“Life in Translation”: Addressing Deaf Visitors in Museums with an American Sign Language (ASL) Multimedia Tour

Research Article

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I. INTRODUCTION

With a growing commitment to universal design, museums across the nation are developing their exhibits and programs to be more inclusive of diverse visitor audiences (Hein, 2002; Reich & Lindgren-Streicher, 2004). Great strides have been made to include the Deaf community, in particular, into museums' learning experiences. A survey sent out to science museums across North America found many institutions reporting a high level of accessibility for the Deaf; 43% of institutions that responded to the survey self-reported that 75% or more of their exhibits were accessible to the Deaf (Tokar, 2004).

Museums like the Museum of Modern Art offer tours and programs on specific days with ASL interpreters. Some audio tours have sound amplification for hearing aid wearers or offer paper scripts for Deaf users (which is a practice that Smithsonian Accessibility Guidelines describe a last resort). More museums like the Museum of Science now use open captioning on all video-based components,. In its Accessibility Guidelines, the Smithsonian writes how open captioning far surpasses scripts:

> *Captioning is, by far, the most effective method of presenting narration in print. It allows people to watch the images and the text simultaneously. A script requires a back-and-forth effort between the screen and the script. It also requires a minimum of 16-point type, visual cuing to scenes and key points, and sufficient lighting for reading.*

Yet for Deaf visitors, captions have to be presented at an adequate reading level or else comprehension suffers (Hertzog, Stinson, & Keiffer, 1989; Smithsonian Accessibility Program, 1996). Labels too can present a challenge to Deaf visitors who generally have been estimated to have a lower reading comprehension level. Studies have found Deaf high school graduates having a median fourth grade reading level (Holt, Traxler & Allen, 1997).

Research has found that providing information in a highly visual and technology-based manner to Deaf individuals is the most effective manner. The use of multimedia or web-based content increased Deaf students' learning compared to traditional lecture formats (Lang & Steely, 2003; Dowaliby & Lang, 1999). Furthermore, students might be more engaged when instructed in sign language rather than through an ASL translator (Lang, 2002). Hence, many recent curriculum projects for the Deaf, like *Classroom of the Sea*, *Project SOAR*, *PiVot*, and *Physics Interactive Video Tutor Project*, have been using technology to provide rich science information graphically and broadcast through the internet (Lang, Babb, Scheifele, Brown, LaPorta-Hupper, Monte, et.al, 2002). Because Deaf students tend to be dependent learners and need a lot of structure, a combination of graphics, text and questions improved students' understanding of certain scientific concepts in Deaf middle and high schools (Lang & Steely, 2003; Wilson & Hyde, 1997).

In applying many of the formal classroom research findings to the museum, where there is a proliferation of handheld technologies being integrated into the visitor experience, there are

possibilities to transform the Deaf museum visitor's learning experience. These handhelds' video and personalization capabilities allow museum visitors to read copy label at larger sized fonts, view captions, and watch interpretation in sign language. Already in places like the Great Blacks in Wax Museum in Baltimore, the International Spy Museum in Washington, D.C., and the Tate Modern in London, Deaf visitors have used handheld ASL tours to access a wealth of cultural knowledge in their primary language. Nancy Proctor of Antenna Audio (2005) wrote that sign language guides ultimately need to keep the Deaf visitor inspired, learning and engaged in the exhibit:

> *Crucially, the Sign Language Guide is not a simple translation of a tour into a sign language…it goes beyond simple facts and information to interpret the object display, drawing the visitor into a three-way dialogue among the exhibit, the tour message about the exhibit and his or her personal reaction to both…To the extent it is possible, the pacing of the signed tour should be roughly equivalent to that of a spoken tour" (p.3)*

According to Proctor, a good sign language tour also has: high quality signers; a great story with appropriate drama; effect and atmosphere; subtitles to strengthen understanding; large text for low vision visitors; high contrast; and has a sign language glossary of new vocabulary. In terms of operations, it has a neck strap, awareness training for visitor services staff, and a signed instructional video at the distribution center.

Many findings were gained from the Tate Modern's British Sign Language Multimedia Tour, the world's first wireless sign language guide, which was originally implemented on an experimental basis and is currently available to all of the Tate's public visitors. Their Tour and ASL version of the Tour had the Curator of Special Projects' special remarks, interpretation of artists' quotations, and interactive features like games and instant messaging designed to build a sense of community. Furthermore, there was an optional subtitling feature and a video glossary of art terms. Many participants of the evaluation's Deaf focus groups voiced enjoyment of the tour and its video components, and found the overall experience empowering. However, many participants wanted to hear from the artists. In addition, many found fluctuations in speed, rhythm and content delivery frustrating and believed that the high level of language could impede some users' understanding. One highly debated point was whether more information and fewer games should be provided because some members found value in the games while others did not.

