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The Neil A. Armstrong Library and Archives: That's One Small Step for a Virtual World Library, One Giant Leap for Education![1]

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Abstract

Migration of library services has moved increasingly toward 2D web services and social interactivity and 3D virtual reference services. Patron satisfaction with reference services is a key tenant for determining a successful reference interaction. The study examines the roles of user identity, educational learning modalities, institutional sustainability, and credibility in achieving overall user satisfaction in reference social interactions within NASA JPL's STEM education-focused library and other more generalized libraries within the virtual world Second Life.

Keywords: Education, Library, Virtual Worlds

[1] Revised and updated from the Virtual Worlds Best Practices in Education Conference, 2010

The Neil A. Armstrong Library and Archives: That's One Small Step for a Virtual World Library, One Giant Leap for Education!

What is education without the library? Libraries are strategically positioned at the geographic center of college campuses for good reason. They represent the primary access point for students to obtain materials to meet their information needs and serve as social meeting places and centers for informal learning. Some would argue that during the Information Age the library has been gradually migrating from the 'bricks and mortar' model of the 19th and 20th centuries to a borderless, networked, digital nexus. The wired campus provides students access to specialized online databases, scanned archival documents, and digitized books. Rather than students going to the library, the library has gone to the students. Whether through automated delivery of interlibrary loan articles or student email accounts, digitized course reserve materials or lectures downloadable to hard drives or I-pods, individualized RSS feeds for new articles on specific subject topics or new uses of social media to reach students, the library and its educational services has gone digital. To some degree, the library has now gone virtual as well. Perhaps the best example of the virtual library is the library project, the Library and Archives at NASA CoLab in Second Life. The Library is the first and only library or archive in a synthetic virtual environment recognized by the Library of Congress. Collaborative efforts have been interdisciplinary in nature, involving stakeholders in academia, business, and government. As academia moves toward greater integration with industry, partnerships with science, technology, and engineering academic faculty and students to government agencies like NASA are increasingly important. This project is an innovative use of virtual worlds as an example of best practices through bridging education to industry/government via virtual world technology.

Figure 1. Virtual Doppelgänger (Photo Credit: Haplo Eberhart)

The introductory photo shows the somewhat awkward juxtaposition of an avatar in a first life scenario. It is a visual reminder that our avatars are not ourselves, but "virtual doppelgängers." While many people feel their avatars are true extensions of themselves, there exists a dichotomy between our perception and others' perceptions of the "self" and "other." I learned (after consultation with an attorney) that this difference is accentuated under the law. Avatars are neither recognized as legal entities nor as extensions of an individual. Liable or slander of an avatar's name, for example, does not constitute liable or slander in the "real" world against the individual whom the avatar represents.[2] Perhaps this is a problem with the law. Perhaps avatar names are in fact aliases. In any case, this brings to mind the question of how people as learners interact with the world, how the world perceives them, and how learning occurs within associated contexts and communities. In the 20th-century, Heidegger believed that "we can never...bring ourselves before ourselves as objects. That is, we can never conceptualize or objectify ourselves, see ourselves either from the outside or from the inside out."[3] Yet, in the 21st-century, when existing and learning as avatars, people do just that. They create a digital version of themselves either how they perceive themselves or how they wish others to perceive

[2] Attorneys may differ in their opinions.
[3] Ed. Groden,M., Kreiswirth,M., Szeman, I. "Heidegger, Martin." *Johns Hopkins Guide to Literary Theory and Criticism*. Baltimore: Johns Hopkins UP, 2005.

