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Opportunities and Challenges for Technology Development and Adoption in Public Libraries

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ABSTRACT

In this paper, we discuss opportunities and challenges for technology development and adoption in public libraries. The results are based on a multi-site comparative study and thematic analysis of ethnographic work in three libraries, each in a different European country. The results explore the socio-technical practices, understandings, and perspectives of library staff and patrons when it comes to the role(s) and function(s) of libraries today. The contributions, which aim at informing the design and implementation of new digital services in public libraries, are two-fold. Firstly, the main findings from the study is presented under six themes. Secondly, a list of key opportunities and challenges focusing on 1) media and technology literacy, 2) institutional transformation and technical infrastructures, 3) resource constraints among library staff, and 4) a shift in focus towards supporting activities.

Author Keywords

Library; technology adoption; multi-site; ethnography; participatory design; public knowledge institutions.

ACM Classification Keywords

H.5.m. Information Interfaces and Presentation (e.g., HCI): Miscellaneous

INTRODUCTION

In the last decade, we have witnessed an extensive changing role of public libraries. Although still open to all, their role as gatekeepers to information and knowledge has been heavily challenged by digitalization and the opportunities it presents for access to information anywhere anytime [13]. This has forced libraries to redefine themselves and reinvent the services they supply to the urban community. As demonstrated by [21], a number of new libraries in the EU have recently started working towards breaking down the institutional walls of the library to redefine their role as an integrated part of urban life, or even as urban spaces in themselves [4, 22]. One key development of libraries has been to refocus on their role as third places [25] in cities, i.e., a communal place in between the spheres of home and work, which is essential to urban community building [19]. Given the trend of urbanization, libraries in urban areas now try to position themselves as key players in the development of cities and deliver new services. In the European project, PLACED, which is a partnership between a set of universities and public libraries in Europe, we aim to explore if, and in what ways, digital technology might support libraries in delivering these services [20].

When it comes to using digital systems and infrastructures to support their services, libraries have thus far focused on digital archive services. This is an understandable and required move, but this also means that there is a gap in our knowledge about the potentials for digital services to support the new role of libraries as places where residents meet, interact, and share knowledge. To advance our understanding of these issues, and to lay the ground for technology design, we have carried out a multi-site case study of libraries in Denmark, France, and Sweden, rooted in qualitative studies and Participatory Design (PD). In this, we focus in particular on the practices and perspectives of library staff and patrons, since these insights are crucial for understanding the opportunities and challenges for technology development and adoption in the public library domain, now and in the future. In this paper, we seek to answer the following research questions: *What are socio-technical practices, understandings, and perspectives of library staff and patrons when it comes to the role(s) and function(s) of libraries today? And which opportunities and challenges for technology development and adoption do these insights entail?*

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BACKGROUND

There is now a solid body of literature describing the dynamics of libraries as third places and directions to further develop it (e.g., [19, 1]). However, these directions rarely leverage digital services, perhaps in part because of the technical complexity they encompass. Nevertheless, there seems to be a need for digital services that can better support knowledge sharing and community building in libraries. Indeed, we can already see that librarians make use of existing social media platforms for outreach purposes [2, 27, 12]. In early HCI, Reich and Weiser call for the importance of situational aspects of computer systems in libraries [26]. A recent ethnographic study of makerspaces in libraries concludes that "without some sort of active facilitation of social interactions and collaborations, or other ways of revealing both the possibilities of the space and the actual uses of it, these makerspaces may fall short of their potential value to library users" [3]. While some recent projects touch upon the potentials of digital placemaking and activity support in libraries (e.g. [4, 20]), research in this field is scarce.

Theoretically, the current study is rooted in and apply insights from activity theoretical HCI [5], particularly recent developments on understanding the dynamics of activities with complex ecologies of users and devices [9]. The study is grounded in contextual design and bridges the traditional values in the Scandinavian tradition of PD [18] with recent research in PD applied to libraries (e.g., [15, 13]) and public knowledge institutions (e.g. [14]), in order to identify and incorporate the needs and ideas of various stakeholders—a development already noted in the design of digital search and archive services [23, 13, 11]. In particular, we focus on the needs of what Nardi and O'Day [24] refer to as library "keystone species": the librarians, who occupy a crucial role and function within libraries, especially in an information society. Through this study, we present opportunities and challenges for technology development and adoption that have been identified at three public libraries.

METHOD

In this study, we used a qualitative multi-site approach [6], where we studied three public libraries, each in a different country, over the course of six months. The primary research carried out included (1) ethnographic studies and semi-structured individual and group interviews, (2) co-design workshops with library personnel, and (3) a focus group with library personnel. Secondary research included analysis of the different websites and social media used by the libraries, and the ways in which the libraries market themselves and their activities online. When applicable, statistics were also obtained through the library staff.

Participating libraries

French library. The largest municipal library in France. Offering services for all, it welcomes over one million visitors every year, and hosts more than 4000 events annually. The library has more than 1.8 million documents. Development projects include several cases on participation, hybrid libraries and users' involvement in services and activities. One of the three main guidelines is to be a "public oriented" library.

Swedish library. A branch library in Sweden, located in one of the fastest growing districts in northern Europe. The library has 365 thousand visitors and around 400 events per year. To better accommodate the needs of the increased population and the dramatically increasing number of visitors a number of projects and activities intended to bring families, children and newly arrived immigrants together has been implemented mixing new technology alongside the traditional form of service.

