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CHAPTER 1

The Mobile Context

A User-Centered Approach to Mobile Strategy for Libraries

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Introduction

Libraries have always looked for ways to make use of new technologies to enhance the resources and services that they provide to their user communities. As the use of mobile devices became more widespread, many libraries invested in developing or purchasing mobile applications and websites to make their resources and services more easily available on this new platform. The primary goal of these initiatives was to adapt existing features and content to mobile devices, adjusting to make use of the form factors and interaction models that were different from those offered by traditional workstation computers. While these projects typically succeed in providing functional mobile applications, in many cases patron engagement failed to meet the expectations set by the library at the beginning of the project.

Most libraries have adopted practices such as usability testing to support their design and development process, but this alone is not enough to realize the full potential offered by mobile devices. The approaches and assumptions underlying how we conceive, design, and implement technology are, for the most part, grounded in the traditions of desktop computing. However, we can no longer rely on the computing paradigm presented by desktop computing as an accurate or representative description of how people use and interact with their personal computing devices. The mobile context provides libraries with a perspective for understanding how their users make use of mobile devices and other forms

of computing technology, enabling libraries to design and deploy mobile applications and services that meet the needs of their user communities.

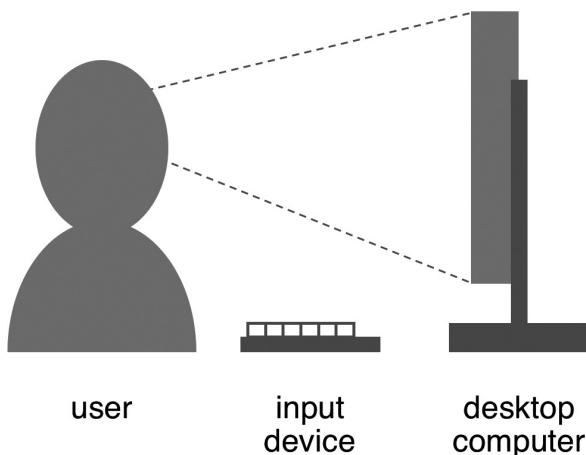
Mobile Technologies and the Decline of the Desktop Computing Paradigm

Today's mobile technologies have ushered in a new era in personal computing. People now have a wider choice of devices available to them to fulfill any task. They can also choose the device that best suits their needs and preferences. Although desktop computers are still used by many on a daily basis, they are no longer the only, or even the primary device of choice (Kim, 2013). This is an important shift, as our assumptions of how technology can be used to carry out or support tasks have largely been defined by our experience of computing "tethered to a desktop computer or laptop" (Bentley & Barrett, 2012, p. 17). Libraries need to move away from a technology-centered approach to application development and to recognize the decline of the desktop paradigm as a model for their users' computing experience.

Most software and web applications were (and still are) designed with the interface, input devices, and configuration of the typical desktop computer in mind. The assumption was that the user would conform to the needs of the technology in order to be able to make use of the application. In this model, the user sits in front of the computer screen with the input devices (typically they keyboard and mouse) in reach (see figure 1.1).

FIGURE 1.1

The desktop context.



The user was expected to adapt to the availability and realities of the technology. In order to use the application, the individual had no choice but to travel to wherever the desktop computer was located, sit before the computer, and focus on the task at hand. The user was also expected to undergo training to learn how to use the application in accordance with the developer's design.

In the desktop model of computing, the interaction between the user and the computer is considered to be independent of context, with the attention of the user entering "into the 'nonspace' of [the computer's] interface" (Greenfield, 2006, p. 71). Where this interaction is taking place, the events occurring around it, the exact positioning of the user in relation to the computer interface—none of this is considered relevant to the conceptualization or design of the application. It is worth noting that even in a recent review of the literature covering usability methods and models, it was found that fewer than 10 percent of the papers considered context as a relevant component of any model of usability (Harrison, Flood, & Duce, 2013).