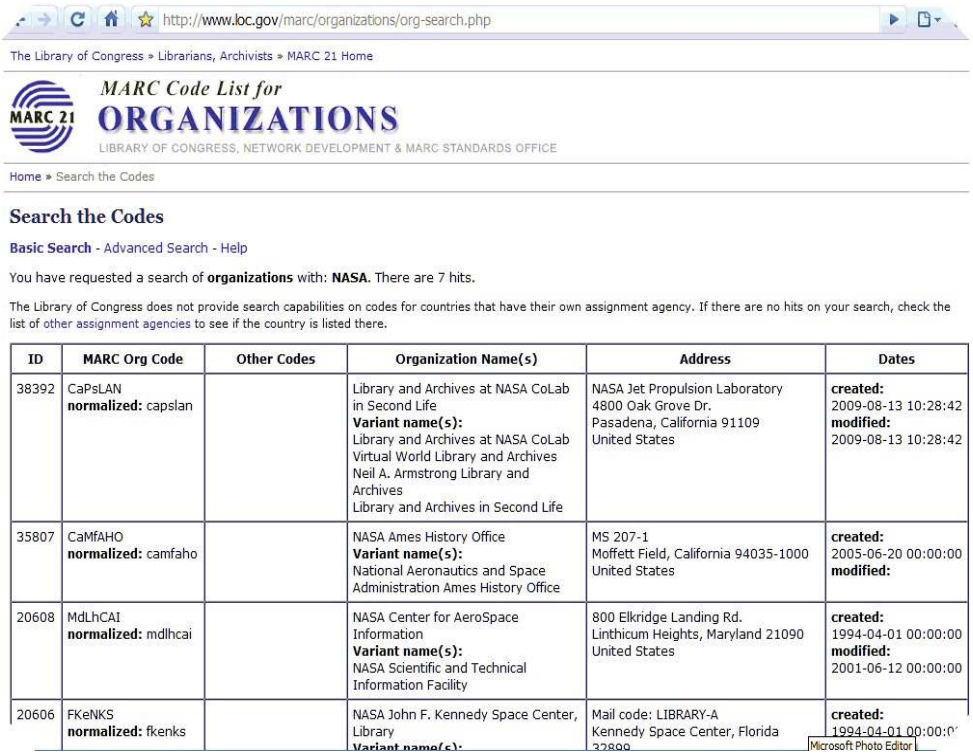
them. In Second Life, avatars find their virtual selves, as themselves objectified. In doing so, they are enabled to watch their behaviors from without in 360 degrees of latitude. Without "real-life" cues such as facial features and, in many cases, vocal intonations, viewpoints become amplified, and therefore virtual worlds are good examples where decision making and responses to psychological stressors can be tested by others. Virtual worlds can also help measure responses to change and the ability to adapt to different and unfamiliar circumstances. The military, for example, uses virtual worlds for training scenarios to measure and improve both of these types of responses to heighten situational awareness. Employers can use virtual worlds to train or improve their employees' skills for personal interaction with a diverse, global consumer base. Additionally, people establish a sphere of familiarity, and when moving in and out of that sphere into different communities—whether virtually or in the "real" world—tension is created that can have social consequences relevant for learning. In such an amplified scenario, it may become possible for the individual learner, via virtual self-objectification, to gain self-actualization and achieve self-improvement. They do this by understanding the limitations of their own ability to cope with stress, to form relationships, to deal with change in a constructive manner, to perform new functions in role play and to coexist in a localized virtual social community and among different social virtual communities, just as they do in their "real life." Experiencing a virtual world can ideally bring about a greater awareness of one's influence on others and one's ability to successfully interact in (or withdraw from) the different cultures and communities they encounter. So too could it reveal hierarchies within those social communities to better understand the formation of power dynamics.

What then is the role of the library in helping learners in this virtual construct? How can the library and its staff achieve the same library and educational standards in a virtual world it does in the "brick and mortar" world? That is what this talk addresses, using the Neil A. Armstrong Library and Archives as a case scenario, citing some of its patron reference questions, as well as integrating the results and feedback from an informal survey.

In examining identity, the identity of virtual institutions as well as those of the individuals in virtual worlds (whether volunteers, employees, patrons, students, clients, or customers) comes under scrutiny. Oftentimes, lack of institutional buy-in from the "brick-and-mortar" versions of virtual world iterations becomes an obstacle for entry as well as sustainability of virtual world presence. NASA is fortunate to be a leader in innovation and

technology. It is not surprising, though, that even at NASA, delivering "real world" applications and acknowledgements are necessary for institutional funding and sustainability.

Figure 2. 2010 Linden Prize Finalist video filmed by Treet TV featured in the NASA Buzz Room (Source: http://buzzroom.nasa.gov/multimedia/videos/199/)