With the Museum of Science's strong commitment to universal design and accessibility, along with our growing identification as a research institution, it was a natural choice to leverage the Multimedia Tour's video capabilities to develop an ASL version. The project was viewed as largely experimental in nature with the Museum testing interest and design for future ASL tour guides on site for the field. Some goals of the Museum's tour were:

- Offering visitors who are ASL users a means of accessing information about the exhibition in their own language;

- Providing a means for delivering more in-depth levels of content for adult visitors interested in learning more about the scientific, technical and Star Wars related topics presented in the exhibition;
- Facilitating connections between the visitor's in-museum and at-home learning experiences through an enhanced "bookmarking" feature that enables visitors to tag exhibition topics they would like to continue learning about at home.

The ASL tour evaluation had two primary research questions: 1) How do visitors integrate the multimedia tour into their learning experience in the museum and 2) What do visitors perceive to be the greatest value of the multimedia tour? Through focus groups, we asked Deaf users to reflect on the ways the ASL tour added to their experience in the exhibition and how we could improve it in future implementations.

About the Multimedia Tour

The Multimedia Tour (MMT), which was produced in conjunction with the field leader of handheld tours, Antenna Audio, had 22 stops that featured behind the scenes interviews with *Star Wars* film producers, explanations of real world technologies and the *Star Wars* films' backgrounds, and a "bookmarking" function that allowed users to select information to be e-mailed to them. Tour stops in the exhibition were denoted by a blue R2D2 icon that wore headphones. The ASL Tour features nearly the same exact content with a woman translating the narration. On this screen, you see a blue background with a shot of the translator from the waist up. She pauses to highlight photos. The interviews with *Star Wars* producers, however, were exactly the same as the hearing version of the MMT and displayed with captioning below the image of the person talking. To access the ASL Tour, Antenna staff had to switch the Tour's mode.

The Tour was on a Toshiba E830 PDA, which was 6.8 ounces and 5.3" x 3.0" x 0.6." The screen size was 3 ¼" x 2 ¼". It had an Intel XSCale 520MHz processor and thin film transistor (TFT) transreflective color display. The screen was very high quality, with 480 by 640 VGA. There is a 5-way navigation button with four application buttons on the bottom of the screen, however, the Tour was run through a touch system with a touch-based T9 keypad to select tour stops and also enter one's email address.[1]

[1] Due to inaccessibility of touch screens for individuals who are blind, an alternative audio-only version of the Multimedia Tour was provided. This version offered the content of the initial stops and no further options for selection, like Behind the Scenes. Antenna possessed two of these devices.

II. METHODS

On two Saturday mornings, December 3 and December 10, 2005, two groups of Deaf adults were invited to participate in a focus group to try out the Multimedia Tour in the Star Wars exhibition and provide feedback on both its effectiveness and how it could be improved.

The groups had been advertised twice on Mass Deaf-Terp (http://groups.yahoo.com/group/Mass_Deaf-Terp/), an online community that posts local social events and news items of interest to the Deaf community. In exchange for joining a focus group, participants were offered free admission to the Museum, Star Wars exhibit and parking. The MMT has free admission to any blind or Deaf visitors. All individuals signed up weeks in advance and many attended with either a friend or family member who was Deaf. One college student brought a hearing friend who was not fluent in ASL. Also on December 3, two non-local Deaf ASL MMT users who happened to be visiting the exhibit as the same time as focus group participants were invited and agreed to also participate in the focus group.

The focus groups were held in a quiet room off the exhibit floors. Participants sat in a circle while a member of the Research team asked questions. Two ASL interpreters were present the entire time and the second focus group's conversation was tape recorded. [2] Before beginning the focus group, participants were asked to take a brief survey on their demographics and their thoughts of the Museum of Science as a welcoming place for Deaf individuals. This survey allowed us to better understand who was coming to the Deaf focus groups and to ask questions that we were not able to touch upon during the actual focus group.

The purpose of the focus group was to gain rich in-depth feedback from many people at once, particularly because it is so difficult to capture Deaf users in our exit interviews due to language barriers. Focus groups followed a topical framework surrounding what visitors enjoyed about the handheld, improvements they might make to the handheld's design, and marketing the tour to the Deaf audience (See Appendix). A limitation of focus groups is that they are in an inherently social setting and lend themselves to bias by other participants. Participants might be less likely to disagree strongly to others' comments and instead conform to the norm, especially if one person is particularly persuasive. Having two focus groups allowed us to test the popularity of ideas that arose in the first focus group with the second.

Most of the focus group participants were in their thirties, with the youngest person being 18 and the oldest being 40. Overall, there were slightly more males (10 of 16, or 63%) than females. With the exception of two individuals, most participants rated themselves as having a very high interest in science and technology and being a big Star Wars fan. One member from each of the focus groups also had low vision. The two focus groups differed slightly from one another in several ways. The first focus group was larger, with 10 participants as compared to the second focus group, which only had 6 participants.[3] The first focus group also tended to be more excited and vocal than the second group.

[2] For longer events, the state recommends having more than one interpreter and letting them switch every 20 to 30 minutes.

[3] There were actually 7 visitors present for the second focus group, however the seventh individual was a friend of a participant who was hearing and did not participate in the conversation.