Our approach to designing and developing computer applications has, for the most part, been grounded in the early days of mainframe computing. At that time, people, and entire organizations, had very little choice but to conform to technology, often using the computer in laboratory-like settings. With the birth of personal computing in the late 1970s, and its rapid acceleration in the 1980s, people began to have a choice of which computer to use, where to use it, and what applications to use. The physical reality of desktop computers did place some constraints on where and how they were used, with most people choosing to sit before them at a desk, much as they used the typewriters the computers were modeled after.

Personal computers were being used in offices, homes, schools, and other contexts that were already far removed from the controlled environments where mainframe workstations had been used. The 1980s also saw the introduction of portable computers, the first mobile computing technology. The first models were little more than desktop computers that were designed to be easier to move than a typical computer and monitor. Advances in technology and miniaturization led to the laptop form factor, giving users a personal computer that was truly portable. All of these devices, however, were for the most part considered to be variations or instances of the desktop computer. People used the same applications that they used on their desktop computers. People adjusted to the smaller keyboards and alternative pointing devices (trackballs, trackpads, etc.) that were created to support the traditional desktop interaction model.

The introduction and rapid adoption of smartphones and tablet computers over the past fifteen years has ushered in a new era in mobile computing, one that is forcing us to rethink the basic paradigm of personal computing. Modern mobile technologies have provided people with new ways of using computing technology without being tethered to a desktop computer. People will continue to use desktop computers and laptops, but will supplement these with smartphones, tablets,

and new forms of personal mobile computing technologies such as wearable devices. In light of this new reality, the model provided by the traditional desktop context, that of a detached user placed before a screen, is not likely to provide us with the guidance and understanding that we need in order to provide our users with the technology choices that they want and need. We can no longer assume that the user will be at a desktop, nor can we say with any certainty which technology the user will employ to carry out a given task. We have to account for the ways in which the various elements of the users' context will influence their decisions of which technologies to use or how that context will impact their ability to make effective use of the technology at their disposal. If we want to provide the communities our libraries serve with useful and compelling online services and applications, we need to focus our efforts on understanding the mobile context of our users.

The Mobile Context

Mobile context provides a rich perspective that includes the user, the technology, and everything that makes up their environment. In seeking to understand what constituted the mobile context, Hinman (2012) and her team asked ten people to take pictures whenever they used their phones. Upon analyzing the photos, they realized that the mobile context was anywhere and everywhere (Hinman, 2012).

There are two related but separate perspectives on the mobile context. The first considers the mobile context from the perspective of the technology, or device, while the second looks at it from the perspective of the person using the device. It is this second, user-centered perspective on the mobile context that is most relevant to the conception and design of mobile applications.

The Mobile Context of the Technology

Designers and developers working in the field of context-aware computing have a conception of mobile context that is by necessity focused on the technology. Their goal is to define the context that needs to be sensed and “understood” by the application in order to enable functionality that leverages the mobile nature of the device. Unlike traditional computer and software development, the context with mobile devices is different because the device can potentially sense, react to, and interact with the world around it in ways that a desktop computer or laptop cannot (Bentley & Barrett, 2012). Writing about context-aware applications, Dey, Abowd, and Salber (2001) define context as the following: “Context: any information that can be used to characterize the situation of entities (i.e., whether a person, place, or object) that are considered relevant to the interaction between a user and an application, including the user and the application themselves. Context is

typically the location, identity, and state of people, groups, and computational and physical objects” (p. 106).

This technology-driven perspective on the mobile context is important to libraries, as the capacity of mobile devices informs our thinking about what kinds of solutions are feasible. However, the capacities and limitations of the technology cannot be the focus of our thinking. Our goal is not to implement technology but to provide solutions that meet the needs of our users. In order to do that, our thinking needs to be grounded in an understanding of the user.