Danish library. The main library of a city in Denmark that combines library and citizens' services. It is the largest library in Scandinavia, with 1,3 million visitors every year, and is the venue for around 5000 yearly events and activities for residents. Its extensive experience in user involvement and citizen engagement have developed into a bottom-up approach encouraging residents to be active parts of service development.

Study procedures and data collection

To address the aim of this paper, a set of studies was carried out with the librarians and staff at the concerned libraries. Our rationale for the different studies was to begin with establishing a dialogue and open collaboration with the librarians, and then moving on to focusing on the specific aspects of their work and if, and how, technology might support library activities. We then aimed to reach a contextual understanding of their responses by conducting observations of the library settings. The three methods are described in turn below.

Focus group - At an initial meeting, partnering libraries were invited to a focus group with the aim to hold a "candid, normal conversation" [28] about their mindsets, visions, values, and concerns surrounding library practices and technology adoption. The focus group comprised 5 participants (3 female, 2 male), aged between 37-46 ($M = 41$; $SD = 3.54$). Two were from Sweden, two from France, and one from Denmark. The discussion was moderated by three researchers. The discussion was audio recorded and later transcribed.

Co-design workshop - Following the focus group, a brainstorming co-design workshop [8] was carried out, the aim of which was more specifically geared towards exploring the participants' perceptions of organizing and carrying out activities at their respective libraries. The participants were the same as in the focus group with the exception that the director of the library in Sweden joined the workshop as well. Here, the participants were asked to fill out sticky notes surrounding what they do before, during and after activities in their roles as librarians, which were pasted on a poster. They were also asked about what (if anything) within these tasks they would like to see become easier to do, and to provide suggestions for improvement. The poster was used during data analysis.

Ethnography - To gain an understanding of the working realities of the libraries, ethnographic studies [7] were carried out at the three libraries. Over the course of a few weeks, researchers were present at the different libraries performing observations and interviews. A variety of different activities that took place at the libraries were attended. Also, the first author visited all three libraries to enable a comparison of the different sites. The protocol for performing ethnography was



Figure 1. Co-design Workshop

established jointly by two of the authors. Field notes were made throughout the studies.

Data analysis

All data were imported into the qualitative data analysis software NVivo 11 and analyzed according to thematic analysis [10]. Through continuous consultation with the second author, the first author coded nearly all data at individual codes, or at several codes where relevant. Then, codes were organized into the following inductively formulated main themes:

- Ideals and values expressed by the librarians
- Tensions between being a service provider and surviving
- Visions and realities of the library space atmosphere
- The roles of books, media, and technology
- Working stresses of librarians today
- Perceptions of, and visions for, activities

Data derived from each different study were treated collectively such that particular themes were developed from several different sources. For example, a particular working stress for librarians such as a lack of resources and time could be a theme that was discussed among the librarians during the focus group, written down on a sticky note as something they would like to be improved, while also being observed by the researchers during the ethnographic studies when librarians had to reluctantly explain to patrons that they did not have time to help them with their particular issues on a given day.

RESULTS

Here, the results from the thematic analysis are presented, where each sub-heading represents main themes, and ***italicized bold text*** represents sub-themes. Unless explicitly stated, the descriptions should be regarded as common for all sites - noteworthy differences as they pertain to the research question are clearly described and problematized when applicable.

Ideals and values expressed by the librarians

For France and Sweden, ***ethical values*** pertaining to democracy, empowerment and emancipation, as well as freedom of expression are seen as foundational for the mission of the library. During the focus group, a librarian from France explained that the freedom of expression is a right that they have to defend against threats of political power. However, it was also stated that librarians have to balance their role to be either activists or neutral. Indeed, defending any value connotes taking a stance, but, for the French librarian, this was also seen as leading to confrontations with politicians who may work towards suppressing such values.

The librarian went on to state that supporting the ethical foundations of the library can occur by means of a shared language within activities and library collections. A variety of activities are hosted at the library to support these ideals, such as activities seeking to raise children's awareness about their rights as citizens, or to build bridges across social groups. For instance, a recent activity described by the librarian pertained to organic agriculture where they invited immigrants who were experienced farmers in their respective countries of origin. Here, the interaction between immigrants and French natives interested in organic farming, who may otherwise live segregated from each other, came together by means of a shared language focused on agriculture.

During the focus group, the librarians discussed the significance of ***libraries as free services***, both in the literal sense that there are usually no financial costs involved for patrons, as well as in its free and inviting culture. Here, people from all socioeconomic and cultural groups are welcome, without any performance expectations or having to fear being judged for being there. The library targets both the individual as well as the collective, a fact primarily seen as an advantage. Nevertheless, this was also seen to present issues in the sense that marketing and communication is difficult. While a librarian in Sweden stated that the freeness of the library is actually their selling point, a French librarian explained that unlike the music industry, for instance, the libraries do not have any flashy news regarding their collections to offer—at least not in the same way as commercial industries do.

All librarians in the focus group agreed that the library was ***a place for teaching and learning***, where librarians were described as mediators of knowledge. Particularly emphasized was the idea of providing patrons with general education about society, and aiding them in their personal development. The analysis further revealed that librarians see it as their duty to help residents in society to function in their day-to-day life, whether it be in professional development, enlightening them about society, sustainable development, gender equality, or fostering their creativity and imagination. As an external organizer of a creative workshop for children in Sweden explained, it was important for her to teach children that they do not need to spend money on beautiful things, but that they can create artwork using recycled materials that they can find at home.

