

Predicting the Future: Library Technologies to Keep in Mind

Abstract

It can be difficult to keep up with library technology, let alone with technology in general. This essay describes several technology trends (virtual reality, augmented reality, the Internet of Things, and adoption of a “buy the data, build the interface” approach to service provision) that librarians should be aware of as they are likely to prove foundational to the services libraries will offer, as well as the services library users will expect.

Keywords

Technology forecasting, augmented reality, virtual reality, APIs, libraries

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Introduction

Developments in technology come at a fast and furious pace. In cellular phones, Apple, Google, Samsung, Huawei, and dozens of other companies release new, more advanced, smartphones in a constant cascade of novelty. The march of home computer models has slowed, but there's always a new piece of hardware to acquire. Televisions grow in size, shrink in thickness, and increase in resolution on a regular basis. Just when it seemed that home technologies had reached a plateau, society was introduced to the need for connected devices, from thermostats to refrigerators to sensor-enabled everything.

Library technology is similar, though the specialized technologies that concern us live on a slower trajectory and more gradual evolutionary pace. Still, it is difficult to know which technologies emerging in the broader consumer landscape will be directly relevant to libraries. Figuring out which technologies matter and which ones have connections with the more specific library mission, is an ongoing challenge for libraries. There are no easy answers, but it is possible to make general predictions about what will be useful and usable for a particular library community down the road. Positioning a library to be ready for next new thing is a useful exercise, even if the "thing" itself does not actually materialize. Why? Because the process of thinking about evolutionary (or even revolutionary) change moves the library into a mode of operation in which change can happen. Once this process is enabled, great things can happen -- even if they aren't the expected great thing.

At the January 2017 Top Tech Trends panel (<http://www.ala.org/lita/ttt>) -- a popular session at both the American Library Association's Midwinter and Annual Conferences -- three panelists representing cutting-edge library technology developments described specific technologies they were exploring or implementing, with a lively discussion among the panelists and the audience ensuing. The author is indebted to panelists Cynthia Hart, Bill Jones, Gena Marker, and Meredith Powers for their insights and observations about technologies they have developed or experimented with at their local institutions, providing a scaffolding from which this extrapolation is built.

This essay will consider several of these technologies, along with several others, but will also explore the thought process that led each library to consider them. As Yogi Berra is said to have observed, “It’s tough to make predictions, especially about the future.” Nonetheless, this essay will endeavor to make predictions about the direction of technology and actions libraries can take to stay ahead of the curve. Even if the specifics are slightly off, these brief case studies will discuss not just the tools, but also the mindset that fosters an adaptive organization ready to take on new technology challenges.

Virtual and Augmented Reality

There are two flavors of “reality” that involve technological enhancement. In the first case, virtual reality, the viewer is immersed in a set of experiences that only exist through the aid of the technology. In the second case, augmented reality, the viewer is receiving additional information through a technology device to supplement what can be perceived with the normal senses. Their common feature is the use of technology to augment the experience of the viewer. One is a powerful attractor of users to the library; the other is a powerful tool for introducing the libraries to people who might not think of the library as a source of locally-relevant information.

Virtual Reality

The Technology

Virtual reality is a powerful tool for allowing an individual to experience something they would otherwise not be able to do, whether visiting a far-off location and being able to navigate through a distant space (a city, museum, or planet’s surface, for example), seeing what a camera has already recorded, or entering a simulation of almost any setting or experience imaginable, from a teaching tool to explain the inner workings of a cell to a fully immersive fantasy video game. Virtual reality experiences can be had at the

movie theater, with three-D glasses available for moviegoers to watch the latest Hollywood release in a far more realistic way. Three-D televisions were briefly a marketing fad, but have not really caught on.

The drawback of experiences designed for “straight ahead” viewing is that they depend on the camera operator having guessed what to show for all users at the time the experience was created. The camera may have been fixed, or move through a space, but the user’s head stays put and reality moves around her.