III. FINDINGS

3.1 Overall Experience from Beginning to End: Visitor Comments and Suggestions

Before signing up for the focus group, none of the attendees had heard about the Museum of Science's Multimedia Tour. Upon seeing the Antenna Audio display of handhelds physically paired with headphones, many of the attendees still assumed that the Multimedia Tour was for hearing visitors only and that it did not possess ASL capabilities. Yet once they learned more about the Multimedia Tour and its ASL version, it cannot be emphasized how thrilled participants were with the idea that they would be experiencing the exhibit in their native language. When the Antenna staff member was explaining how to use the handheld tour, and said how it was being used for the first time in a local museum, one individual from the December 3 focus group clapped his hands together and excitedly exclaimed, "We're pioneers!"

As participants' experiences inside the exhibit would prove, the explanation Antenna staff gave on how to use the handheld was at best, cursory. One Deaf ASL Tour user wanted to see instructions again, but did not understand how. Other users did not know how to enter their email address, how to turn off captioning, or that one could pause the video feed. Yet ironically, it became apparent that the Deaf individuals would have never received proper training on how to solve these problems or even any information from Antenna Audio had the interpreter not been present. During the second focus group, for example, the Antenna staff member explaining how to use the handheld seemed so taken off guard and unsure that the translator explained his awkward silence as not knowing what to say. Antenna staff should be well versed and trained to work with potential Deaf users to be readily able to explain features in detail.

As was the case with users of the hearing Multimedia Tour, once inside the exhibit, there were several types of users. Some individuals used it heavily and were absorbed in the content while others were so engrossed in the exhibit and reliving their childhood (Sam, 12/3/05) or plainly uncomfortable with the neck lanyard (Jenny, 12/10/05) that they barely used it. Some group members split up for the majority of the time inside the exhibit while others stayed close together, especially the individuals with low vision who had trouble navigating without a partner. Most participants ended up going inside Robot Theater, unbeknownst to them, was not captioned or featured on the handheld.

Despite these differences, to all focus group participants, the ASL handheld Tour was significant on many levels. On one level, the ASL tour represented the opening up of museums doors to the Deaf and of becoming more inclusive. One woman, Rebecca, said that the ASL Tour "means a lot of changes are coming" into exhibits and programming and that museums were moving into a new age (12/3/05). For what felt like the first time, museums were openly recognizing the Deaf as a very important population and incorporating specific Deaf-friendly components into their exhibits and it was a warmly received gesture.

On another level, many Deaf individuals declared that the handheld provided access to an experience they normally would not have: a sense of gained independence and control over their

experience. The focus group participants said not only did they not have to arrange for an interpreter, which is a difficult task with a long waiting lists and weeks of advance notice, but they did not have to follow an interpreter at the group or interpreter's pace. Nor did they have to rely on other hearing members of their group or basic handouts like maps for information: "I've been to several science museums and felt my only option was the map. I found out after the fact that there was a lot more information available to me. I had to rely on [the] hearing person who was with me" (John, 12/10/2005). Instead, as Jim and many Deaf users said the ASL Tour "let me go at my own pace" and explore topics of interest at greater depth: "I enjoyed the *Lord of the Rings* [exhibition at the Museum of Science], but in Star Wars, I just felt like the general public. I like that ready access" (Jim, 12/10/2005).

Interestingly, although the Museum and general hearing public conceptualized the handheld as an add-on enhancing experience –providing additional content and Behind the Scenes information to the visitor—to many Deaf individuals, the handheld represented equal access to the exhibit's content information. When asked how their experience without the handheld would be different, participants answered simply, "We wouldn't have any information." Conceivably they meant that easy access to exhibit-related information would have felt significantly reduced with exhibit components not being in their primary language and because of a lower reading comprehension level. Like hearing visitors, others commented that the handheld also just "gives me a lot more info" (Max, 12/10/2005).

In addition, the handheld provided Deaf visitors with access to some form of information they might have missed out on or had difficulty gleaning from the exhibit due to crowding. If they wanted to watch a video, for example, they did not have the luxury of standing three or five feet away and listening while peeking over other visitors' shoulders. Instead, they would have to stand close enough to see the captioned text: "If [the handheld] was part of the exhibit, I might have to wait in line" (Jim, 12/10/2005). They liked having their individual tours of their own.

Participants brought up the idea of how wonderful it would be if the Museum of Science had a handheld that extended throughout the Museum. Moreover, it would be amazing if all museums had an ASL tour. One participant, Aaron, wanted to see a noticeable kiosk or information booth that alerted Deaf visitors to all of the Museum's offerings for their populations. Maybe it could have wayfinding mechanisms, members of the second focus group suggested to help visitors locate exhibits and show times. Both focus groups wanted to see the Museum move in the direction where handheld devices would be ubiquitous and comprehensive.

Despite all focus group participants' enthusiasm about the handheld's existence, this does not mean that all were equally thrilled with the design of the Tour's content or handheld itself; as one person wrote on their survey, it was far from perfect.

3.2 Issues with the Handheld's Design

Previous handheld museum tours have presented problems to the general public by dividing visitors' time between the handheld, engagement in exhibits and interaction with group members (Semper & Spasojevic, 2002). Museums had responded by keeping Tour stops short and providing an opportunity to send information home. Yet for the focus group participants, this ASL Tour still seemed to divide their experience and to a greater degree than hearing users. Many Deaf handheld users felt they had to continually "Look up and down" (Jenny, 12/10/05) and to make a choice between what to see; unlike hearing visitors, they did not have the option to listen and watch at the same time. One woman's comment captured this sentiment when she said, "I feel like I'm just looking at text versus experience, so I have to choose. I don't like having to choose" (Danielle, 12/3/05). There were many factors that contributed to the handheld's divisive nature and focus group participants spent much time suggesting ways to alleviate the problem.