Interestingly, there was an expressed tension between ***technology literacy versus technology skill***, i.e., teaching residents, on the one hand, how to use and handle technology in their everyday life, and on the other hand, to develop the critical skills necessary to reflect upon technology and its ramifications, here referred to as technology literacy. While a librarian from Denmark gave greater weight to the former, French librarians were clearly more concerned about literacy. The librarians from Sweden placed themselves somewhere in between. As a librarian from Denmark expressed during the focus group: *"But I also think that it's important that we at the library show*

and visualize and experiment with technology to show people, and also the young people, that we are dealing with these new technologies and trying to work with them, and show how they work". Hence, their focus was on the image that they convey, making the library a place that could be relevant for an increasingly digitalized population.

In France, however, the activities that focus on technology use are not about learning how to handle technology, nor about conveying an image of the library as technologically savvy, but rather to raise awareness surrounding, e.g., privacy and data security in the digital age. As one librarian from France expressed: *"I think there is also the question of information literacy, and not only how to use the technology. [...] For the kids, they have access to a lot of information because they have technology. So they have the devices, so they can have the information, and they don't know how to measure, evaluate, assess, this information. So a lot of the work librarians in France are doing at this moment is really about going back to what is good information"*.

In Sweden, it was argued that libraries do not have a choice but to adopt the role of teaching residents how to use technology (e.g., teaching children programming, or teaching adults how to use digital services). In terms of technology literacy, while perceived as important, the librarians instead rely on schools to teach this to children.

Tensions between being a service provider and surviving

The primary influence experienced to threaten the existence of the library were explained to be ***external forces***. The obligation to report statistics were seen as a particular strain, since statistics are not able to detail the values and aspects that are taken most seriously by the librarians themselves. Librarians in Denmark and France noted that the need to report statistics invariably impacts values negatively. As one librarian in Denmark asked: *"How do you count in numbers that you are doing something for homeless people? That, you know, they're having a better day because they can come and join an activity for free, for example. And it's an activity in one of the open areas, so we don't maybe count the people coming there"*. A Swedish librarian further reported that some valuable library services are unable to produce statistics: *"There's always people who don't have a library card, but they come everyday, and they read the newspaper"*. While the librarians did not foresee their immediate futures as being threatened, they nevertheless perceived a trend in which their budgets were being reduced. The source of these forces were suspected to be of politic origin, particularly in France.

As a service provider, ***meeting the needs of residents*** was seen as important. Since they explained to not have any commercial interests in attracting residents to the library, they take no issue with non-users, i.e., people who actively decide not to come to the library such as busy adults and young teenagers. Rather, the problem was identified as being that certain groups in society simply do not realize what the library has to offer, where people in their 30s were considered one such group. Thus, they discussed ways to reach out to such groups so that they can have knowledge about what the library can potentially offer them. In line with this view, they said that, as service providers, they need to be prepared should any particular group wish to engage with the library. It was deemed important to target all social groups in the population, requiring creativity from the librarians to do so. Nevertheless, during a staff meeting at the Swedish library, a librarian expressed that activities that people do not go to should simply be cancelled such that the librarians can devote themselves more to the popular activities. In other words, demand should dictate the supply of activities, and this was demonstrated at the Danish library where, e.g., a recurring activity about literature was cancelled due to lack of participants.

Taken together, the aforementioned discussions pertain primarily to organized activities; however, residents' needs are perhaps more prominent in the everyday work of the library. In a large place like the Danish library, citizen services are available along with the traditional library services. Here, librarians are kept at the back of the library, whereas an information desk and other forms of services are located at the entrance for the quick convenience of residents and tourists. In contrast, the front information desks are staffed by librarians in the Swedish and French libraries. In Sweden, there is no citizen service office close to the library, so the librarians explained that a lot of people come into the library expecting help with tasks that the librarians are not professionally trained for, such as filling out forms or finding the way somewhere. As one librarian put it: *"Librarians are expected to know everything"*. In France, opening hours for civic services are reducing, forcing residents to seek help at the libraries instead, which causes some problems when the librarians do not know how to help them. All in all, the librarians expressed concerns about having to take over civic matters as offices were disappearing throughout their respective communities.

Despite humble efforts to function as service providers, librarians expressed a mindset that they constantly need to take ***steps towards preserving libraries*** by renewing themselves and keeping up with contemporary society. Here, a number of aspects were seen as important. First were the activities offered, where the number and versatility of activities were seen as having to answer to the demands of a broad audience. Second, the location and space was seen as crucial for conveying a desirable image of the library. As a Danish librarian explained: *"When we were at the old library just two years ago, and it was this quite dusty, old building, we had a completely different image. [...] They [residents] saw this old building, and they saw these librarians and all the books on the shelves. They saw what they've been seeing for many many years. [...] And then we moved to [the new building], and it was a giant step towards a new image, because it just attracts people"*. At the Danish library, they also offer tours, signalling a certain pride taken in the building itself. This is further supported by their choice to place librarians at the back of the building, which was explained to be a strategic choice by one of the employees. Not only are librarians spared from dealing with civic matters, but this placement also forces visitors to explore the whole library before reaching a librarian. The drawback to this was explained to be that patrons have trouble finding them. To solve this issue, the librarians have now been designated to

mobile carts in order to make them visible in the library space. However, it is unclear whether this approach is successful.