The Mobile Context of the User

The purpose of the concept of the mobile context is to provide us with a framework to understand the possible elements that can have an impact on the users’ choice, and use, of mobile technology to carry out tasks that move them towards the successful realization of their goals. The mobile context describes the constraints that need to be considered when designing, developing, and implementing mobile technologies. These constraints can be categorized as device constraints, environmental constraints, and human constraints (Hinman, 2012, p. 46). Device constraints refer to the limitations of the mobile devices’ size, display, and input mechanisms. Environmental constraints consist of the physical, visual, and audible environment that the person is surrounded by and moving through. The human constraints include the person’s cognitive ability, cultural influences, as well as his or her personal ergonomic limitations for working with mobile devices.

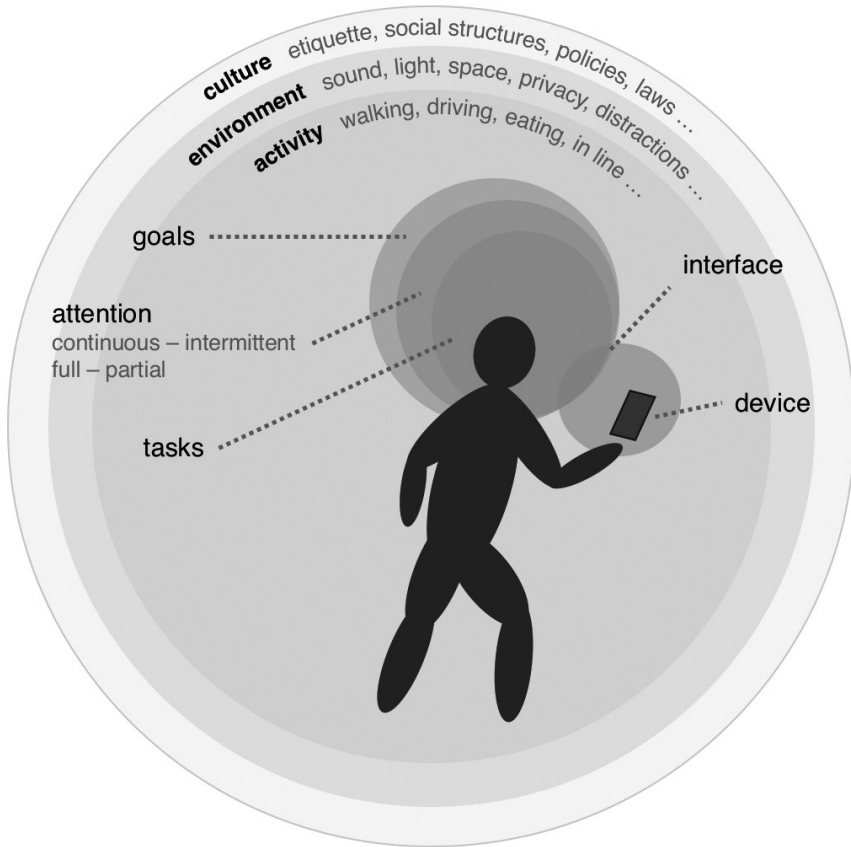
The diagram in figure 1.2 illustrates how a person using technology to carry out a specific task can be seen as being embedded in a complex system of overlapping and interrelated motivators and constraints.

In most cases, the technology involved will be some form of personal mobile technology, such as a smartphone, tablet, wearable device, or even a laptop. In addition, the physical spaces where the user is located, and moving through, will often contain additional technology options to supplement the user’s own personal mobile technologies. This is especially true in libraries and on university campuses, which often provide public workstations and touch screen displays for people to use.

At the center of this model of the mobile context, however, is the user and the task that he or she is trying to accomplish. The user is typically performing this task while engaged in another activity in a physical environment that is continually changing and providing stimuli. The user’s attention is not likely to remain fully on the task, but instead will shift from one part of the context to another, as demanded by the task or activity or made necessary because of other interruptions. It is this variable and ever-changing nature of the mobile context that perhaps differentiates it the most from the desktop context (Tidal, 2005).

