

PLACE-CENTRIC DESIGN FOR PUBLIC DISPLAYS IN
LIBRARIES

ALIX DUCROS

Under the direction of:
MOHAND-SAÏD HACID
&
AURÉLIEN TABARD
&
CLEMENS NYLANDSTED KLOKMOSE

Université de Lyon
LIRIS
SICAL

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*The outer world, from which we cower into our houses,
seemed after all a gentle habitable place*

— R.L. Stevenson

To Zola, who was the most lovely excuse to delay this thesis.

ABSTRACT

Public libraries are lively third places welcoming people from all levels of society. In addition to offering extensive collections of documents, they host a wide range of events: from public readings, clubs, to hands-on participatory activities. Each of these events sparks the curation and creation of a variety of content by librarians and patrons: articles, bibliographies, playlists, etc. Documenting these events also leads to the creation of new content such as video or audio recordings of conferences.

This diverse set of documents related to events is a complement to the preexisting collections. They provide a valuable trace of the history of the library, and opens opportunities for novel ways to communicate about events. Unfortunately, both the events and their related resources do not have a clearly defined place in the library. They vanish once the event is over. To anchor event-related content in a meaningful way in the library space, I followed a place-centric design approach. Public displays appear to be promising mediums for place-centricity. Yet, in an already crowded information space, their use and placement raises questions both on their design and their aim.

In order to get a more precise idea of how we could anchor digital information about events in public libraries, we partnered with three public libraries in Sweden, Denmark, and France. We conducted a series of design workshops to imagine how future public displays could be used for events and leverage the places of libraries. This process led to the co-creation of 18 design concepts. From these I draw a design space of public displays in libraries and identify that public displays are perceived as an opportunity for the library to give access not only to new categories of content: live videos, websites, or playlists, but also to content created by the patrons themselves.

While conducting these workshops, we reflected on the impact of design tools and activities on the creation of prototypes. To better understand how design tools could shape place centric design, I conducted a study comparing paper and digital sketching tools in situated enactments. I developed Ébauche, a collaborative sketching tool for public displays that supports bodystorming and compared it to paper in a study involving 16 interaction designers. Using both tools, designers were able to roam in a library while designing information systems for public displays. I found that paper led to broader exploration of ideas, and a deeper physical integration in the environment. Whereas, Ébauche encouraged refined and more sophisticated interactive enactments.

Finally I present and discuss a case study of a public display technology probe: Explore, that conveys information about events in various places of libraries. Explore was deployed over a total of nine months in the public libraries of Lyon, Aarhus, Goteborg. The different versions of the probe displayed information about events of the library and additional content coming from librarian curation or patron participation. The use of the probe highlighted resources curated and created by librarians that could add value to existing collections of the library. This long field test of Explore also allowed us to identify that public displays were anchored in the place in Lyon by integrating with the mediation activities of the librarians, while their integration in the event's space and time proved to be particularly relevant in Aarhus.

RÉSUMÉ

Les bibliothèques publiques sont des tiers lieux vivants accueillant des personnes de toutes les tranches de la société. En plus d'offrir de vastes collections de documents, elles accueillent un large éventail d'événements : lectures publiques, clubs, activités participatives, etc. Chacun de ces événements donne lieu à la conservation et à la création d'une variété de contenus par les bibliothécaires et les usagers : articles, bibliographies, listes de lecture, etc. La documentation de ces événements conduit également à la création de nouveaux contenus tels que des enregistrements vidéo ou audio de conférences.

Cet ensemble très divers de documents liés aux événements vient compléter les collections préexistantes. Ils fournissent une trace précieuse du passé de la bibliothèque et ouvrent la voie à de nouvelles façons de communiquer sur les événements. Malheureusement, les événements et les ressources qui y sont liées n'ont pas une place clairement définie dans la bibliothèque. Ils disparaissent une fois l'événement terminé. Pour ancrer le contenu lié aux événements dans l'espace de la bibliothèque, j'ai suivi une approche de conception centrée sur le lieu. Les affichages publics semblent être un média prometteur à cet effet. Pourtant, dans un espace informationnel déjà chargé et accueillant des activités très diverses, leur utilisation et leur emplacement soulèvent des questions tant sur leur conception que sur leur objectif.