Visions and realities of the library space atmosphere

There is a number of services that attract patrons to the library, indicating that ***libraries are multifaceted places***. Accessing books is perhaps the most significant aspect that most people associate with libraries. In all three libraries, librarians explained that residents often come by for quick stops, perhaps to return or pick up a certain book that they have reserved, or access the library's printing and copying services. All librarians attested to the fact that patrons also come for a significant amount of the day to work or study, either on the library's computers or their personal devices. Both the French and Danish librarians mentioned that they also have "regulars", i.e., patrons who tend to go to a lot of different activities (particularly retired people who may have more time during the day). However, regulars were explained to not be as clearly observable in the large Danish library where there is a greater flow of people coming and leaving. In terms of young children, all libraries have designated children's departments where children's books are placed, coupled with some toys and seating areas. Here, kindergarten classes and families visit for some time during the day, or partake in a specific activity. Exhibitions of various kinds are also readily put on display at the different libraries. In the Swedish library, a librarian stated that they always welcome exhibitions by local artists, photographers, etc. However, one of the staff at the Danish library explained that exhibitions are frequently not engaged with by the patrons. Therefore, they try to encourage artists to have interactive exhibitions, e.g., where the artist is present in person to engage patrons.

There was a clear distinction between the overall atmospheres of the libraries as ***vibrant hubs versus quiet havens***, and this influenced expectations about patron behavior. While the Danish library can be described as a vibrant hub, the Swedish library is better described as a quiet haven, and the French library as more similar to a busy office building, although patrons generally did not make much noise there either. At the Danish library with its open spaces and eye-catching interior, the noise level was high, which people in general did not seem too bothered by. Here, children ran about, jumping and playing, older adults were playing interactive games in the children's area, a school class organized spontaneous theater, visitors had their lunch on the floor, and a band played (loud) Brazilian jazz music. At the same time, people were seated nearby at tables working on their personal laptops, seemingly undisturbed. Employees at the Danish library explained that activities in open spaces function as attractions and encourage patrons' spontaneity. As observed in the French library, a journal lecture held in an open area caught the interest of several bypassing patrons who then lingered at the event. This was conveyed to be one of the strengths of these open spaces.

In the Swedish library, on the other hand, noise seemed to be a sensitive issue for both patrons and librarians. People seated in groups at desks generally kept talking to a whisper, and if they grew too loud, patrons would actively complain directly to the group by asking them to keep the noise level down, or by contacting one of the librarians to sort it out (although the library had a policy not to tell people to quiet down). Another indication of this surfaced when parents with children came into the library asking where the play-area was. Here, the librarians emphasized that the children's department is for quiet reading and not for play. Furthermore, activities are almost always held behind closed doors such that the rest of the library not be disturbed. If bigger activities are held in the open space (e.g., author lectures), these take place after closing hours.

The roles of books, media, and technology

All librarians in the focus group tended to agree upon ***the lessened prominence of books*** in this increasingly digitalized society. As a librarian from France noted about the role of the librarian: *"It has changed from just gathering books, and now we are, we have to be the link between the literature, and the information, and the citizens"*. Notwithstanding, librarians still recognized the value and importance of the printed medium. This became clear in the references made to books during activities in the French library. Also, an external organizer at the Danish library argued that libraries should primarily be about books despite the supply of other services. Yet, during the field study at the Danish library, the vast number of bookshelves in the space seemed scarcely populated by actual people. In France and Sweden, however, this did not seem to be the case. In one of the branch libraries in France, for instance, most of their children's books were almost always on loan.

There is also a variety of ***technologies part of the libraries***. All three libraries have a book return machine, which librarians referred to as 'their robot'. Thus, the librarians do not have to sort the books themselves, but only shuffle the appropriate cart to its correct location in the library once it has been filled (although, they do have to find the correct shelf). In the Swedish library, they rarely have time to put the books back on the shelves; they therefore leave them on a separate cart with a sign encouraging people to also borrow books from this unsorted shelf. Unlike in Sweden, where the librarians send the books through to the robot, patrons at the Danish and French libraries return their books through the robot themselves. They can then watch as the books are carried off on the conveyor belts through glass windows. The librarians expressed much appreciation for their book return robots; some spoke about it in an anthropomorphic manner. In a branch library in France, the librarian said that the robot's name is 'Elmut', and that they are very fond of it. In Denmark, the name of the robot is 'Tage' (indicated as a pun as Tage is both a name, and a Danish word meaning 'to take'). In Sweden, they simply call it 'the robot'.

Other technologies, such as computers and tablets, are placed around the libraries for patron access. One exception is that, in Sweden, tablets are no longer available since these used to get stolen. Unlike the French library where tablets are mounted inside metal stands, and at the Danish library where screens are locked away when not in use, the Swedish library only had metal wires attached to the tablets which could be severed using fairly simple tools. All libraries also have digital displays on the walls showing, e.g., art exhibitions, and employees used

key badges for the doors. More specific technologies include touch screens with beta software at the Danish library, as well as music streaming service booths and a dance cabin at the French library. Booking is handled in either digital systems or on pieces of paper. For example, in the Danish library, booking a study room requires patrons to physically sign their name on a piece of paper next to a desired time slot. In Sweden, schedules for organized activities are kept in a physical folder, which a librarian referred to as *"a stone-age method"*.

