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TECHNOLOGY

Seven Things Every Information Professional Needs to Know About Consumer Technologies

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INTRODUCTION

The consumer space has, in recent years, greatly surpassed the enterprise space as a place to find the latest trends and innovations. In fact, businesses have increasingly begun to interface actively with consumer computing, with concepts such as *Bring Your Own Device* (BYOD).

Hospital librarians should familiarize themselves with some of the key trends in the consumer space to better engage with their patrons, including physicians bringing their personal devices into the workspace.

1. THE MOBILE REVOLUTION IS OVER

The mobile revolution has actually been over for years. In essence, as soon as Web developers could no longer comfortably get away with ignoring mobile devices as a platform, the mobile revolution had ended. Mobile devices are now ubiquitous, and in many places mobile devices are the primary means of internet access.

For hospital librarians, this means a radical rethinking of Web presence. Hospital librarians should test their Web sites on mobile devices and work with their institutional Web teams to improve sites that fall short when used on tablets or smartphones. For some institutions, this means building two Web sites, one for mobile and one for desktops, with Web script automatically directing users to the appropriate site for their device. A better solution, however, is Responsive Web Design, in which sites are designed so that they are able to automatically reformat themselves for different screen sizes. Building a responsive site can be challenging, but there are tools, such as the widely used twitter bootstrap package (<http://getbootstrap.com/2.3.2/>), that can make it easier.

In addition, hospital librarians should be conscious of the need to make their electronic resources available on mobile-friendly formats. This means that articles should be readable on small screens. Some databases will be largely accessed through a user's Web browser, but many users may want to download an "app" from the Apple or Android stores to access the resource. Librarians should keep instructions for activating these apps on hand in the library . . . many of them require obtuse and involved setup procedures. In some cases there will be network problems in getting one of these apps to recognize an institutional license for access, requiring intervention by the IT department.

2. LOCAL RESOURCES ARE ON THE WANE

In the early days of computing, many computers took the form of large "mainframes" which did the actual computing, with many "dumb terminals" with screens and keyboards that had very few resources of their own, mainly functioning as access points for the mainframe. Modern personal computing began to turn this paradigm on its head, championing a model of many local units with fairly respectable resources (such as a powerful central processor and memory)

that ran programs on their own. These machines could be networked together to leverage their collective power, but they still remained separate, discrete units.

As part of the shift toward mobile computing, the pendulum has swung in the other direction. Increasingly, computing devices have more modest resources, relying on storage and computing power from the internet to provide a satisfactory user experience. Such internet resources are commonly referred to as "cloud computing" or, simply, "the cloud". People are sometimes confused by this nomenclature, but the concept is simple; devices with modest processors, limited memory, and little storage using the storage and processing resources of large (often virtualized) servers connected to them through the internet to do the things their users want done. Everyone who stores copies of their files in Dropbox, or uses an app like MedlinePlus Mobile to process a query and access information held on NLM servers, is using cloud resources. As we can see, this is increasingly similar to the old "server/terminal" model, only with more mobility for the "terminals".

Part of what has helped make this transition possible are recent improvements in technology. Batteries have gotten better, and processors are increasingly modest in their power requirements. At the same time mechanical hard drives are being replaced by solid state drives (more on that later) which lack the motors and moving parts of earlier, power-hungry laptops. These developments have not only powered tablets and smartphones, they've also created a new category of laptop; the ultrabook. As an example, I own an 11" 2013 Macbook Air. With only 4GB of memory and a modest 128GB of storage, it would seem to be a machine of limited capabilities. But with its capable (but still not desktop class) haswell processor and speedy solid state drive, I've been able to use it to perform tasks that should have been out of scale for this machine. By leveraging cloud resources and selectively syncing Dropbox, I have access to everything I need and have never run short of resources.