Part of the problem lay in the captioning, which lagged a second or two behind and was constricted by the small space of the handheld's screen, allowing only 5 or 6 words to appear at a time. Thus, the Deaf user felt as though he or she would have to wait for the next few words to show up on screen to get the full message – making the handheld experience feel like a long, drawn out and tedious process. Both focus group participants wanted more captioning options like having multiple lines displayed at once. This would allow visitors to read the stop quickly instead of waiting for each line to appear, however others thought captioning should stay consistent to the TV's standardized single-line closed captioning presentation. One man, Jeff, wanted one or the other – captioning or ASL – but not both: "Maybe it should be an option to the person using it, to have text or signing, but not both – that would cut off some of the time" (12/10/2005). (In actuality, there was an option to turn off the closed captioning, however he and many others had not been aware of that function.) Others suggested having "a supplemental guidebook so we don't have to wait for each fact to come to you in the PDA" (Manuel, 12/10/2005) they could instead turn to a booklet to find the key points made in each clip. These comments reflected the different preferences of text presentation and the diversity of the Deaf community as one woman reminded us that "we have a broad Deaf community" and not everyone is fluent in ASL; thus, "combinations are helpful" (Linda, 12/10/2005).

Another aspect that contributed to the handheld's divisive nature was the length of the videos. Some suggested shortening the clips: "It would be nice if [the] experience on [the] PDA is shorter. [You experience] some fatigue after watching for 3 hours. Your eyes would fall out. I'm not saying reduce it to a Mickey Mouse book" (Mitt, 12/3/2005). *S*ome Deaf users emphasized that it is not necessary that the ASL interpreter translate the interview so closely. Instead, the interviewee's comments could be translated in abbreviated fashion, thus making clips shorter. However, while the first focus group felt strongly about shortening clips, the second focus group simply expressed wanting more than 90 minutes in the gallery. Nearly all individuals from both focus groups felt that 90 minutes in the exhibition were too short to be using the handheld and experiencing the exhibit; many who had used the ASL Tour felt they were looking "at the PDA not the exhibit" during their visit. Many said they felt they could spend all day in the exhibit exploring content (with one man joking that he would love to spend

so much time in the exhibit that he wanted to sleepover) and that the exhibit experience should be advertised as such. This is interesting to contrast with the hearing Multimedia Tour users, whose median time of 85 minutes in the gallery, based on a small sample, was close to our allotted time (Tisdal, 2006). The difference highlights how people with disabilities tend to take longer in exhibits, as Tisdal's remedial exhibit evaluation (2006) and other research has well established.

To make the ASL Multimedia Tour more engaging and more integral to the exhibit experience, the Tour should have images of the artifacts they were looking at, playing to Deaf people's visual orientation. Many participants emphasized how Deaf people find visuals extremely compelling and one person said for this reason, he loves coming to the Museum of Science to see phenomena in motion.

Both focus groups unanimously agreed that the "signing image was too small" and that the videographer should have "zoom[ed] in" to see the interpreter from the waist up (Jeff, 12/10/2005). The screen size, in and of itself, could have been larger as the handheld's screen was only 3 ¼" x 2 ¼" and the ASL image was 1¾" x 1 ¼". It is important to remember that many Deaf individuals, like those individuals with Usher's Syndrome, also have low vision; two of the focus group members had low vision and one member in particular had difficulty viewing the handheld's images.

One way to incorporate the aforementioned suggestions of increasing screen size and greater captioning options might be a horizontal screen. A man from the first focus group, Sam, argued that with a landscape or horizontal screen, "you can use high definition and have an option of… QuickTime," and make its use more efficient with "4 lines of text sequencing instead of [a] linear [presentation]" (12/3/05). The idea that a horizontal handheld could have more options appealed to nearly all members of Sam's group after some debate, but less so to the following week's focus group because it wouldn't be as ergonomic and would seem more Gameboy-like. Some members felt that the horizontal versus vertical orientation could again be a matter of the user's personalization, depending on one's preferences, and perhaps another option they could choose from.

3.3 Issues with the Design of the Exhibition

While these particular focus groups did not focus on the *Star Wars* exhibit itself, some important comments arose about inconsistencies within the exhibit and how the handheld could play a role in addressing these problems. Once inside the exhibit, both focus groups experienced difficulty finding the R2D2 Tour stop signs. The signs were admittedly small, being only 2½" x 2½". People felt they had to do "a little bit of work" finding the signs and requested that they be "a little bit bigger," "a brighter color," and "let people know certain exhibits are not on the PDA" (12/10/05). When they entered the exhibit, many had expected some logical ordering of stops, but the "numbers weren't in any particular sequence" (Mark, 12/3/05). Many felt they had to work to find the MMT stops.