The librarians considered the library a place that need to provide equal access to technology. Organized activities, presentations and walkthroughs are often held via digital screens or projectors. However, visual impairments influences the possibility for using this kind of technology. In a recurring activity for senior citizens in the Swedish library, the external organizer disclosed that they cannot hold presentations on screens since eyesight degrades with age. Further, the use of technology by the audience, unless it is an active exercise, is not encouraged. For example, during a lecture directed toward students in the French library, phones were asked to be switched off to not disturb the presentation.

Working stresses of librarians today

Librarians expressed a ***lack of resources and time*** to help patrons at a desirable level and meet residents' needs. For example, the need for access to computers is straining, where a librarian from the Swedish library expressed that they never seem to have enough computers to offer. In terms of organized activities, when asked about their documentation habits, librarians from all three sites expressed that they simply do not have enough time to, e.g., video record and upload activities even if they wanted to. Since there are no dedicated hours for this kind of work, the librarians felt that these initiatives do not happen unless there is a driving spirit. A librarian from Sweden further stated that it is not only about time, but also about knowledge how to document their work. At the same time, the librarians feel stressed that they need to begin planning the next activity when a former is over.

Digital overhead, while very much related to time restraints, was emphasized quite extensively by the librarians—particularly relating to lack of efficiency and user-friendliness with various digital systems that librarians are forced to use. Matters are made worse when new systems are continuously introduced, seemingly no easier to use than the previous. In Sweden, additional complaints surfaced frequently regarding technical issues. For example, a librarian working on adding literature to a language course in one of their systems complained about the tedious process of having to enter this information manually, rather than just selecting from the collection. Similarly, the RFID chips in the books were often not readable by the sensors, requiring the librarians to type them in manually. Also, when switching to a new label maker for books and shelves, even the most technologically savvy of the librarians expressed frustration with not understanding the new device. The same frustration could be seen when the library received new office software, and the technical issues thereof led to a stressful situation when an author came to the library to hold a presentation. Here, they had to test a number of different computers before they reached a solution.

An additional source of digital overhead is caused by faulty data mining of the Swedish library's website by third party sites. In the cafeteria, an exasperated librarian explained that she was tired of having to contact Google and other sites to explain to them that they were advertising incorrect opening hours and activity information, or using creative commons pictures for their activities that do not reflect the image of the library. She explained that she had to *"chase"* the different companies who are not quick to respond to their criticism. It was explained that the problem is made worse, since patrons seem to search for activities in the area through search engines such as Google and fail to double-check the information provided directly by the library, leading to misunderstandings.

Against the fact that libraries are indeed spaces open for anyone, they also tend to encounter situations and attract people with a variety of issues. In Sweden, the librarians expressed that they were tired of having to deal with issues of ***vandalism, theft, and altercations***. Indeed, confrontations and accusations are not uncommon there, and certain people come regularly to the library to engage in unethical/illegal conduct. The library now has a designated guard overseeing the premises who is familiar with the people who tend to cause problems, which seems to be somewhat settling for the staff.

Perceptions of, and visions for, activities

A number of ***observations of current activities and their participants*** held at the different libraries were done during the field studies. Activities held at the libraries are either one-off events or recurring ones (e.g., weekly or monthly). Lectures held by authors are special events. In Sweden, an author is invited approximately every 6 months, and these visits are planned way in advance and typically attract a higher than usual number of patrons. Activities that specifically target children and young teens are often directed at schools, unless they target toddlers in which case families are focused upon. Here, parents constitute carers of their children, who are not typically involved in the activities themselves. Common for the different libraries is that activities tend to attract patrons with a variety of social backgrounds.

Strategic planning and evaluation are major tasks associated with the organization of the activities at the libraries. They usually have wider goals which reflect the overall values and mindsets of the libraries. These are used as foundations when deciding, e.g., the balance of different types of activities, or to discuss with external partners how activities should be planned. In the Danish library, they can be contacted by magicians, authors, etc., who ask to do an activity at the library. The only requirement placed on authors/speakers is that there should be some form of Q&A after the session, but other than that, librarians do not interfere. If a band wants to come and play, they can provide a room, but the band needs to fix everything else. While this strategic planning is currently only handled locally, they are planning to work more closely with branch libraries in the future when organizing activities. Librarians in both Sweden and France mentioned that they would like to have more strategic planning of activities and their aims, and

also more discussions with branch libraries. They would also like to involve patrons early on in the planning stage such that activities reflect their needs. The problem seems to be that they do not have enough time.

While many activities are being carried out by external partners, the librarians' roles are typically to handle practical coordination, ensuring that the technology works, booking and providing a room or space for the activity, introducing the speaker, etc. Presenters are then typically left to their own devices, unless it is a bigger event with, e.g., a renowned author, in which case the librarians usually attend and continue to host the activity. In France, reporting and evaluation of activities afterwards is the most structured. Here, photographs of ongoing activities are taken for annual reports, however, these are not made publicly available.

Despite these current and desired practices surrounding the organization of activities, there are clear issues in bringing people together to create a joint effort. External organizers may have their own outlets for publicizing their activities, using posters and social media, while this is not strategically planned with the library. This increases disparity and lessens the possibility for libraries and the public to acquire an uniform view of what the libraries have to offer. Joint efforts surrounding planning or evaluation tend to die out unless there are driving spirits working in the libraries. But even then, there is a lack of uniformity because librarians are not knowledgeable about what other librarians are currently working on. They do not have time to attend activities organized by their colleagues. Sometimes, formal initiatives are made to strengthen the unity in this regard, yet, these also tend to be periodical. When the initiative ends, so does the collaboration.