ID	MARC Org Code	Other Codes	Organization Name(s)	Address	Dates
38392	CaPsLAN **normalized:** capslan		Library and Archives at NASA CoLab in Second Life **Variant name(s):** Library and Archives at NASA CoLab Virtual World Library and Archives Neil A. Armstrong Library and Archives Library and Archives in Second Life	NASA Jet Propulsion Laboratory 4800 Oak Grove Dr. Pasadena, California 91109 United States	**created:** 2009-08-13 10:28:42 **modified:** 2009-08-13 10:28:42
35807	CaMfAHO **normalized:** camfaho		NASA Ames History Office **Variant name(s):** National Aeronautics and Space Administration Ames History Office	MS 207-1 Moffett Field, California 94035-1000 United States	**created:** 2005-06-20 00:00:00 **modified:**
20608	MdLhCAI **normalized:** mdlhcai		NASA Center for AeroSpace Information **Variant name(s):** NASA Scientific and Technical Information Facility	800 Elkridge Landing Rd. Linthicum Heights, Maryland 21090 United States	**created:** 1994-04-01 00:00:00 **modified:** 2001-06-12 00:00:00
20606	FKeNKS **normalized:** fkenks		NASA John F. Kennedy Space Center, Library **Variant name(s):**	Mail code: LIBRARY-A Kennedy Space Center, Florida 32899	**created:** 1994-04-01 00:00:0

Figure 3. Library of Congress Listing

Therefore, I applied to the Library of Congress for recognition of the Neil A. Armstrong Library and Archives at NASA JPL/Caltech. The application was accepted the library is the first and only virtual world library or archive to gain such recognition to date. In the Library of Congress screen capture, it is listed on equal footing with the "brick-and-mortar" libraries at NASA. Just as important as formal recognition as a "real" library has been the ability to migrate "real world" experiences into a virtual world environment. In every instance I have tried to implement best library and archival practices as I would have in a non-virtual environment. In the library, I posted a photo of my experience at NASA Glenn Research Center library and archives in my "first life" to help establish trust in me as a professional librarian by potential patrons. So too do I say in my profile that I am a credentialed librarian. As the Director, I participate in professional activities, such as presenting at "real world", "virtual world", and mixed reality events, publishing, and posting to professional listservs about the virtual library to promote its use and acceptance in the professional community. My avatar brings with her my "real life" experiences in education, both in learning and teaching.

Educators are the first to realize that the ability to question is the foundation of learning. The NASA library is a subject specific library, and in that definition it strives to assist others to learn about NASA and its objectives in science, technology, engineering and mathematics (STEM).

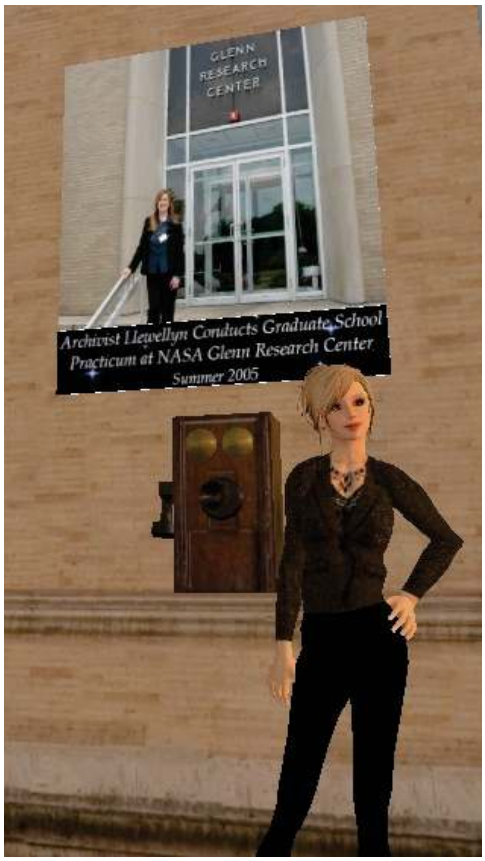


Figure 4. The Author in Real Life and Second Life

The tangible value of the library revolves around access to materials, but its "intangible" value is perhaps more worthwhile; it is a place to stimulate interest and curiosity. To paraphrase Dr. Watson, with whom I worked as his archivist at Cold Spring Harbor Laboratory, teaching and learning science means asking the big questions. For him it was Schrödinger's question, "What is Life?" and Darwin's question, "How did life evolve?" He explained both, for which he won the Nobel Prize. How do we inspire students to think about and approach the big scientific questions like he did that still lay ahead, like "Where in the universe can life be found?"

Figure 5. James D. Watson with the Author at the Cold Spring Harbor Laboratory Library and Archives

Preservation and access to historical archival materials and published materials that encourage discovery, explain the scientific process, and allow personal engagement with NASA personnel and volunteers are the main functional goals of the library. Preservation of digitized and "born digital" scientific archival material is the subject of much discussion in the profession and is a concern in the scientific community. That is not to say that accomplishing these things is easy in a virtual library, or in a "brick-and-mortar" library for that matter and is a subject upon which I lectured at an international history of science conference Oxford.[4] These questions are "leading edge," and applicability of best practices in a virtual world is very close—if not on—the "bleeding edge" of library and archival science.