A step up from this fixed-view variety of experience is immersive video, filmed with a spherical camera (so as to capture the complete view up, down, and all around) from a fixed point. While the fixed point may move through a physical space, the perspective is still pre-planned and the person experiencing the video can only look around as the camera moves. Such immersive experiences are relatively accessible, assuming the individual has a smartphone and an inexpensive headset to hold the smartphone in front of the wearer’s eyes. Google Cardboard is one such inexpensive, do-it-yourself version of these eyeglasses that allows any smartphone, with the free software installed, to participate in three-D experiences. Traditional “2D” news providers are expanding their offerings to be sure they are where their readers are. For example, the *New York Times* now offers the “Daily 360,” a curated video that allows the viewer to explore a particular place; there are many other sources of such 3D videos. These brief experiences are high-fidelity and can allow someone to view a place too challenging for the average person to see in real life. The most extreme version of this is a tour of the surface of the dwarf planet Pluto, based on pictures taken by the New Horizons probe (“Seeking Pluto’s Frigid Heart,” 2016).

Technologies such as the Oculus Rift and similar devices, specialized binocular headsets that connect to a computer to present a stereoscopic immersive experience that knows when the user turns her head and adjusts the view accordingly. Because the image is generated by a computer, it can be far more detailed and immersive; the user’s entire field of vision is provided by the headset, and can carry the user along in a journey. Combined with a handheld controller or keyboard, the user has much more control

over the interactions, making choices, picking directions of travel, etc. These are video game systems taken to the next level.

Library Impacts

As discussed at the Winter 2017 Top Tech Trends panel, libraries have several ways to embrace the virtual reality trend. One that is more or less universally available is to make virtual reality headsets -- from the inexpensive Google Cardboard “goggles” into which users can place their smartphones, to the higher-tech and higher-cost virtual reality headsets such as Oculus Rift -- available for patron use. Exposing library users -- and library staff -- to these technologies is a good start. A more involved next step could be creating virtual tours of the library, using virtual camera set-ups to explore the physical space of the library.

Aside from these entry points to exploring and sharing virtual reality technology, virtual reality seems a bit outside what libraries can truly invest in and develop services around, at least in the near term. It may be, at some point years out, that true “telepresence” in virtual worlds becomes as common as internet transactions are today, but for now, investing in virtual reality tools and experiences are ways to stay connected with a library’s user community, and less to extend services.

Augmented Reality

The Technology

The other flavor of computer-enhanced reality is in the category of augmented reality. This category is more or less made for libraries. Augmented reality, briefly, is the provision of additional information to the real world. In straightforward forms, it can be street and business names attached to a satellite image in a mapping tool. The incredibly popular Pokémon Go game is another form; it adds information (to be generous with the term) to the real world, showing where Pokémon, gyms, and supply depots are located.

Smartphone apps such as Layar connect a real physical location, the phone's camera, and image or textual data to provide layers of information on top of what the user can see. William Denton outlined a vision for how libraries could integrate themselves into existing tools in (Denton, 2014), pointing out how historical image collections lend themselves to a "what was here" layer in existing smartphone applications. In such a model, someone could be standing in front of a building on Main Street in a community, pull out the smartphone and open the app. The building in front of the individual may appear nondescript, but the app could provide a layer of photographs of what that site looked like in the past, or textual information -- if properly indexed with geographic location -- for people or events relevant to that location and that community's history.

Library Impacts

Libraries (as well as archives and local history museums, among other cultural memory institutions) are natural sources for data to augment the physical location. It is not hard to imagine a not-distant future where normal mapping applications simply applied additional historical or cultural context to the map, accessed as easily as switching on street names or toggling to a satellite view are on in today's tools. Making this kind of contribution requires work in several areas, the most fundamental of which is ensuring that content is geotagged -- that is, "the process of adding geographic metadata about an object or place usually using latitude and longitude coordinates" is "a low-cost endeavor and can provide a new interface to these underused resources" (Griggs, 2011). There are a number of standards to describe how to encode geographic data into records. The W3C includes geotags in the Resource Description Framework (<https://www.w3.org/TR/2014/REC-rdf11-concepts-20140225/>) and there is a similar metadata microformat for encoding individual HTML web pages with geographic location data (<http://microformats.org/wiki/h-geo>).