Inclusion, accessibility, and service were factors seen as important when it comes to the way in which activities are handled. In terms of inclusion, this denotes the idea that everyone should be invited to partake in library activities. When asked if some digital communication technology could facilitate activities, the Swedish librarians speculated that digital interaction could facilitate patrons' involvement in controversial topics, encourage shy people who otherwise do not have the courage to ask questions openly during activities, encourage the asking of *"stupid questions"*, and allow for anonymous participation. Yet, this should not become the primary interaction channel between, say, presenter and audience—instead, questions should be asked out loud for a lively interaction. When it comes to accessibility, i.e., the idea that the library space, collections, and materials should be equally accessible for all residents, this was mostly emphasized by the Swedish librarians. New digital services were seen to present an opportunity to make the activities accessible for people who are not able to come to the physical library. Specifically, they found it valuable to be able to save questions and answers from activities. Also, they advocated strongly for the ability to live video stream activities so that anyone can take part. In terms of service, the librarians valued good service for patrons. In France, this could be seen in their devotion to participants' interests when they offered to email visual supports and references to people who were part of an activity. At the Danish library, it was suggested that external presenters could also engage with their audience a week or so after a lecture. They further expressed a desire to not only improve services for patrons, but also for themselves in their professional roles. In particular, a participant from the Danish library asked to have a service that made it easier to generate output from activities, but they also expressed a desire for better technical services in general that could make tasks more efficient for their visitors.

There are many outlets in which libraries try to ***market and increase visibility*** of their activities. These include library websites and brochures or magazines, social media (Facebook, Twitter or Instagram), paid newspaper ads, digital screens in the libraries, blackboards with event agendas in individual departments, personal invitations, and targeted advertisements (e.g., in the doctor's office, bakeries, supermarkets, etc.). Whenever activities are externally organized, these are further advertised by whatever special interest group is holding them. Regardless, the librarians are unsure of to what extent this marketing fulfills its purpose and reaches a broad audience. It is suspected, and somewhat corroborated by the field notes, that activities are best marketed through word-of-mouth, and that activities are found on external sites that data mine content from the libraries' websites. Here, special interest sites (e.g., a music website or family website) seem to be the more common sources as these deliver relevant results in search engines. In that sense, interests are not directed at the library itself, but rather at the content that happens to be made available there. One thing that is of importance to the libraries is to improve marketing and PR, but librarians would also like to create more links between collections and activities, as well as links between their websites and social media platforms. In Sweden, they expressed a desire to have digital screens put up showing what is happening in the library as well. While this is already done in Denmark and France, the field notes revealed that finding activities or relevant information via the screens was not easy. In France, for instance, there was simply too much information shuffling past on the screens that it was unclear if and when something activity-relevant would appear.

Activities held in closed areas sometimes require participants to book a ticket or seat in advance. This is done to limit the number of people, and for planning purposes. In Denmark, a small fee is sometimes charged, in order to make sure that those who have tickets actually show up. The Swedish library does not always offer this opportunity despite a limited number of seats, so librarians just hope for the best, which usually works out. However, the libraries have experienced ***issues with ticket systems***. The French library has occasionally experienced issues getting people to sign up beforehand. At the Danish library, participation in a popular one-time event held by an external association required a ticket. These had been sold out prior to the event, and people outside the library commented on the association's Facebook page about not having bought a ticket on time, and thus, missing out on the event. However, the event was held in an open area of the library, so people who happened to be at the library could simply drop by and participate in the event without a ticket. Taken together, the employment of ticketing systems seems to be overall problematic for libraries.

All librarians agreed that they would like to ***establish an activity life outside the activity itself***, a more solid and structured before- and afterlife of activities, although this might not be relevant for all activities that the library organizes. This could, e.g., take the form of online communities around a topic of interest. For example, a Swedish librarian imagined that a community for children about programming in Scratch or robots could be interesting. Children could sign up to the start-date and become a part of the community. There, children could ask questions, upload their videos/pictures of their creations and correspond with others in the group when there is no official meeting at the library. Sometimes the group could then meet in the library. If videos were used, they would not want to go via Youtube or similar commercial services; instead, they would want this handled within a digital service maintained by the library. Another practice that librarians value is the connection between activities and collections. A librarian from France explained that this connection was mainly about providing something valuable for residents. Although participant creations are often showcased during a limited time period, a link is not established between activities (e.g., a knitting workshop) and collections (creations made during workshop). It is, however, common practice that librarians hosting various activities try to convey this link to the people who are present at the event by, e.g., making a reference to a book they have at the library. They may also post links to relevant resources on social media or in a blog post about a particular event. Yet, they would like to leverage this practice by making activities and literature searchable together somehow.

In conjunction with activities, librarians have a number of tasks that they need to do. They do the practical planning and booking of speakers, rooms, etc; they try to invite people to come to the activity. During events, they may feature as a host, moderate, or lead the events themselves, as well as prepare necessary equipment. Following the activity, they need to clean up, conduct evaluations, do press reviews, and report statistics before going into planning the next activity and applying for funding. To ***ease the librarian's work burden***, librarians expressed a desire for a number of improvements. In both France and Sweden, they mentioned the need for better technical solutions and support (e.g., extra technical staff). Librarians in Sweden also raised the need for improved facilities, as well as a joint calendar over activities to ease their planning. While digital services could potentially help, it is important that this does not contribute to increased digital overhead as discussed earlier. Also, both Swedish and Danish librarians expressed a vision where external organizers took more responsibility for marketing their activities. Today, external organizers may record, live stream or post pictures on social media during events. It is possible that the venues of external organizers bear more fruit, since these may have more followers in their specific community than the library does.

