the point. The most successful uses of VR I've seen were sound and image with a meaningful merging of physical and

		heel as I can't get sponsors interested.			virtual reality. In our physical location, we use a lot of computers and technology, but it is made completely inconspicuous to the visitors.
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