Visitors also expressed frustration at not understanding what was going on at the interpretation carts: “there was no sign [so] I didn’t know what it was about [and] I didn’t know how to participate” (Rebecca,12/3/05). The handheld might include information on those specific carts or general information on what those carts were.

Another contentious issue, in particular for the first focus group, was the Robot Theater exhibit. Many were surprised to find absolutely no captioning – they had assumed the Theater, like the rest of the exhibits, would have captioning. “I almost fell asleep a couple of times,” Ken said of the exhibit (12/10/2005). Suggestions were to have “possible uses of PDA in theater" (Mitt, 12/3/05) or “have a special light design for an interpreter.” One man suggested drawing inspiration from the Blue Man Group, in which they use a “red enhanced LED light at the lower end of the stage” to have captioning that is not distracting the rest of the audience during the show. Anything would have helped the experience” (Rebecca, 12/3/05). Another person said even having scripts and flashlights to follow along would have made the experience better.

3.4 Focus Group Suggestions for Marketing the Multimedia Tour

According to an the Antenna Audio site manager, an estimation of 100 Deaf individuals had taken advantage of the free Multimedia Tour according to Antenna Audio’s assistant manager; however, 18 of those individuals had come as part of our Deaf focus groups or Museum-related access feedback. Clearly, there is much room for growth in outreach to the Deaf community, especially with the Museum’s large investment in the ASL tour and dedication to serving diverse communities. There are an estimated one million people who are functionally Deaf (Mitchell, 2005), 421,000 people who are Deaf in both ears, and an estimated 22,255 individuals in Massachusetts who are unable to hear normal conversation (US Census Bureau as cited by Harrington, 2004).

Focus group members largely appreciated having the Tour and all believed there should be greater advertisement. None of them had known about the Tour prior to the focus groups. All agreed that the best way to tap into the community was through word of mouth. One man, Jeff, was on an advising board for a Deaf community organization and viewed himself as “an instrument” to tell people he knew (12/10/05). Another man, Mitt, suggested making flyers and passing them around Deaf community groups, as the flyers would exchange hands frequently and make their way through different groups (12/3/05). Other suggestions included taking the ASL Multimedia Tour to Deaf expos and giving out free Museum of Science passes to the Deaf community to create buzz. Both groups also thought the exhibit webpage should more clearly outline the fact that the ASL handheld was available and moreover, free to the Deaf community.

Both groups expressed the power of images in marketing. How an advertisement is presented has deep implications on the Deaf community because without seeing a captioning or interpretation symbol, Deaf individuals naturally assume it is not Deaf friendly. Even the

pairing of the headphones with the handhelds outside the *Star Wars* exhibit signified to many Deaf participants that it was not designed for them. All advertisements in the Globe, magazines and billboards should prominently feature symbols signifying exhibits being captioned with a handheld interpreted in ASL (see Figure 1). Moreover, the MMT's advertisement sign outside the exhibit should have interpretation and closed captioning signs. Unless visitors heard about the ASL Tour from a disability-related newsletter article that featured the exhibit's universal design, how reasonable it is to expect the general Deaf public to be knowledgeable about the handheld?

FIGURE 1 Open captioning and Interpreter Symbols

Finally, in advertising events and exhibits, it is important that we give plenty of advance notice of events or Deaf-friendly features. Mitt emphasized this point by saying "As a Deaf person, it takes me a much longer time to be able to get to a one-day sale" (12/3/05).

IV. DISCUSSION

Overall, the handheld Multimedia Tour is an honorable first step in including an important population. Similar to remedial evaluation findings (Tisdal, 2006), in which Tisdal followed one Deaf visitor and his hearing wife throughout the gallery, visitors felt much more comfortable and at ease having information in their own language. Many were very pleased that the ASL Multimedia Tour gave them access to information and seemed to enjoy the content. It was a welcoming symbol. Yet there is much room for improvement as this is a relatively new field and audience that museums are especially paying attention to. The focus groups provided many improvements for future handhelds, from design to advertising and the presentation of content information. More largely, however, the focus groups shed perspective on differences in the way Deaf persons perceive and experience the features of an exhibition as compared to hearing persons. These cultural differences arose for timing, differences in learning styles and preferences and norms for the Deaf and hearing.

4.1 Timing

I think [it's important to] emphasize we live in an iPod culture. [We] continually get [a] stream of information. [But] remember, we [Deaf people] live life in translation. It's a vague thing. (Mitt, 12/3/05).

From the focus group, we gained an understanding of the fundamental difference in timing – of living life in translation. Everything – from hearing about events broadcast via email, text message or radios—takes greater time for Deaf people to organize attending to than hearing people, in part due to translator availability and in part due to the fundamental nature of their culture where information always comes delayed. In contrast to our society's rapid changes in technology—of podcasts and Blackberries–which are only accelerating the pace at which we receive and expect information, this cultural shifting is not consistent for Deaf people.

To better grasp the "life in translation" timing concept, one focus group participant suggested handheld designers go around the entire exhibit watching the ASL tour to get a better sense of what the Deaf person's experience is like. In doing so, one would soon realize one would only be spending a considerable amount of time on the handheld for information – it was akin to a hearing person only having a scrolling text-only tour without any sound. In effect, if you look away, you missed information. Interestingly, Chris Tellis (2004) of Antenna Audio had originally advised against creating this situation when displaying an image; yet the generalizabilty of this situation is much wider than developers had imagined.