As a consequence of this transition, reliable, high quality wireless networks are a must, especially in buildings which block a significant amount of cellular bandwidth. It's often useful for librarians to keep a variety of adapters and cables on hand to provide patrons with a way to use cabled network connections in the case of a wireless outage. In the case of my MacBook Air, for instance, any wired connection would have to be through the thunderbolt port, as it lacks an ethernet port. For such a connection, an adapter is required.

3. THE COMPUTING DIVIDE ISN'T ABOUT MOBILE AND DESKTOP; IT'S ABOUT ARM AND X86

The title of this section may seem counter-intuitive. After all, we have become accustomed to tech companies providing different operating systems for desktop and mobile devices. And, as a further reinforcement of that point, the mobile systems are generally designed around touch interfaces, as opposed to desktop operating systems, which require a mouse and keyboard. This paradigm is shifting, however. The Windows 8 and 8.1 operating systems run on desktops, but are also designed to use a variety of touch gestures. Touchscreen laptops are increasingly prevalent, with touchscreen support appearing in linux and other environments.

The real divide in operating systems is a result of the architecture of the processor. ARM processors are built on designs licensed from a British company called ARM Holdings. These chips are notable for their low power requirements and their integration of many components into one chip. This low power consumption not only lengthens battery life, it also reduces the production of waste heat, so that the system can be cooled with fewer resources. ARM processors are typically much less powerful than x86 processors, but are well suited to mobile devices.

x86 processors, by contrast, use an Intel architecture. Robust, and typically boasting more processing power than ARM processors, the x86 family are commonly found on desktop computers. These processors, instead of having as many system resources integrated into the chip, have traditionally relied on external cards, such as graphics cards, to provide more powerful video, sound, and floating point processing.

Because the architectures of these chips are fundamentally different, the same code cannot be run on both. This means that even if we were to use an operating system available for both types of chip, such as one of the many distributions of linux, we would need a version of the operating system specifically compiled to work with our type of processor. In addition to this problem, the processor and the device it is inside must have the memory and processing power necessary to run the operating system (and the framework it supports).

While these architectures are fundamentally different, they have begun to draw closer together in terms of their features. ARM processors have continued to grow more powerful, while Intel has worked hard to reduce the power requirements of their processors. Intel has also begun to add respectable integrated graphics to their processors, allowing them to tackle low to moderate video processing without a graphics card. Increasingly, these two architectures have begun to come into direct competition. Microsoft's surface tablets, for instance, come in two versions; one that uses an ARM processor and can only run the mobile version of Windows (Windows RT), and the Pro version, which uses an x86 haswell processor capable of running the full version of Windows 8. In the world of laptops, there is now a "Chromebook" (designed to run Google's ChromeOS) which sports an ARM processor, in direct competition with Chromebooks powered by x86 chips.

As these two competing architecture continue to square off against each other, this tension will define the future direction of personal computing hardware. Librarians may find themselves in the position of dealing with patrons confused about the kind of apps that will be

compatible with their hardware. The divide between Windows RT (mobile operating system and Windows store apps only) and Windows 8.1 (can run full desktop applications and mobile apps) may cause the most confusion.

4. THE END OF MOVING PARTS

For a long time personal computers had a lot of moving parts. The main storage was usually provided by a mechanical hard drive, which sported a motor and physical sensors which read magnetic signatures from metal platters. They had optical drives, with motors and lasers. And, of course, they had large cooling fans to keep the energy hungry processors from over-heating.

Apple was one of the first companies to stop bothering to include optical drives in their computers. While people complained, others felt the move made sense. Given that a DVD holds just under 5GB, while flash drives are now available that can plug into a USB port and hold up to 128GB, optical drives had become obsolete from a pure capacity standpoint. Increasingly users were choosing to download new software from the internet directly, rather than using installation disks, further reducing the optical drive's utility. While they can still be found on many PCs, an increasing number of laptops are leaving them out.

Hard drives, once a mainstay of computers of every kind, are steadily being replaced by solid state drives. Based on the same basic technology as flash drives, solid state drives have no moving parts and offer much greater transfer speeds for a lower energy cost. In addition, solid state drives (SSDs) are much less vulnerable to physical damage from a device being dropped or otherwise abused. This fact, along with their low power consumption, made the technology perfect for both laptops and other types of mobile device.