The theory of Multiple Intelligences came about in 1983 with the publication of Howard E. Gardner's *Frames of Mind*, wherein it was recognized that intelligence is not limited to IQ. Gardner categorizes learning modalities (intelligences), as Linguistic, Musical, Logical-Mathematical, Spatial, and Bodily-kinethestic. By design, the library attempts to facilitate different learning modalities.[5] For example, students love to touch the protein molecule on

[4] Bohle, S.. "Science Archives and History: Facilitating Discovery through Laboratory Notebooks" given at the Sixth Three Societies Conference: Connecting disciplines; University of Oxford, UK; 4-6 July 2008.
[5] Gardner, Howard E. *Frames of Mind*. NY: Basic Books, 1983.

display. They can listen to podcasts and short audio recordings of a Tuskegee Airman and Neil Armstrong.[6]

Figure 6. Students and their professor visiting the library

One goal of a science library is to establish and maintain the trust and respect of patrons by establishing subject matter expertise achieved in a virtual world. Visibility and publications in the "real world" science community such as science educators, researchers, and students is paramount for trust and respect. The library displays are based on real science and real data. The protein p53 is a tumor suppressor. The original idea of the p53 molecule, for example, came from my experience writing a grant proposal at Cold Spring Harbor Laboratory (a National Cancer Institute Research Center) on 3d visualization of DNA and protein structures. I am pleased to announce that my article, "Studying the Causes of Cancer Creating the First 3d Model of p53 in a Synthetic Immersive Environment" about the p53 model on display is published on

[6] Preston Pugh. Personal interview, Lima Public Library, 2009.

the Nature website.[7] In dualistic fashion, I must also appeal to the library and archival communities by writing for such publications as *The Metropolitan Archivist*.[8]

Figure 7. Nature Article (Source: http://blogs.nature.com/ub51cd45e/2010/03/12/studying-the-causes-of-cancer-creating-the-first-3d-model-of-p53-in-a-synthetic-immersive-environmen)

[7] Bohle, S.. "Studying the Causes of Cancer Creating the First 3d Model of p53 in a Synthetic Immersive Environment." *Nature*. http://blogs.nature.com/ub51cd45e/2010/03/12/studying-the-causes-of-cancer-creating-the-first-3d-model-of-p53-in-a-synthetic-immersive-environmen. 12 March 2010.

[8] Bohle, S.. "The Library and Archives at NASA CoLab in Second Life: A Virtual Co(-l)laboratory" http://www.nycarchivists.org/metro/2010_1.pdf. *The Metropolitan Archivist*. Winter 2010, p. 7-8.

Figure 8. Cover story appearing in the *Metropolitan Archivist* (Source: http://www.nycarchivists.org/metro/2010_1.pdf)

Just like good students, a good reference librarian never loses the ability to ask great questions. When Mark Sykes was on *Science Friday* here in Second Life, I could not help but ask a question related to NASA's new policies, "In terms of lunar exploration, what about other countries, and what does this mean for geopolitics?"[9] Taking it one step farther, I pursue a similar question during an interactive webcast, asking, "How will the 'New NASA Plan' handle international cooperation and make changes to ITAR (International Traffic in Arms Regulations)?" The four minute reply was from Bill Nye "The Science Guy" and Louis Friedman.[10] As a librarian and former journalist, I have learned to approach people, speak up, and not to back down when asking uncomfortable questions, as well as to support Freedom of Information and an open and transparent government. That applies to a virtual, web-based or

[9] Science Friday. "Rethinking the Human Future in Space." *National Public Radio*. http://www.npr.org/templates/story/story.php?storyId=120613250&ps=rs. 20 November 2009.
[10] Nye, B., Friedman, L. "The New NASA Plan." *The Planetary Society*. http://www.ustream.tv/recorded/4822238. 18 February 2010.

face-to-face interaction. So too did I participate in answering journalists' questions such as those asked for a CNN article.[11]