The ***view on patron participation*** varied. One idea that surfaced during the studies was the notion that patrons should become more actively involved in planning, marketing and carrying out activities at the libraries. In Denmark, a lot of residents use the library (or primarily their facilities) for work and private study. Here, it seems to be the general conviction of the employees high in the hierarchy that residents should not simply use the library in this way without giving something back. Today, the Danish librarians make active requests of participants to hashtag pictures potentially uploaded on social media with the library hashtag, but their visions extend that. One suggestion was that people should create official events where they share what they are working on, help market events, etc. Although librarians in France and Sweden also mentioned increased patron participation, this relates more to empowering patrons, and not about the libraries benefiting from their labor. As the librarians further noted, patrons will only get involved in activities if they feel motivated to do so. Today, if they are to involve participants in some way, a Danish librarian suggested that it needs to happen during the event and not after, e.g., through a digital platform. However, other librarians at all three libraries expressed skepticism towards shifting focus from activities to technology, referring to the negative focus and immediacy instilled by modern social media.

In terms of participant-generated content (whether it be a book review, a drawing, a video of the event, etc), it was argued by all librarians that whatever content associated with a particular activity is produced by patrons, this should be clearly marked if linked to the library collection. Although they did express a desire to create links between activities and collections (see above), any content would need to be screened and approved by a librarian, while also being clearly marked if accessed by others. For example, say a patron produces a written review of a book in the collection; this review could potentially show up as a search result in the library search database because there is a link between the book and the review. However, in such a case, it would need to be tagged with a keyword indicating that it is patron-generated content, and not necessarily reviewed by the library.

DISCUSSION: OPPORTUNITIES AND CHALLENGES FOR TECHNOLOGY DEVELOPMENT AND ADOPTION

Scrutinizing the findings from the qualitative studies, we can identify four overarching themes of particular importance when it comes to developing and deploying technologies in contemporary library spaces. As is clear from the study, the libraries in question are heterogeneous, and even within the same library, there are a wide range of practices and understandings of what the library is, and could come to be. Due to this heterogeneity, we cannot offer clear-cut recommendations for developing novel technologies. Rather, we will unpack each theme as a tension between challenges and opportunities. Both sides need to be taken into careful consideration by developers and decision makers. In this way, the themes can be understood as high-level design considerations, as in [14]. The first two themes, related to technological literacy and activities as driver for library use, concern the services that libraries offer (See figure 2 and 3); the latter two themes, related to institutional transformation and resource constraints, concern the institutional frames and conditions that can critically affect technology adoption (See figure 4 and 5).

Media and technology literacy

Challenges - The results point to a shift from the library as provider of books and gatekeeper of knowledge towards hav-

MEDIA AND TECHNOLOGY LITERACY	
Challenges	**Opportunities**
Media accessible to all	Digital support for all
The lessened prominence of books	Link between collection, information, citizens
Provide equal access to technology	Resources adaptable to different capabilities
Teach privacy and data security	Digital community and peer support

Figure 2. Media: Opportunities and Challenges

ing an important role for making media not only accessible to everyone, but also providing equal access to technology. This includes raising awareness on central, novel aspects related to technologies, e.g., privacy and data security in the digital age. Interestingly, the lessened prominence of books does not seem to make the library less relevant, perhaps even on the contrary, but it challenges the role of librarians. Some librarians have the experience that they do not possess the right skills for being front-runners when it comes to new technology, and others experience a huge burden from having to make sure that all residents can take part in the ever more digitalized society on equal ground, as in [16]. A huge challenge also lies in providing enough computers, tablets, etc., in order to answer to the increasing need for digital access. At the same time, some librarians feel that technology should not grow too prominent.

Opportunities - Although there are many challenges coupled to the shift towards media and technology literacy and the changing role of libraries and librarians, there are also many positive experiences and opportunities. With new technology, it is possible to reach those who are otherwise unable to come the library. This can be by live broadcasts or documentation of activities, but also by supporting more active participation by establishing possibilities to engage even though not present. There are also many possible new ways to support external organizers of activities at libraries to have more direct contact with patrons, forming the basis for new communities.

Activities as driver for library use

Challenges - One of the clear tendencies in our studies, which is also reflected in recent research contributions that examine the state and development of public libraries, is the move towards supporting, organising, and hosting activities. This is seen as a key element in the current transition that libraries undergo, and as a core component of libraries as third places. This shift entails a range of challenges and shifts in understandings and practices. Activities are ephemeral, in contrast to traditional static media, and managing activities is very different from curating and managing a collection. Currently, there is poor technological support for this shift, as the main focus has been on digitalizing collections. There is currently a strong disconnect between the two, and even though patrons would like to have some form of access to activities as part

ACTIVITIES AS DRIVERS FOR LIBRARY USE	
Challenges	**Opportunities**
Use of resources without engaging in community	Participant activation in organizing activities
Lack of knowledge sharing regarding activities	Documentation and archiving by participants
Activities live only here and now	Structured before- and afterlife of activities
Creations and knowledge generated in activities not visible after the activity	Knowledge and creations from activities searchable in the collection
Resources in the collection need to be curated by library personnel	Community and external organizers curation
Exhibitions rarely noticed	Interactive exhibitions

Figure 3. Activities: Opportunities and Challenges

of the collection, there are yet no well-suited tools for library staff to provide this. This reflects a basic lack of understanding of how activities could or should be captured and represented Moreover, if activities are to be better integrated with the collection, it would require additional resources for library staff to generate and curate this content. Likewise, the very task of organizing these activities is time-consuming and goes beyond the traditional competences of library staff.

