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Imagining Library 4.0: Creating a Model for Future Libraries

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ABSTRACT

Purpose: The purpose of this paper is to suggest a Library 4.0 model based on the concepts of Library 4.0 discussed in the literature as the future of library service. The concepts and model of Library 4.0 can be adapted to fit every different kind of library.
Design/Methodology/Approach: For this purpose, first, major reference databases (e.g. Google Scholar, EbscoHost, LISA, etc.) were examined for literature that discusses Web 4.0 and Library 4.0. Second, examples of information technology environments as well as studies and news articles related to information technology were comprehensively collected and analyzed by focusing on those which may influence libraries. Third, examples of cutting-edge information technology applied in libraries were examined and analyzed. Other examples were found of cutting-edge information technologies that have not yet been used in libraries but would be applicable to the next-generation library. Fourth, this study developed a model for next-generation library service provided by Library 4.0 and representative keywords explaining Library 4.0.
Findings: First, opinions of scholars tracking the rise of Web 4.0 vary widely, but Web 4.0 features commonly suggested by previous researchers are: reading, writing, and executing simultaneously, intelligence-based agents, connected web, ubiquitous web, intelligence connections, and intelligence-based web. Secondly, this study determined the features of Library 4.0 as: intelligence-based, massive data, augmented reality, context aware, cutting-edge displays, and infinite creative space. Third, in this context, the keywords that best explain Library 4.0 are: Intelligent, Makerspace, Context-Aware Technology, Open Source, Big Data, Cloud Service, Augmented Reality, State-of-the-art Display, and Librarian 4.0.
Originality/Value: Discussions about Web 4.0 have begun, but little has been written about Library 4.0. This study is significant for deriving keywords for Library 4.0 and presenting the development direction of Library 4.0. In the future, research on Library 4.0 can actively proceed from this starting point.

INTRODUCTION

The LIS field has seen discussions of Library 3.0 for the past 10 years. The development stages of various library iterations have been continually researched by scholars and analyzed by field librarians as new digital technologies allow for large-scale changes in a short amount of time. Libraries, by nature, are very similar to living organisms in that they are influenced by external pressures to constantly evolve, including, in this case, changing information technology environments and a greater reliance on web-based services.

The age is fast approaching when technology and humanity will merge and become one (Rohrbeck, Battistella, & Huizingh, 2012). Passive entertainment such as television in its current form represents the 1.0 age, while Web 2.0 represents an age of content created by users, such as blogs and podcasts (Kirschner & Muller, 1987). Web 3.0, then, is the ongoing era of users jumping into media, using virtual worlds and becoming more active. In the future, Web 4.0 will be when humans are upgraded with technological extensions, always connected to the internet ("always-on") (Farber, 2007). That era has already started for the younger generations alive today, who already communicate with the web in the same way that they would talk to their friends (Kirschner & Muller, 1987). The online space and the physical space are not as differentiated for them as for generations past.

Web 3.0 represents data and analysis filtered through artificial intelligence, while Web 4.0 technology will become one with users' lives (Callari, 2009). Godin (2007) lists three conditions for constructing Web 4.0: ubiquity, identity, and connection. "Ubiquity" refers to the lines between offline and online life becoming blurred, with users connected to Web 4.0 at any time and place. "Identity" means specific protocols will exist to determine efficiently who the users are, what they are doing, and what kinds of things they need. "Connection" means a continuously connected network of users. Godin predicts that, once Web 4.0 is constructed, unwanted information like spam emails will disappear and only information needed by users will be provided because, unlike versions of the web in the past where users wander from place to place in a sea of information when searching, Web 4.0 will only provide information suitable for users by integrating all the

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known data about their identity. For example, customers passing by a particular store will be identified, and personalized advertising messages for each person will display for them as they pass.

Library 3.0 or 4.0 will not only reflect the changing nature of the web as described above, but it will also feature new attributes based on the uniqueness of libraries. Noh (2010) said Library 3.0 will combine the concepts of a social semantic digital library, linked library, and mobile library, while Kruk, Decker, et al. (2007), Kruk, Woroniecki, Gzella, Dabrowski, & McDaniel (2007) and Alotaibi (2010) emphasize the social semantic library as a 3.0 library. In light of the services presently provided by libraries, we are already living in the era of Library 3.0, and it seems appropriate to begin a discussion of Library 4.0.

While substantial time has passed since the discussion of Web 4.0 started, it is difficult to find studies suggesting models for Web 4.0 and predicting its features. However, considering the discussions of Web 4.0 made by researchers, some concepts have already been introduced to libraries, beginning to constitute Library 4.0, and other concepts are still being actively discussed in advance of being applied to libraries. However, these discussions are fragmentary and not embracing Library 4.0 as a whole. Therefore it is necessary at this time to start a discussion on Library 4.0 to predict the direction of and strategies for development of future libraries so that future librarians can play a leading role in responding to the era of Web 4.0.