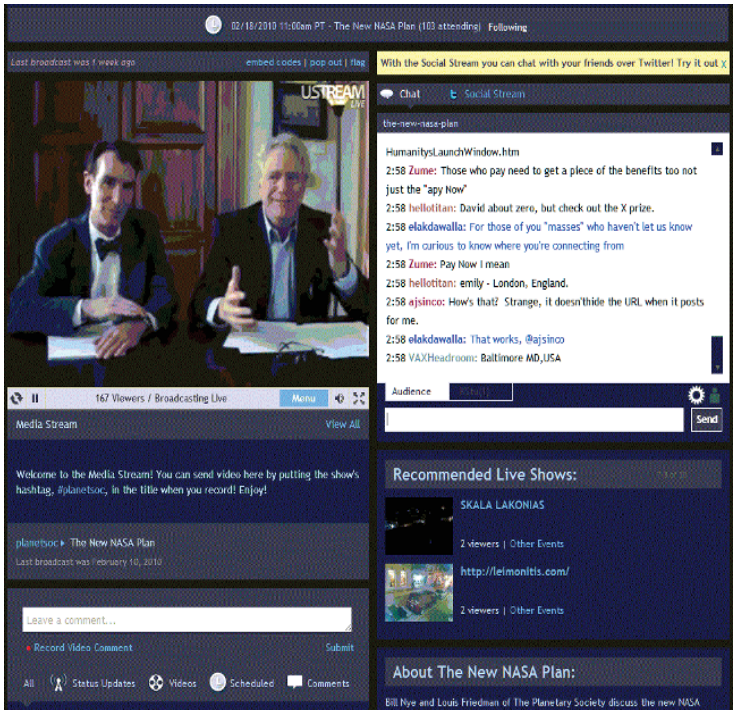


Figure 9. Bill Nye and Lois Friedman Discuss the New NASA Plan (Source: http://www.ustream.tv/recorded/4822238)

As a virtual librarian, I often refer patrons to web sources. I don't consider myself, as one survey respondent stated, a "Google Helper." The respondent stated that the role of the virtual librarian appears limited to assisting people in navigating to a web page and that without database access can't perform well. Perhaps a consortia of virtual libraries will one day purchase access to subscription databases. It is not a bad idea. But I would hardly call a good reference librarian a "Google Helper." For one thing, librarians know a wealth of information about evaluating resources. Directing patrons to the right resources means not just knowing how to manipulate a search tool, but becoming instinctively familiar with the right resource for the right job. They need to know how to evaluate new resources in terms of their reliability, their applicability, and their suitability for the question and purpose at hand, and they need to teach these skills during the reference interview through information literacy.

[11] Eradicator. "The Next Giant Leap." CNN. http://ireport.cnn.com/docs/DOC-301402. 20 July 2009.

One of the great things about being a virtual world librarian is the ability to IM or talk to subject experts in the science community and ask questions on behalf of patrons, or to invite the expert to meet with the patron directly. Going to the source sometimes is not a web page or a virtual book, but connecting with a person. With complex scientific reference questions, I have occasionally requested the help of subject experts, like Dr. Mather, and scientists and science educators inworld.[12]

Figure 10. The author and avatar of John Mather, Nobel laureate in physics, in Second Life

In many ways the library and archives is a celebration of and preservation of the past. Archives are often consulted in "brick and mortar settings" to prepare for celebrations like the

[12] Bohle, S.. "Can results from Planck prove inflation paradigm?" *The Nobel Prize Foundation*. http://www.youtube.com/watch?v=aN9uaAEXnbY. 13 November 2009. Additional questions filmed at the library were asked of Nobel laureates Albert Fert ([the author]. "Are zeolite crystals grown in space viable for nanotechnology?" *The Nobel Prize Foundation*. http://www.youtube.com/watch?v=uek8-TapUPs. 13 April 2010" and David Gross ([the author]. "At the LHC, why collide lead ions instead of some other element?" *The Nobel Prize Foundation* http://www.youtube.com/watch?v=d4tbDBgX0HU. 25 June 2010, and [the author]. "Could you explain 'compactification' commonalities in string folding and protein folding?" http://www.youtube.com/watch?v=BLJ88MQ-6ak. 25 June 2010).

40th Anniversary of the Apollo 11 moon landing. The Archive also supports the role of NASA CoLab to inspire future generations through role play, by providing virtual world shuttle suits and a working space shuttle model so visitors can experience being on board during a virtual shuttle launch and space trip.