Although adding geographic tags to existing records that do not have them is low-cost, it is not no-cost. Some of it can be automated to the extent that existing textual metadata include locations that could

be converted into latitude and longitude through computer code. However, most subject headings are broad (at a city level) and are not specific enough. It will likely take collaboration between local subject experts and metadata experts within the library to make progress in this area. The San Francisco Public Library took a crowdsourcing approach to locating digital images in the real city, inviting local history buffs to help out; depending on the nature of a library's collection, this may be a good first approach ("Geotagging & Crowdsourcing," 2011).

Internet of Things

The "Internet of Things" (IoT) is a catchphrase for technologies that add networking capabilities to normal appliances, tools, and technologies that already exist. That is, able to access the Internet, or at least to access a hub within a home or office, with the hub then accessible to the Internet.

The Technology

Until a few years ago, from the perspective of the typical individual, computers and smartphones were the only things "on the network" (able to access the Internet). As the decade moves on, however, the cost of adding network access to any particular device has decreased, and as costs have decreased, use of networking technology has increased. In 2017, all sorts of typical household devices are capable of being networked in this way. It is now possible for light bulbs, small appliances, stereo systems, thermostats, door locks, and more to talk to each other and, via a hub, to an authorized user who manages the system, often from a smartphone. Changing the temperature of a room is as easy as adjusting the thermostat -- or changing the hue of light emanating from the LED light bulbs in the room's fixtures.

Having "everything" on the Internet is a powerful force for change. Like many such powerful forces, it can be for better or worse. On the positive side, the IoT leads to more convenience and flexibility for individuals, although some of this convenience feels more like a marketing ploy than actual convenience.

Samsung, for example, is marketing a refrigerator that has internal cameras that take a picture of the fridge's contents every time the door closes so that you can see what is in the fridge from your smartphone -- or from the digital display on the front without opening the door again. ("Home has a New Hub," 2017).

The reverse of the convenience factor is that if household devices are networked and accessible by their rightful managers, they risk being accessed by hackers or others. The effects of such inappropriate access range from the inconvenient to the truly damaging. Anything with a microphone or camera could be used to eavesdrop or spy on residents of the home. If the home "knows" everyone is away and has set the thermostat to the appropriate setting, then so could anyone who wished to enter the home illicitly. If someone wishes to do damage, turning the heat off in winter while the residents are away for the weekend could do the trick.

Library Impacts

As with augmented reality in a previous section, libraries would do well to think about the Internet of Things as an opportunity to connect with their user communities to offer training and instruction on topics such as privacy and confidentiality, topics close to libraries' core values ("Privacy and Confidentiality," 2017). But beyond the service aspect, there are opportunities for libraries to experiment with the Internet of Things themselves. Along with decreased cost of networking individual devices to a local hub has come a corresponding decrease in the cost of the hardware that is networked. Sensors of all sorts -- motion, temperature, light, etc. -- have become commodity items that can be assembled at very little expense.

Jason Griffey received a Knight Foundation grant for the "Measure the Future" project, whose goal is to "enable libraries and librarians to make the tools that measure the future of the library as physical space. We are going to build open tools using open hardware and open source software, and then provide

open tutorials so that libraries everywhere can build the tools for themselves” (“Measure the Future”, 2017).

If the library is networked in this way, Griffey suggests, it opens the door to providing useful real-time statistics about the way the library is being used. For example, with inexpensive motion sensors, it is possible to know which library seating areas have free spaces to which sections of the new book shelves are most frequently visited (Griffey, 2014). These statistics might be useful to other patrons in the moment, or to the library over the longer term for space planning or budget allocations.

Becoming an active user of the Internet of Things requires slightly more intensive investment than becoming knowledgeable about the IoT. However, the costs are low and the technologies are relatively straightforward. Investing in active learning will enable the library to become a better resource to the community; talking about the IoT from a position of active knowledge will be more valuable than not.