Technology keeps making great leaps forward, meaning that today most people have access to devices that were only the stuff of science fiction in the films of ten to thirty years ago. It is imperative that library development stays abreast of these fast-moving trends. Accordingly, this paper suggests a Library 4.0 model based on the concepts of Library 4.0 discussed in the literature and the aspects that have already been applied in some contexts. The concepts and model of Library 4.0 can be adapted to fit every different kind of library.

RELATED WORKS ON LIBRARY 4.0

Many scholars have suggested developmental directions for future libraries. In particular, when a new concept or technology appears and massively influences society at that specific point in time, researchers present forecasts for how it will influence libraries and how libraries will develop thereafter. In this study for suggesting a library model, the first step was naturally an attempt to analyze all of the available research. However, it was discovered that there are few studies available specifically on the topic of Library 4.0. Thus, considering that Library 4.0 is a form of next-generation digital library, this study focuses on examining the papers suggesting models of next-generation digital libraries.

First, there are studies classifying and examining the features of digital libraries from their first generation to the present and suggesting development directions for the next-generation libraries. Greenstein and Thorin (2002) focused on the experiences of premier research libraries in the USA and comprehensively discussed the essential challenges faced by digital libraries as well as how cultural, legal, and financial support would influence the history and development directions of digital libraries in the future.

Almost 5 years before Greenstein, Mukaiyama (1997) argued that digital libraries will hold a central place in the 21st century and technologies making up the next-generation digital libraries will be three-system architecture (integrated messaging system, electronic agents, multimedia database, and application system), individual technologies (digitized literature, smart search engines, SDI agents, concept-based search, hypermedia search, and concept-based video search using 3D visualization), and integration technology (for instance, content recording structures). These technologies have already been applied to libraries.

Kroski (2009) listed the defining features of present-iteration digital libraries as mobile (new services and basic technologies, mobile content and new transmission formats, and mobile apps), social (social and library websites, attractive user experience, and cooperation with community businesses), and open (open source applications and open content). Kroski also predicted that essential areas of next-generation digital libraries would be the semantic web, grouping, cloud computing, life streaming (online recording of daily life by collecting blog comments or online photos and directly shooting videos), and filtering. Therefore, the elements Kroski forecasted for next-generation digital libraries (NGDLs) roughly match those ascribed to Web 4.0 to some degree.

Breeding (2011) argued that plans in preparation for future libraries are essential for fully utilizing new technologies as soon as possible to avoid obsolescence. As he pointed out, up to now, changes in libraries have been in terms of formats (digitalization and adoption of various multimedia) and affluent convergence (lack of boundaries between equipment and content formats). RFID systems, which presently allow automatic and simple handling of physical materials, may lose their value. However, he was not able to forecast which technology would play a significant role in the library's future.

Piper (2013), in his paper regarding the future digital nature of libraries, referred to a project conducted by HathiTrust (hathitrust.org) and DPLA (Digital Public Library of America) as a model which may become a guideline for constructing massive libraries in the next 15 years. The project will be conducted based on a shared system, metadata, and digitalized contents. The project is very similar to Google's digital books endeavor (GoogleBooks) except without the commercialization aspect. The process is the same: 1) providing search tools for the virtual catalogs available, 2) expanding the scope for all books written in all languages, and 3) user-based systems for helping users find new books. Cooperation between organizations on such a massive scale has not been possible before.

McGettigan (2013) introduced examples of construction of NGDLs and information services, hybrid libraries combining traditional libraries and virtual ones providing virtual reference service, personalized OPACs, 24-h service, and downloadable media. The revolutionary service spirit of next-generation digital libraries is based around the ideals of space for free community networking, technological resources provided free of charge, connections with the local economy, a sense of belonging to community, and promoting a high level of trust in the local community. Other such efforts have been made by public libraries, notably the Chattanooga Public Library and the Willingboro Public Library.

The ALA has provided examples of applying cutting-edge technologies to library services since 2009, and in 2013 evaluated the most innovative ones among them as mobile internet, cloud sourcing, open source development, and cost effective online education (ALA, 2013a, 2013b, 2013c). The ALA also selected five outstanding cases of institutions applying these revolutionary technologies to libraries. Among those cases, Corcoran Library (Boston College High School Library in Massachusetts) allowed all students to access the library's online resources through their mobile sites and developed applications which become optimized for mobile search. The library announced that it will develop archives and a virtual reality tour available through QR code (ALA, 2013a, 2013b, 2013c). In 2014, excellent examples selected by the ALA were: 1) "Creative Solution", a digital sign board system, 2) "Me Card Technology" which allows users to access all the libraries connected through one card, 3) a system under which the users and the department of archives can upload open stories of new library construction through photo and video streams, and 4) simple video creation systems (ALA, 2014).

In addition, there are many studies discussing innovative changes in the contents of books in NGDLs. Among them, Crane et al. (2006) conducted research modeling of NGDLs and discussed groundbreaking changes in the content of books. The limit of NGDLs, he concluded, is based on existing print versions. He also described necessary features of future digital collections as: sophisticated screen design, voluntary learning, and real-time community participation. He asserted that,

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