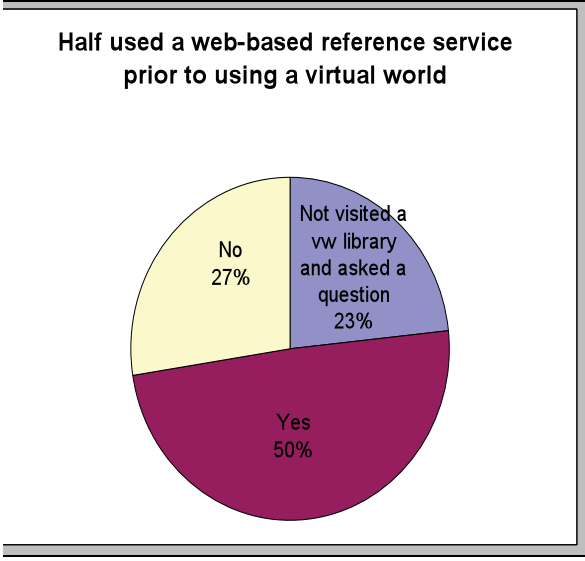
The future of education is now. Using virtual worlds and virtual world libraries for science education is no longer science fiction but science fact. There is a lot of work to be done to get the message out about the educational value of virtual world libraries and archives to both fellow professionals and the general public. NASA CoLab in Second Life is a place to network with NASA volunteers, employees, and contractors about the NASA work environment and the skills needed to work at NASA. In the Library visitors can find links to some "little known" resources to finding a job, grant, and contractor position with NASA. The Library also makes use of Web 2.0 applications like RSS feeds, Twitter, and Flickr groups.[13] A quick rundown of the archival and subject specific library holdings after about 1.5 years of operation shows that there are: over 200 aeronautics and astronautics archival items, 5 years of unique, "born virtual" NASA meeting transcripts, donations, 15 full-text NASA digitized books (some over 300 pages long), 1 technical report, 1 serial publication (*NASA News & Notes*), 2 educator guides, and 12 reference desk pathfinders.[14] As time goes by, more books, serials, and archival materials will be added. Presently, I am working on establishing at the library an archival finding guide and a Fedora OAI-compliant content management system to archive virtual world materials, both of which will be delegated to volunteers.

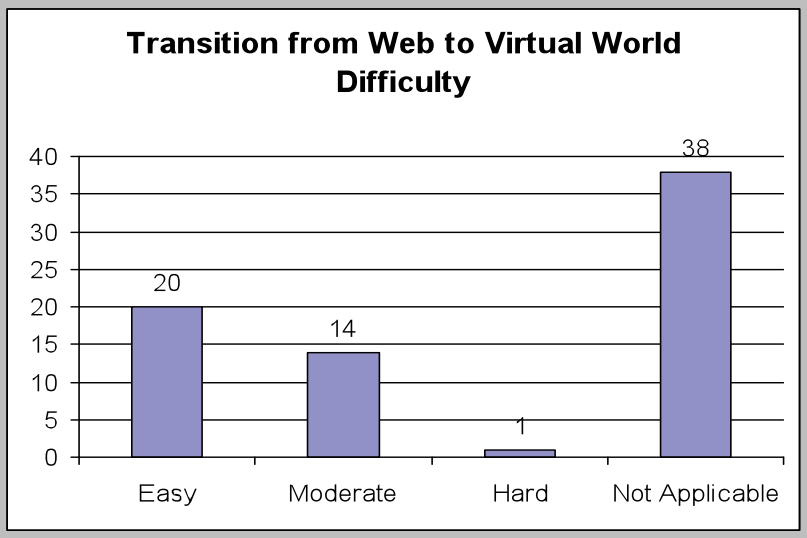
[13] RSS feeds include: "NASA Breaking News," "Current Space Shuttle Mission Updates," and "Hubblecast." Some of the Twitter links are grouped into the following categories: "Current Astronauts," "Former Astronauts," "International Astronauts," NASA Centers," and "CoLabLibrary." With 215 members and 1,211 items, the most successful new Flickr group I started was called "Apollo 40th Anniversary Celebrations Around the World"

[14] Most of the full-text books are made by the Library Assistant, Charlie Navarathna. Pathfinders include: "NASA Digital Collections," "NASA Archives," "NASA Technical Data," "NASA Libraries," "Tuskegee Airmen," "NASA," "NASA CoLab," "Space Medicine," "Women," "SL Science Places and Events," "Libraries, Archives, Museums," and "Search SL."