4.2 Differences in Learning Styles and Preferences

Because Deaf individuals are also often considered dependent learners, they need a lot of structure (Lang, Stinson, Kavanaugh, Liu & Basile, 1999). Furthermore, they prefer seeing many visuals. As a field, we can move forward better understanding these cultural differences

and preferences in learning styles by playing upon their strong visual orientation. As emphasized from the focus groups, Multimedia Tours should have plenty of imagery. There should be more video clips of artifacts in motion or in creation phases interspersed among the Tour. Taking the suggestions one step farther, perhaps there might even be an option to select additional information based on a visual representation of the gallery. One could learn more information by selecting highlighted artifacts, similar to Woodruff, Aoki, Hurst, & Szymanski's (2001) suggestions. Drawing from the formal education literature, animation could be used to illustrate concepts that are being communicated by using movement. While Antenna Audio's Proctor (2005) wrote that ASL tours should not be direct translation, it should be argued that the statement be extended further so that content and features are not direct translation. Truly different content needs to be integrated with additional features like animation and brief descriptions of each stop in or accompanying the MMT, helping structure learning and a decision whether or not to watch it.

4.3 Cultural Norms for the Deaf and the Hearing

Participants brought us into their world, where they frequently use Sidekicks or cellular devices that have keyboards, not T9 keypad configurations, and where they are so used to not having access to programs, events and things in their primary language that without interpretation symbols on the Multimedia Tour signs and advertisements, participants will not be aware of services tailored to them.

Many of the lessons that can be learned from this handheld revolve around understanding that a direct translation of even the hearing tour's design and other non-content related aspects to the ASL version of the tour ignores some of the important cultural differences.

In reflection, one of the original intentions of the institution was to provide a guide for Deaf in their own language, leveraging the video capabilities of the handheld. In many ways, our original assumptions were that providing a tour would be better than not and that we could provide a straightforward translation of the hearing Multimedia Tour. However, through the focus groups, we have realized the naivety of our assumptions.

Furthermore, upon reexamining the original goals of the MMT, it becomes apparent that two of the goals contradict one another. One the one hand, we were trying to provide Deaf users with access, but on the other hand, we were trying to provide a deeper level of knowledge. What's missing is an intermediary step – an introduction to the exhibit that provides basic information about the exhibition. By jumping right to the goal of providing in-depth information – and simply in the form of translation, we missed providing basic level information like those on exhibit labels.

4.4 Recommendations

In summary, from the focus group findings emerge a set of immediate recommendations to be taken by the project team and a set of design recommendations for future handhelds:

Immediate Recommendations

1. Prominently market the handheld with the ASL and closed captioning symbol and the exhibit with the open captioning symbol. This should become standard procedure in all qualified marketing materials. This includes newspaper advertisements, website features and the sign outside the exhibit. It should also include handing out flyers or e-mail postcards to local Deaf community groups as well as some complimentary tickets. The ASL Tour should also be featured at Deaf expositions.
2. Improve signage both inside and outside the exhibit. Create larger multimedia tour signs inside the exhibit, especially for those with low vision. Prominently place an ASL symbol on the Multimedia Tour advertisement outside of the exhibit and on the website.
3. Train Antenna staff on the front lines on how to work with blind and Deaf individuals and how to be more sensitive to their needs.

Design Recommendations to the Field

- Continue to prototype and employ focus groups with Deaf users (especially in the United States, for the Britain-based Antenna Audio) before making such handheld multimedia tours public so that the handheld's design, content and advertising can be better tailored to user needs and preferences. Had limited funds and time not been issues and the focus groups been conducted before the handheld's final production, many of these recommendations would have been incorporated into the current version of the ASL Tour.
- Implement an instructional ASL video at the Antenna front desk: "if no distribution staff know sign language, consider play[ing] a signed video at the distribution desk to instruct Deaf visitors in the use of the tour" (Proctor, 2002, p.5). These video could both be easily accessed again for individuals needing help on how to use the device and dually serve as an advertisement to the Deaf.
- Simulate going through the exhibit only using the ASL or text versions of tours to gain a better understanding of the timing effect. Also, include individuals who are Deaf in the planning process.
- Continue to display short messages with a greater emphasis on the visuals
- Contemplate ways the ASL MMT can allow for more interaction with the exhibit and the visitor's social group.
- Consider using animations and graphic organizers to present information.
- Have a larger interpreter image, focusing on the waist up
- Experiment with more text captioning options, including the ability to read larger chunks at a time
- Create a small pamphlet with an outline of each stop's content.

Knowing what we know now, if we re-imagined what an ASL Multimedia Tour would look like today, it would still provide background information on the artifacts and have Behind the Scenes information. However, the handheld would be based on a Blackberry type device with a keypad or connect to a computer with a keyboard. It might take a step back and have some translation of label text and interpretation of exhibit components; it might even encourage greater interaction and thought by posing questions for consideration. This handheld might

also show the artifacts in the exhibition in motion and creation. In addition to visually displaying the artifact briefly on the screen, it might visually represent what was being said. Users could quickly reference an outline of content information to pick and choose from, either on the handheld or for a pamphlet.