FIGURE 1.2

The mobile context. Adapted from “Design Sketch: The Context of Mobile Interaction,” by J. Braiterman and N. Savio, 2007, *International Journal of Mobile Marketing*, 2(1), p. 67.



The mobile context also recognizes that users are individuals and that they will differ in meaningful ways. The users' previous experience and familiarity with the library, with the library's systems, with technology, and specifically mobile technology, will all impact both the technology choices that they make and how effective they are in using the technology. Their own cognitive abilities, emotional state, and motivation to complete the task also play a role in the choices they make and their ability to use the technology effectively. The users will also be influenced by cultural norms of what is considered appropriate behavior, selecting and using technology in a way that suits their behavioral response that larger cultural context.

This model of the mobile context demonstrates how clearly inadequate and ill-suited the traditional, contextless user-computer model is for informing our work with mobile technologies. The desktop context described earlier can in fact be seen as a specific instance of the mobile context model, one where the choice of technology, location, activity, and environment are predetermined. In order to use computing technology to carry out the task, the person has to go to where the desktop computer is located, sit still at that location, and focus his or her attention on performing the computing task at hand. However, this is an artificial construct even for desktop users today, who are not necessarily sitting quietly and are rarely in an environment that is free of distraction. Even within the virtual “nonspace” of the human-computer interface, people are likely to be trying to do several things at once, to be subjected to various forms of virtual distraction (e-mail messages, reminders, notifications, etc.), their attention continually shifting between all of these elements. People working at a laptop or desktop computer may also opt to use their mobile devices as they are perceived as being more convenient or a more “natural method” for carrying out a specific task (Heimonen, 2009). Walsh (2012b) described this use of a mobile device to supplement a laptop or desktop as “dual screening” (p. 14). He also observed, at least within an observational group of more advanced mobile technology users, the practice of moving content between devices so that the content could be utilized on the user’s preferred device (Walsh, 2012a).

Mobile technologies are no longer a poor alternative that people use when they do not have access to a desktop computer. From the user’s perspective, depending on the task, the mobile device is equal to, or even superior to, the desktop computer. The mobile context is the perspective that allows us to understand and design for that reality.

Tasks and Micro-Tasks in the Mobile Context

Mobile devices give people the choice to decide how they want to use them and integrate them into their lives. Kim (2013, pp. 10–12) notes the wide range of behaviors that constitute contemporary mobile device use. Sometimes, people using mobile devices are in a rush and have only a short period of time in which to complete their tasks. Other times they are willing to spend extensive amounts of time viewing content, communicating, or playing games. People may turn to their mobile devices for distraction when they are bored, or they will rely on them when they are fully engaged in some activity. Although there was a time when the limited capabilities of mobile devices meant that they could be used to carry out only simple tasks, the functionality of today’s devices matches that of many desktop computers. People are using their devices to run more complex applications and in some cases have turned to their mobile phone or tablet as their only personal computing device.

In order to fully understand the mobile context, libraries need to seek a deeper appreciation for what motivates people's use of mobile technologies. For example, Silva and Firth (2012) describe how smartphones, tablets, and other mobile devices that we have here at the start of the twenty-first century provide people with a wide range of ways to filter, perceive, experience, and otherwise mediate their interactions with the space around them. Location-aware devices make possible new ways for people to access information related to their current context and to connect with objects and people in the space around them. The emergence of smart devices, appliances, and objects that are said to make up the *Internet of Things* (Kopetz, 2007) has moved us further along toward a future of ubiquitous computing, and already we are seeing how our personal mobile devices integrate with this world (Islam & Want, 2014). The idea of mobile technology as a means of mediating our experiences with the world around us provides a useful, broader perspective on why and how people seek to use their mobile devices and serves to ground the more specific observations we make about mobile device use.