Survey Results

igure 11. For tech savvy library patrons, the learning curve is not excessive. Only 1 out of 36 respondents who said ney made the transition from web-based reference service to virtual world reference service thought it was hard.





> ***"I don't really see it as a transition. Virtual reference in Second Life and other 'chat reference' services are just other options for finding information in addition to "live" reference at a real world library reference desk," one respondent stated.***

Those who presently use "Ask a Librarian" or similar service might be the group of individuals for targeted marketing of virtual world reference services. "Ask a Librarian" patrons are good candidates to lead into the virtual world, but because that is the case, they will compare the two services' ease of use. One patron commented on the ability, once in a virtual world, to locate the library for the assistance they required, "This difficulty in way finding exists throughout Second Life (and I understand most existing virtual worlds), compared to the now standard 'Ask a Librarian' or simply 'Ask' buttons, on library web pages." This suggests that libraries with virtual world libraries might add similar links or buttons leading to their virtual world presence to their websites adjacent to the web-based service, along with their staffed service hours.

Comparison of Informal Attrition Rates for Web and Virtual World Library Patrons

Number of Visits	Virtual World	Web	
1-4	20	15	
5-8	1	8	
9-12	3	1	
13+	11	14	
SUBTOTAL	**35**	**38**	**73**
N/A	38	35	
TOTAL	**73**	**73**	

Looking at the number of visits, it is possible to informally determine attrition rates. If a patron tried the service, that is *participation*. If they returned, that is *retention*. If they did not return, that is *attrition*. To do the calculation, I first, determined the number of respondents who used a virtual or web reference service one or more times by adding them to determine the total number of people who participated in each category. Second, I calculated the total number of web AND virtual world participants who asked reference questions (that is, excluding those replying "Not Applicable", which is 73). Some overlap of web and virtual questions by the same patron occurred. Next, I subtracted the number in each category from the total of 73 and that leaves how many respondents did ***not*** return for subsequent service. For "Virtual World" that was 38 and for "Web" it was 35. By dividing each of these by the participant total number of 73 and then multiplying by 100, the attrition rate was derived.

Virtual World	20+1+3+11=35	73-35=38	38/73=.5205	.5205*100=**52%**
Web	15+8+1+14=38	73-38=35	35/73= .4795	.4795*100=**48%**

Figure 12. The reduced ratio of informal attrition rates, Virtual World to Web was about 13:12.

So, patrons try the service and don't find it terribly difficult to adjust, but will they be satisfied enough to return again and again? Virtual world reference services showed a very similar attrition rate as those seen for web-based reference services. Yet, because virtual world reference services are newer technologies with time to develop, improvements in virtual world delivery methodologies such as follow-up, group joining, automated delivery of announcements

via subscriptions, expansion of service delivery audience, and improved and expanded reference services appear to hold the possibility to engage and retain more patrons than the web-based service model.