Opportunities - On the other hand, our studies also show that there are great potentials in better supporting activities. There is a very strong interest in activities among patrons, who visit the library both to participate in activities they have heard of prior to their visit, and to browse and discover ongoing events in a more serendipitous manner. There seems to be an opportunity space for digital services that make it easier to create and organize activities, connect them to the library collection, and capture and curate information during them. For instance, in the case of an author visit and book reading session, services could enable the organizers to quickly create the activity, link it to a physical location in the library, share this information via social media and the library website, and link to books and biographies on the author. Given the resource constraints, such services could support input from the library patrons who participate in the activities. If we take the example of the author visit, activity participants could, for instance, post comments and questions, record videos and take photos of the session, which could then be curated by the responsible librarian. Digital services could also offer better opportunity for participating before and after an event, e.g., by allowing patrons to post questions and reviews, and discuss the author's works before the author visit, and it could enable them to maintain these discussions and post reflections after the visit.

Institutional transformation and technical infrastructure

Challenges - We have witnessed large organizational changes over the last decade that have forced libraries to refine themselves. Some of these changes are due to budget cuts in other

INSTITUTIONAL TRANSFORMATION AND TECHNICAL INFRASTRUCTURE	
Challenges	**Opportunities**
Information overload on screens	Link collection, activities, websites and social media
Ticket and booking systems	Intertwine the digital with the physical spaces
Take over civic matters	Digital peer support
Space matters	Activities in open spaces attract

Figure 4. Institutional transformation: Opportunities and Challenges

organizations, leaving librarians to take over, e.g., civic matters, tourist information, and even personal data security in an online world. While large data mining companies might help to make patrons aware of library services and activities, it can also provide confusion when the information is not provided first hand by the library itself. Many librarians find it hard to reach residents because of information overload and a constant fight for attention. This is an issue even when patrons are physically in the library, where the many screens in the library space can seem a good solution for providing information about library activities and services, but can also add to the general sense of information overload. As it has become more prevalent for libraries to organize activities, systems for room booking and ticketing have become commonplace. However, in a free and open institution such as the library, patrons tend to reserve seats and spaces that they do not use. This can be remedied by, e.g., small fees, but such solutions run counter to librarians' values. In the midst of the institutional transformations of libraries, there is also a growing concern among both library staff and patrons as to whether the identity of the library should be that of a home to noisy and lively activities, or that of a quiet haven.

Opportunities - The shifting role of the library presents new opportunities in establishing links between the library collection and the library activity, potentially enriching both. This extends to connecting the library collection and activities with social media platforms. It is clear from our studies that physical space matters, which becomes evident, e.g., when activities in open spaces attract new audiences compared to activities happening in closed spaces, but new digital services could play a role in building and extending social connections and relations between patrons, i.e., not just to create awareness of the activities and the collection, but to strengthen local community building [20].

Resource constraints among library staff

Challenges - Library patrons expect both the services that they traditionally associate with libraries, e.g., access to media, and help in finding and discovering media, as well as new services, such as the aforementioned ones relating to technology literacy and organization of activities. This places a strain on library staff resources, firstly in terms of having less time for each type of task; secondly because the new services also require library staff to build up new competences and knowledge. Moreover, the push to continuously rethink the organization and one's own role in it can take its toll on library staff, as also reported in [17]. In sum, this means that designers must seriously take into account whether new technologies can alleviate or overcome the resource constraints; otherwise, there is a clear risk that new technologies will not be adopted.

RESOURCE CONSTRAINTS AND LIBRARY STAFF	
Challenges	**Opportunities**
Lack of knowledge, time, and infrastructure to document activities	Documentation to increase inclusion, accessibility, and service
Integration of new technology and software	Systems adaptable and integrated to existing technology infrastructure
Work efforts in organizing activities	Increased citizen participation in organizing and communicating activities in partnerships
Vandalism, theft, and altercations	Open spaces for everyone

Figure 5. Resources: Opportunities and Challenges

Opportunities - While library staff are acutely aware of the resource constraints, there is a particular potential for technologies that can ease, combine, rethink, or redistribute tasks. If we consider, e.g., the move towards organizing and hosting activities, this can for instance come in the form of digital services that can outsource tasks otherwise undertaken by library staff to, e.g., local community groups and NGOs. Novel services could enable them to create and announce activities, invite participants, assemble materials related to the activities from the library collection, etc. This would enable library staff to save time on these tasks and enable them to take on a different role in which they can focus more on establishing partnerships and developing overarching themes for activities and recurring events.

CONCLUSION

Our agenda has been to map contemporary challenges and opportunities associated with technology development and adoption in public libraries, especially as they pertain to organized activities. We have done so through qualitative studies in libraries in three different countries, aiming to investigate socio-technical practices, understandings, and perspectives of library staff and patrons when it comes to the roles and functions of libraries. The main themes we have identified-demonstrate that the heterogeneity and ongoing transformation of libraries today make it a very challenging domain for design and technology development. It is a domain in flux, but also one in which there seems to be potentials for developing digital services that better support these new and emerging roles of libraries.

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