The task a user is trying to complete can be thought of as consisting of several micro-tasks. Micro-tasks are a series of smaller tasks of limited scope that are each part of a larger workflow that is carried out to accomplish a broader task or goal (Kim, 2013, p. 11). For example, a student wanting to take a book out of the library might carry out following micro-tasks:

1. Get the title of the book.
2. Find out if the library has the book.
3. Reserve the book.
4. Receive notification that the book is ready to pick up.
5. Find out when the library is open.
6. Find out how to get to the library from a friend's place.
7. Find out when the friend is available to go with him or her to the library.
8. Take note of when they will be visiting the library.

This planning work done, the person would then need to travel to the library, meeting the friend somewhere along the way, locate the book in the library, and then check the book out. Each of the activities could possibly be broken into smaller micro-tasks, all of which would occur over an extended period of time, interrupted by whatever other activities that the person engages in as he or she goes about the day.

The above example is meant to not only demonstrate the complexity of analyzing tasks in the mobile context, but to also emphasize the importance of doing so from a user's perspective. A technology-centric approach will describe the task in terms of the actions that involve the technology. An organizational-centric approach will describe tasks in terms of the steps, requirements, and constraints of the organizational process they are related to. Only a user-centric perspective would, for example, identify elements like the user's desire to involve a friend as he or she seeks to complete the task. These types of micro-tasks, traditionally consid-

ered external and outside the scope of consideration, are an essential part of the mobile context and can no longer be overlooked.

It is possible to imagine a number of ways that each of these micro-tasks could be carried out, many of which could involve the use of some form of mobile technology. The challenge for us is that for each micro-task, people will choose which available technology to use based on their preferences and their assessment of how useful or well-suited a device or application is for a given task (Walsh, 2012b). These choices are likely to vary as the context changes and will be different for each person. Some people are comfortable with computing on the go, some prefer to at least be stationary, while others prefer to wait until they are sitting in a more traditional setting even to use their mobile phone, tablet, or laptop. Some prefer or have to use one device for everything, while others are able, and prefer, to use different devices for different tasks (for example: a phone for communications and looking things up, a tablet for reading, a laptop for writing).

The widespread adoption of mobile technologies has changed people's expectations about how they can use technology to communicate, accomplish tasks, and interact with the world around them. Libraries that ignore this reality and continue to implement technology based on the traditional, oversimplified model of desktop computing are likely to find themselves increasingly unable to meet the needs of their users. Libraries that make a commitment to explore and understand the mobile context of their users can leverage that understanding to improve not only their mobile and desktop technology deployments but also their user experience across all aspects of the library.

Exploring the Mobile Context of Your Users

Although acknowledging the inadequacy of the traditional desktop model to describe how people use technology is an important step, the mobile context only identifies the various elements and relationships that need to be understood in order to successfully conceive and implement mobile technologies. Relying on professional expertise or findings from the literature can inform our work, but only in a general sense. In order to develop a detailed and accurate understanding of the mobile context, libraries need to explore and immerse themselves in the mobile context of their users.

Libraries can begin by undertaking exploratory studies to better understand the mobile context of their users, to understand how they go about learning, teaching, and carrying out research, and specifically how they make use of mobile technologies to support these activities. These exploratory studies would allow libraries to understand their users' needs and behavior in a particular context to see

if there are opportunities to improve service using mobile technologies (or other solutions). Bentley and Barrett (2012, pp. 20–21) provide an example of such a process, describing a staged process used with design teams at Motorola and MIT that begins with a broad exploration of an area of interest to identify issues and opportunities to deliver new or improved products. From these initial explorations, they develop specific research questions that guide a second round of more specific observations, focus groups, and interviews. The understanding gained through this process is then used to inform the design of new products and services.