As mechanical drives have faded from the scene and processors have become less power-hungry (and, consequently, have begun to produce far less waste heat) the size and

complexity of cooling mechanisms, such as fans and heat sinks, has been able to go down on many systems. The overall effect of these changes has been to make devices more robust, faster, and capable of far greater battery life. This has reduced (but not eliminated) the need for libraries to supply power adapters as a courtesy to patrons. It has also made mobile devices more useful as a platform for checking out library materials or providing entertainment to patrons.

5. THE END OF PRIVACY

As devices have become more mobile and resources have increasingly moved to the cloud, information has become more vulnerable. Many services, such as those provided by Google, track habits and store extensive amounts of personal information including online habits. Information stored online has proven to be vulnerable to hacking and cracking attacks of many kinds. Our own government, after years of denials, has now publicly admitted to extensive (and poorly controlled) surveillance on both American citizens and foreign nationals. As our digital lives increase in complexity, we also leave an increasingly complex digital trail behind.

There are some tools which can reduce (but not eliminate) this digital trail. Duck Duck Go is a search engine that does not retain information about the Web searches its users perform. The Tor package, which is available as a download for just about every desktop platform, connects users to the internet through a series of anonymizing nodes designed to make it difficult to determine the source of a connection. In addition, private Virtual Private Network (VPN) services are designed to provide encryption over public wireless networks, and may also anonymize their online traffic. Hospital librarians can help their users understand the vulnerability created by something as innocuous as browsing the Web, and steer them toward tools designed to ameliorate those problems.

6. INTELLIGENT ASSISTANTS

Apple's Siri assistant provoked a strong reaction (both positive and negative) from users. By speaking to Siri on an iPhone in relatively natural language, users could get answers to a variety of questions, or perform a broad range of tasks. This development was quickly followed by Google's Voice Search and, eventually, Microsoft's Cortana. These "virtual assistants" are meant to provide a more intelligent level of interaction than previous "intelligent agents", such as the almost-universally despised "clippy" that Microsoft included at one point in Word.

These assistants are part of a larger revolution in semantic processing, in which software applications are being built which can better "understand" information, and information is increasingly being enriched to make it easier for software applications to understand. Such tools are very important because they save human beings time and improve the effectiveness of search. However, while they seem tailor made for mobile devices, they usually require resources far greater than what the mobile device can supply, making them reliant in an internet connection to work properly. Users also sometimes don't realize that these convenient searches may not provide them with authoritative (or properly focused) information. In many cases they also don't realize how much information about them is being stored by the providers of those services. Hospital librarians must keep these things in mind, reminding users of these fact as appropriate and helping them conduct more comprehensive searches as needed.

7. THE FUTURE OF INTERFACE

One of the problems with mobile devices are their small touch-screens, which can make for a clumsy interface and a limited display field. Voice activated intelligent assistants help ameliorate

this problem, but not entirely. Google's answer to this problem has been the creation of "Google Glass", a pair of glasses with an integrated camera and display. The appliance is able to add information to a user's view of their surroundings . . . a method known as "augmented reality". This type of interface also allows users to control certain functions with eye movements.

In a further development of wearable technology, smart watches have been coming to market in increasing numbers. For now these watches are mostly just an extension of a user's smartphone, but the recent addition of a strong voice interface to Google's smart watch may begin to make these devices more practical for consumers.

Hospital librarians can expect to see such devices start to enter their libraries. Users may need to be reminded that devices with integrated cameras, like Google Glass, might inadvertently become scanners that violate copyright if the images of such material are shared.

CONCLUSION

The shape of technology is constantly shifting. The consumer tech space has been particularly dynamic, forcing change onto other technology sectors. By understanding these trends, hospital librarians will be better able to interface with their users and will be better able to foresee some of the changes they can expect to see in the technology infrastructure of their home institutions.