In a sense, it seems ironic that the Deaf users at times almost preferred reading a text blurb at times than use the handheld. This request, however, does not underscore the importance of receiving information in one's own language and the comfortable, welcoming setting it creates. Rather, the request for a text blurb highlights the importance of not being attached to the handheld, and having the freedom to reference each stop. Such guidebooks would essentially serve as graphical organizers of the handheld's information -- a method that has been touted as an effective method to teach the Deaf (Lang & Steely, 2003; Lang et al., 1999).

One might also question placing more graphics and animation into the handheld. It might be perceived as pulling individuals further away from the exhibit experience and feel even more divisive. Yet it is interesting that the ASL tours and the hearing Multimedia Tours provide the same photographic and film clip content, yet the level of visual stimulation was not satisfactory to Deaf users. This difference could be due to the fact that since ASL Tour users are only going to be receiving information from the handheld through sight anyway, they are committed to looking at it unlike hearing users who have the ability to walk around listening to the handheld while still getting visual stimulation. Until the day ASL or multilingual screens are built into exhibits, the handheld might be dressed up to have more forms of stimulation.

It is a common fear amongst museum professionals that handhelds will pull the user out of his or her social experience with his/her group and from the focus group findings, this was found among some focus group participants and in Tisdal's (2005) case study. Drawing from the field of science learning among the Deaf population, future ASL MMT should prompt questions to allow for creative thinking and social interaction. This might also promote greater learning (Dowaliby and Lang, 1999). Future research should explore options such as syncing, instant messaging and polling that allow users to interact through the machine and opportunities to have conversations.

V. CONCLUSION

It should be noted that while the handheld ASL Multimedia Tour was valued in many regards, having a Tour with or without ASL capabilities was not absolutely necessary in a rich, hands-on, heavily multimedia-based exhibit. It was a high cost and low impact project without which, realistically speaking, Deaf visitors still could have navigated throughout the exhibition fine. As we saw in some of the focus groups, some individuals chose not to use it. This might be due to some of the same reasons hearing visitors did not also use it – for example, because the content was repetitive or the design was not conducive to their preferences (Chin & Reich, forthcoming).

However, for many, the Tour provided an invaluable experience by giving access to information in a more easily understood method. As a science museum, it is still important to provide outreach and to welcome the Deaf community through technology, communicating an important message: "*You have a place here*." Now that we have started, there is no turning back. Handheld tours are further important for the wealth of information they could provide in basic and advanced levels and extending learning at home with bookmarking capabilities. With better design and perhaps some different content, it could provide even more value to a Deaf visitor. This project has been an opportunity to continue building upon existing knowledge on how to effectively design ASL Multimedia Tours and has allowed us to extend beyond the basic understanding to taking future Tours to a new level.

As technology continues to change and as it becomes easier to incorporate ASL into video-based technologies, museums and other cultural institutions should think about ways of providing Deaf individuals access learning in their primary language. As many focus group participants said themselves, with such handhelds, the Museum itself could potentially be looking at another source of revenue – the Deaf community would be more likely to feel welcome and visit the Museum of Science if handhelds were prevalent and well advertised. Perhaps the future will bring video ASL podcasts where one day, Deaf visitors can come to the Museum either with their own iPod or a handheld and download tours of the Museum to view in a visual way. Or more radically, handhelds could draw upon forthcoming technologies like screens that are flexible and can expand or My-Vu glasses that simulate watching 20" plus virtual screens. If museums, themselves, cannot acquire resources to do so, they should find ways to work in partnership with local Deaf organizations or companies to ensure that Deaf individuals have the opportunity to learn in their primary language at our cultural institutions. The Deaf are an important audience we should and can reach much more easily through the advancement of technologies.

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VII. APPENDICES

ASL FOCUS GROUP (12/3, 12/10)

Thanks for coming to see the *Star Wars: Where Science Meets Imagination* exhibit and to give feedback about our ASL Multimedia Tour. Here is today's schedule:

10AM VISITOR ARRIVAL

- Sign-in, get visitor sticker
- Get parking validation.
- Get: schedule, map in case you become separated from group, and free admission tickets to Star Wars.

10:15AM STAR WARS EXHIBIT

- As a group, walk to exhibit. Get ASL Multimedia Tour outside exhibit. This is the first time we're using the ASL Tour!
- Spend up to 90 minutes visiting the exhibit. Explore the exhibit as you normally would. If you finish earlier, you can leave the exhibit and explore other parts of the Museum – but you cannot re-enter the Star Wars exhibit. If you need to go to the bathroom, ask staff for a pass.

11:45AM MEET IN LOBBY.

- Regroup and head to Test Tube, Blue Wing 2nd floor.

12PM BEGIN FOCUS GROUP ON ASL-MULTIMEDIA TOUR

in Test Tube, Blue Wing 2nd floor, next to the Butterfly Garden

- Tell us your thoughts on the Tour – what did you like? What didn't you like? We'll ask you several questions.
- Today's **interpreters** are: Mr. Chris Robinson & Ms. Aimee Schiffman

1PM THANK YOU!