In many cases, libraries may consider themselves to already be past the exploratory stage. Having identified what they perceive as a need or opportunity to improve library service using mobile technology, these libraries will have a good idea of who and more importantly which behaviors they need to observe. Libraries may want to be cautious, however, and not focus too closely on their original ideas, but instead make their observations open enough to allow for some exploration of the problem space, if only to validate their original assumptions about the nature of the problem, as well as the potential for using mobile technology to address it.

The people and situations that we choose to study will depend on the motivation for undertaking the study. Observations should include all behaviors and aspects of the context that appear to be meaningful to the participants or that influence their behaviors in some way. For example, if you are specifically interested in improving services for faculty, you'll need to observe faculty members in a number of settings. If you are interested in supporting learning in the classroom, your study would include students, but also faculty and teaching assistants, with the observations being made in the classroom during (and potentially before and after) class.

Libraries traditionally turn to surveys, focus groups, and interviews as ways of better understanding the needs and preferences of users. Unfortunately, none of these methods are appropriate for exploring how people use mobile technology. You also cannot get an accurate picture of how people use mobile technologies in an artificial, controlled laboratory-like setting (Zhang & Adipat, 2005). If we are to develop an accurate understanding of the mobile context of our user communities, we need to observe the mobile context directly. Bentley and Barrett (2012, p. 42–43) recommend using task analysis as a framework to explore the mobile context. This can be done by asking participants to carry out the relevant tasks in the actual context of interest. Researchers can observe behavior directly, while asking participants to speak aloud while they carry out the task. Doing this gives the researcher access to what people are thinking. Partially structured interviews can be used afterward to seek further explanation and insights into observations made during the task analysis.

Even without the participation of users, librarians and project team members can benefit from situating themselves in the same contexts as their users as they

try to identify and develop solutions. For example, brainstorming sessions held in real-world contexts can provide teams with an appreciation of the opportunities and limitations within which their applications will need to work (Hinman, 2012, p. 56). Librarians are then likely to have a more realistic sense of how willing their users are likely to be engage with any given solution. It is also harder to ignore the constraints imposed by the context because librarians are actually experiencing them as opposed to having to imagine them.

It should be noted that many libraries will likely find it challenging to dedicate the time and resources required to carry out extensive field observations. However, any amount of time spent observing or directly experiencing the real-world conditions in which mobile technologies are used is likely to be beneficial to the design team. Even a one-hour observation session can provide insights and shift people's thinking enough to help them improve their understanding of the mobile context and therefore make better decisions about what to develop and how it should be designed (Bentley and Barrett, 2012).

Informing Your Mobile Technology Strategy

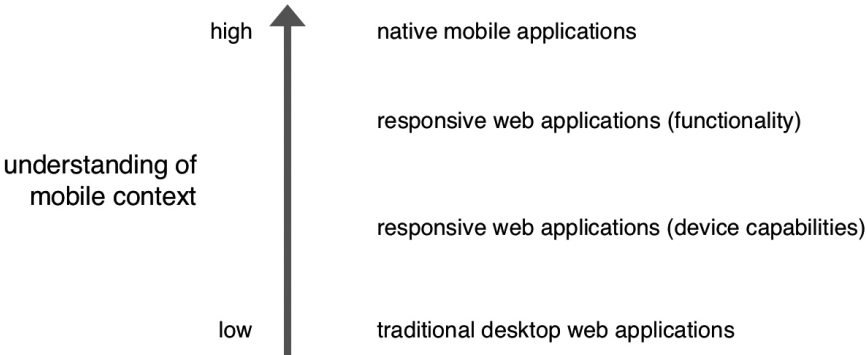
Libraries that want to achieve their goal of serving their user communities can no longer assume that people will adapt their preferences and needs to the services the library chooses to offer. Instead, libraries need to be ready to adapt their own services and operational models to meet the needs of their users (Mello, 2002). The mobile context provides libraries with a perspective that is focused on the users, the tasks they are trying to achieve, and the complex environment they are living in. From this perspective, libraries can gain a better appreciation for how their community uses the library and the ways in which the services and resources offered by the library fall short of meeting user needs. They can also better conceptualize changes that are likely to improve the user's experience.