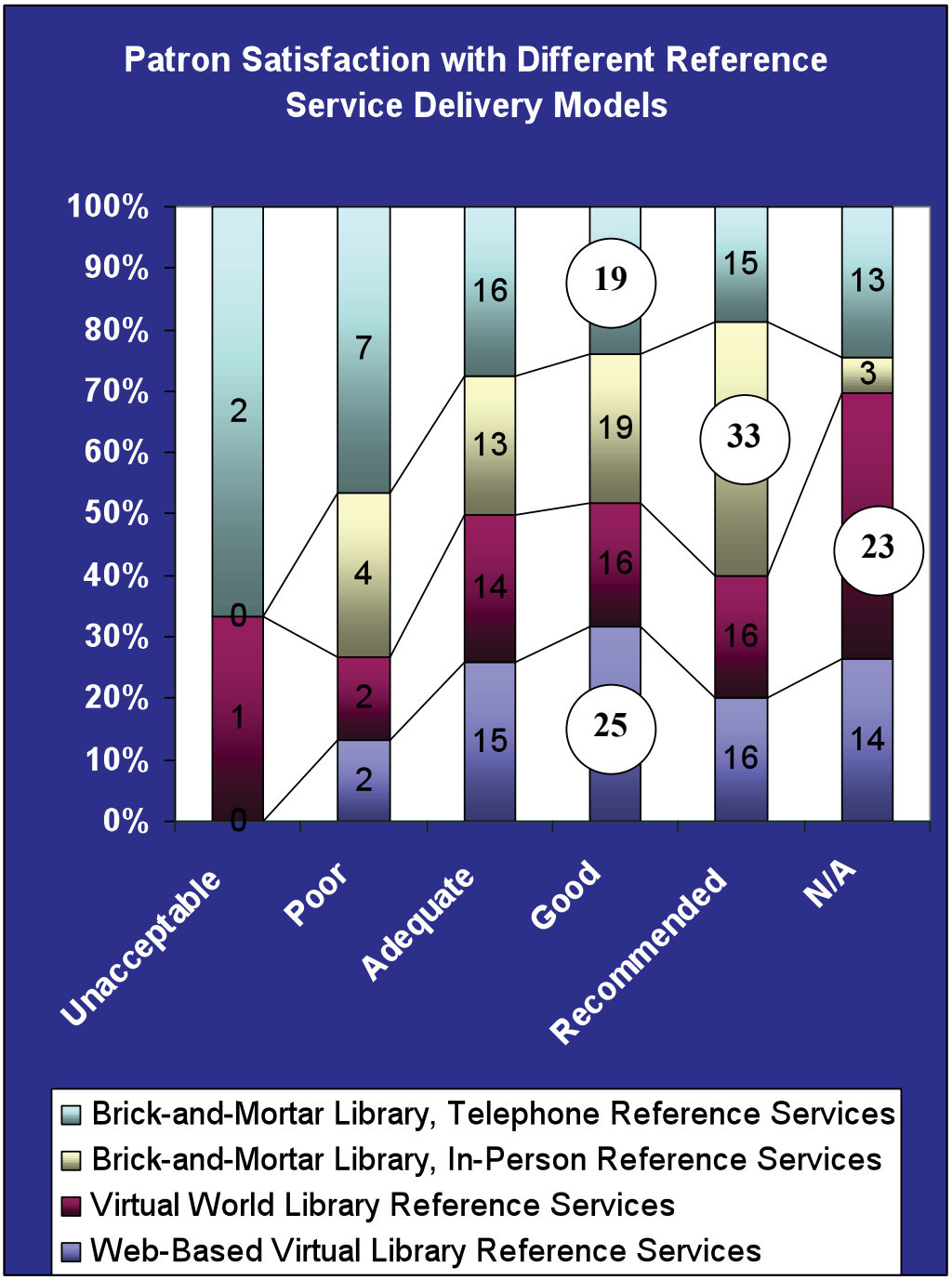


Figure 13. The traditional Brick-and-Mortar, In-Person service delivery model remains the most satisfying to patrons and should be emulated in virtual worlds.

So, which model emerges as the most successful? The survey's quantitative findings and 57 qualitative comments revealed a high level of satisfaction with certain aspects of the Brick-and-Mortar, In-Person model which might be carried into the virtual world to improve service quality and retention rates. For example, the qualitative feedback comments suggested that virtual face-to-face scenarios should heighten and enhance discussion and personalization: "For my purposes, discussion is normally required, so in person with a librarian is great," one patron said. "Virtual world reference was more direct with the person visible and doing things with people in front of me and the chat was more active, greater sense of presence," commented another. Another respondent wrote, "In order to be more than just a 'Google Helper', virtual reference needs to make use of deep web resources." Expanding services through greater access to informational resources from inside a virtual world such as the same subscription databases and publications offered at the "brick and mortar library" could improve retention. This could be achieved with links to subscription services from inside the virtual world, where a user ID and authentication number login is entered manually or automatically via a HUD or other device.

Conclusion

Highly successful models for library and archival reference services, like the Neil A. Armstrong Library and Archives, have been achieved in virtual worlds. As the internet permeates society, and the digital divide begins to close, people are becoming used to integrating technology into their daily lives. Some even enjoy the challenge of exploring new technologies. Of those who use the existing web services, like "Ask a Librarian," they are finding they are able to transition successfully to virtual world reference services. Reaching new patrons and retaining existing patrons will be key to virtual world reference success. One of the major obstacles prevention initiation has been that many library computers (and patron home computers) lack the needed graphics cards required to run virtual worlds within the library or at home. The key to retention seems to be, as other LIS studies have indicated, patron satisfaction. Patron satisfaction is the primary objective regardless of format, for the successful reference interview. Many of the survey respondents indicated they had not yet tried virtual world reference service, but of those who had, virtual world reference service ranked high in patron satisfaction and low in patron dissatisfaction indicating it is a viable reference delivery service model that is ready to be implemented on a wider scale.