- Receive free admission passes to the exhibit hall (*Note: You may use your exhibit hall pass for up to a year. You can get in to the exhibit halls free today with the visitor sticker.)

If you have any questions, please contact Elissa Chin (echin@mos.org), Sr. Research/Evaluation Assistant, or Christine Reich (creich@mos.org), Manager of Informal Education Research/Evaluation. Our TTY phone numbers are: (617)589-0480

Star Wars ASL Multimedia Tour Survey

Gender: M F
Age:

On a scale from 1 to 10, how interested are you in learning about science and technology?

1	2	3	4	5	6	7	8	9	10
Not at all interested									Very interested

On a scale from 1 to 10, how much of a Star Wars fan are you?

1	2	3	4	5	6	7	8	9	10
Not a fan at all									A very big fan

What percentage of time did you spend using the Multimedia Tour when in the Star Wars exhibit?

- ❑ 25% or less
- ❑ 26-50%
- ❑ 51-75%
- ❑ 76-100%

How often do you visit museums?

- ❑ Multiple times a year
- ❑ Once a year
- ❑ Once every couple years
- ❑ Rarely
- ❑ Never

What are your impressions of the Museum of Science as a welcoming place for Deaf visitors?

Do you have any other comments you'd like to add?

Deaf Focus Group Protocol

Welcome Key Points

- We are from the Research/Evaluation Department, what we do, introduction of team, interpreters
- Commitment to universal design - SW evaluation
- This is the first time the Museum of Science has ever used an ASL-Multimedia Tour. We didn't design it, can't fix it right away, but want to inform future designs.
- Focus group background – one person speaks at a time (to record things), honest conversation – so both positive and negative comments, would love to hear from everyone.
- (Quickly introduce focus group members, favorite part of the exhibits)

Questions:

About the Exhibit

- Overall impressions of exhibit

About the Multimedia Tour

1. Tell me what you think overall about the Multimedia Tour.

- Like most about Tour?
- Like least?
- What learned didn't know before from Tour?

2. Coming into the exhibition, what were your expectations of the Multimedia Tour?

- Expectations of Tour
    - Features
    - Content
    - Interface
    - Overall Value
- Meet or not meet expectations?

3. If you didn't have the Multimedia Tour, how do you think your experience in the exhibit would be different, if at all?

- Artifacts
- Interactives
- Content
- Welcoming atmosphere at exhibit overall?
    - Enjoyment level
    - Learning level
- Staff
- Social interactions – positive vs. negative ways?
    - Nature
        - Coming by self vs. with friends
    - Quality (depth)
    - Frequency
- Bookmarked information
    - Everyone know about feature?
    - Kinds of information bookmarked

        - Frequency of bookmarks
    - Expectations of info sent home
        - Forms/Media
        - Depth
    - Decisions not to bookmark information
    - Continue to learn about technologies
- What do you think your experience would have been like without the Multimedia Tour? Tell me how you imagine that experience to be like.

4. What would you change about the ASL Multimedia Tour?

- Problems/difficulties faced
    - Ease of finding Multimedia Tour stops
    - Interface
- Improvements for future exhibitions
- Usage in rest of the museum, other exhibits
    - What content want

5. *What can we do to make the Museum of Science a more welcome place for Deaf people?*

- How should we be marketing the Tour to the Deaf Community?
- How would the Deaf community respond to the Museum of Science having an ASL Tour?
- Have you used a similar tour in other museums or places before? Were they equipped with ASL? Designed for Deaf people? Tell us about your experiences.

6. I have some questions about your experience overall in the exhibit.

- Role of crowding
- Magnitude/Role of Tour in exhibit experience
- Additional comments?

Observation Guidelines

As Deaf visitors come to try out the Multimedia Tour, it's important that we capture any information that will be helpful to guiding our focus group questions and our interpretation of the data. Overall, we are interested in observing how the Tour weaves into their experience at the exhibit.

Your role, as an observer, is to discreetly record points of interest in visitor behavior. As an outside observer, your contact with the participants should be minimized. You can answer questions. Take notes on interesting behaviors with your interpretations of the events. Your notes will help formulate last minute questions & areas of interest. They'll also help to interpret the data, but your notes themselves aren't going to become forms of data. This means your notes don't need to be incredibly detailed - but more general, capturing your interpretations and what interesting types of behaviors you saw.

The following questions should help guide your observations:

Behaviors

- What do you notice about their interactions with the exhibit? With their friends/peers? With other visitors? With staff? With interpreters?
    - Frequency of interaction
    - Quality (depth) of interaction
- Perceived enjoyment level? Flow?
- Usage level of Tour? Long/short time spent?
    - interactives
    - artifacts
    - video based exhibits

Problems

- What are some common problems they encountered with the Tour?
    - Interface
    - Typing in information to bookmarks
    - Problems with locating the Multimedia stops
- What questions did they ask others (e.g., to interpreters, each other, MoS staff)?

Reflection

- How are their interactions different from non-Deaf Tour users?
- How does crowding affect their experience, if at all?

Questions?

What questions arise during your observation that we could ask during the focus group?