There are several ways that a library can provide support for their services and resources on mobile devices. The decision on the most appropriate technology strategy is often based on the library's development resources and capabilities. However, an accurate assessment of the library's understanding of their users' mobile context can play an equally important role in choosing how to proceed. Kim (2013, p. 12) summarizes the trade-offs that libraries often consider when deciding on the technological approach that they are going to use for supporting mobile devices. Many academic libraries possess, or can easily acquire, the technical skills necessary to implement responsive web applications in a reasonable time frame. However, web apps run in a browser and have limited access to the full capabilities of the mobile device. Native applications can take full advantage

of the mobile technologies and often provide a superior user experience. However, providing this experience requires the library to commit to a significant and ongoing investment of resources. Native apps require specialized knowledge and are harder to develop. They are also platform-specific, meaning that libraries need to implement and maintain separate versions of their apps for each platform they need to target. As a result, few libraries are able to develop custom native applications, choosing to implement responsive, mobile-ready versions of their websites instead.

More importantly, it takes more than technical proficiency and capabilities to successfully implement a mobile solution. In order to be effective, libraries should take care to deploy technology solutions that are in line with their understanding of the mobile contexts of the community they serve. Figure 1.3 shows the level of understanding of the mobile context required to be able to effectively deploy the various types of mobile solutions.

FIGURE 1.3
Understanding of mobile context required for mobile solutions.



Libraries with little or no understanding of their users’ mobile context should limit themselves to deploying traditional desktop applications and websites. While users will still be able to access these websites on their mobile devices, they will be hard for people to use (Heimonen, 2009). A basic understanding of the mobile context of their users, and specifically an understanding of the mobile devices they use, can allow libraries to create responsive web applications that are tailored to the display and input capabilities and limitations of the devices.

As the library develops a more comprehensive understanding of the mobile context, it can move beyond “retrofitting old experiences into a new mobile medium” (Hinman, 2012, p. 43). It can use responsive technologies to customize its applications, adding, removing, and modifying functionality to suit the needs of the context. Libraries that go further, developing and maintaining a deep understanding of the user context, can invest in developing and deploying native apps

that take full advantage of the capabilities of the mobile device. Far from being a straight port of the library's desktop applications, these native apps can be tailored to the specific needs and realities of the patron's mobile context.

Libraries that lack the technical expertise or capacity necessary to design and build mobile applications themselves can opt to license third-party mobile applications. However, this does not alleviate the need for the library to invest in exploring and understanding the mobile context of its users. Understanding the mobile context will allow libraries to identify what applications are needed and how these applications need to deliver their functionality if they are to be used by students and faculty. Libraries will also be able to leverage their experience in observing, exploring, and understanding the mobile context to work with users to assess the various third-party applications as part of the selection process. By grounding the selection of third-party applications in the mobile context, libraries can ensure that the needs of their users are the primary consideration when establishing selection criteria and that these requirements will carry sufficient weight to balance other factors such as technical, organizational, and financial requirements in the final assessment.

Conclusion

Despite the rapid adoption of smartphone technology, we are still in the early days of mobile computing. At the time of writing, it has been less than ten years since the iPhone was released (Allison, 2007). Recently, we have seen the emergence of both wearable devices as well as the proliferation of embedded technologies that over time will provide people with even more computing options in any given context. We are still learning, both as individuals and as organizations, how to best incorporate this technology into our work and our lives. Our approaches, techniques, and best practices for designing, developing, and deploying software applications are still very much rooted in the traditional desktop model. The mobile context provides librarians with a user-centric perspective from which to better understand their relationships and interactions with the communities they serve, preparing them to better meet the challenges and opportunities presented by technological advances the future is sure to bring.

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