The DIY Approach: Buy the Data & Build the Interface

Until now, this essay has largely focused on some tools that are common in the broader world that might provide some advantage to libraries. In this final section, we focus on trends in library technology more specifically. One of the most prominent features of the last 20 years has been a remarkable evolution of the concept of “Web 2.0.” This concept “describes World Wide Web websites that emphasize user-generated content, usability (ease of use, even by non-experts), and interoperability (this means that a website can work well with other products, systems and devices) for end users.” (“Web 2.0”) When the term came about in 2004, it stood in stark contrast to the “publish-only” model of the Internet at the time; websites were created, edited, and maintained by their creators. User-generated content was minimal. However, the rapid adoption of APIs, feeds, common data standards, and most important the user’s

expectation of being active participants in the web experience, redefined the web. “Web 2.0” is no longer; it is simply “the web.”

The Technology

The impact of this evolution has meant that all sorts of tools, services, and applications are more open to sharing and customizing. It is probably fair to say that “is there an API” is a question asked of library service and content vendors as routinely as “is it accessible.” The only time the answer is concerning is when it is in the negative. At the same time as the tools libraries rely on become more accessible to sharing the data and information they maintain, the skills and tools needed to take advantage of that data have become more commonplace and generalized. That is not to say that everyone knows how to parse an XML or JSON feed of books recently circulated, merged with a book cover image service, to build a display of dynamically-generated popular items, but it is not entirely black magic, either. The barrier to entry into customized interfaces and displays is constantly being lowered.

A more complex example is one that was recently completed at the University of Michigan Library. After conducting research into the usability and functionality of the library’s commercially-provided OpenURL link resolver interface, the library decided it made most sense to bring the interface in house, using the data available from the vendor’s API to generate full-text links to content users were seeking in citation databases. (Varnum et. al, 2016) The new service, based on the Umlaut open source software (<https://github.com/team-umlaut/umlaut>), handles the heavy lifting of sharing parsing an OpenURL into a citation, querying the library’s licensed link resolver knowledge base, and providing full-text links to the user.

Library Impacts

Hosting tools and interfaces locally can allow specific interfaces to be closely integrated into a library's overall web presence. This enables the library to immediately gather problem reports and respond to user's questions, provide a user experience that is consistent across the interfaces the library offers, reduce training burdens by providing as much consistency as possible across services, and allows the library to much more closely track usage of those services and tools at finer-grained levels of granularity, to match the library's own needs.

An additional force behind libraries building their own interfaces is one that seems increasingly important to many libraries in recent years: moving the responsibility and duty to safeguard patron data from external library partners to the library. This driver may be most acutely felt in academic libraries, but is likely common across all. If the library maintains the interface and provides services around it, any user-specific information can be maintained on the library side of the transaction, rather than passed along to the vendor.

What's the Endgame?

This essay encompasses a wide range of trends, from specific technologies that might provide opportunities to increase the library's participation in the community to opportunities to build a library's service and application platform to meet local needs.

There are, in broad strokes, great similarities among the needs and usage patterns of library service consumers across libraries of a similar type. It may seem a great deal of effort to recreate services locally; in some cases, particularly toward the commodity end of library services, that may be true. Yet, at the same time, each community (town, campus, etc.) has its own special characteristics and service needs or

habits. A library that can configure itself to the local needs of its community is a library that is more likely to be viewed as successful and relevant by its constituents.

Investments in new and emerging technologies (in the cases of virtual reality and the Internet of Things) and service customizations may seem expensive in the short run. However, they are foundational to remaining relevant to communities and to the general concept of providing information and services at the point of need. The understanding of “point of need” has evolved to encompass a community where significant portions of the user population can be connected to the library and its services at any time, from any place.

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About the Author

Ken Varnum is Senior Program Manager for Discovery, Delivery, and Library Analytics at the University of Michigan Library. A frequent speaker and author on topics of library technology, discovery, and future forecasting, he edited the 2014 LITA Guide *Top Technologies Every Librarian Needs to Know* and the 2016 book *Exploring Discovery: The Front Door to Your Library’s Licensed and Digitized Content*. He has served as moderator or panelist at the Library Information Technology Association's Top Tech Trends panel at the American Library Association's twice-a-year conference three times since 2014.