Afin d'avoir une idée plus précise de la manière dont nous pourrions ancrer les informations numériques sur les événements dans les bibliothèques publiques, nous nous sommes associés à trois bibliothèques publiques en Suède, au Danemark et en France. Nous avons mené une série d'ateliers de conception pour imaginer comment les futurs affichages publics pourraient être utilisés pour des événements et tirer parti des lieux des bibliothèques. Ce processus a conduit à la co-création de 18 concepts de design. A partir de ces concepts, je propose un *design space* des affichages publics dans les bibliothèques qui nous permet d'identifier de nouvelles opportunité pour ce medium pour donner accès non seulement à de nouvelles catégories de contenu : des vidéos en direct, des sites web, ou des listes de lecture, mais aussi à du contenu créé par les usagers eux-mêmes.

Tout en menant ces ateliers, nous avons réfléchi à l'impact des outils et des activités de conception sur la création des prototypes. Pour mieux comprendre comment les outils de conception peuvent façonner un design centré sur le lieu, j'ai mené une étude comparant des outils de dessin papier et numérique dans des mises en situation. J'ai développé Ébauche, un outil de dessin collaboratif pour affichages

publics qui prend en charge le bodystorming, et je l'ai comparé au papier dans une étude impliquant 16 designers d'interaction. En utilisant les deux outils, les designers ont pu se déplacer dans une bibliothèque tout en concevant des systèmes d'information pour des affichages publics. J'ai pu constater que le papier permettait une exploration plus large des idées et une intégration physique plus intégrée dans l'environnement. En revanche, Ébauche encourageait des mises en scène interactives plus travaillées et plus sophistiquées.

Enfin, je présente et discute une étude de cas d'une sonde technologique d'affichage public : Explore, qui transmet des informations sur des événements dans divers lieux des bibliothèques. Explore a été déployé sur une période de neuf mois dans les bibliothèques publiques de Lyon, Aarhus et Goteborg. Les différentes versions de la sonde affichaient des informations sur les événements de la bibliothèque et du contenu supplémentaire provenant des bibliothécaires ou de la participation des usagers. L'utilisation de la sonde a également mis en évidence des ressources conservées et créées par les bibliothécaires qui pourraient apporter une valeur ajoutée aux collections existantes de la bibliothèque. Ce long test d'Explore sur le terrain nous a aussi permis d'identifier que les affichages publics s'ancraient dans le lieu à Lyon en s'intégrant aux activités de médiation des bibliothécaires, tandis que leur intégration dans l'espace et le temps de l'événement s'est avérée particulièrement pertinente à Aarhus.

PUBLICATIONS

Some ideas and figures have appeared previously in the following publications:

Alix Ducros, Clemens N. Klokmose, and Aurélien Tabard. 2019. **Situated Sketching and Enactment for Pervasive Displays.** In Proceedings of the 2019 ACM International Conference on Interactive Surfaces and Spaces (ISS '19). ACM, New York, NY, USA, 217-228.

Daisy Yoo, Peter Dalsgaard, Alix Ducros, Aurélien Tabard, Eva Eriksson, and Clemens Nylandsted Klokmose. 2020. **Putting Down Roots: Exploring the Placeness of Virtual Collections in Public Libraries.** Proceedings of the 2020 ACM Designing Interactive Systems Conference. Association for Computing Machinery, New York, NY, USA, 723–734.

Daisy Yoo, Aurélien Tabard, Alix Ducros, Peter Dalsgaard, Clemens Nylandsted Klokmose, Eva Eriksson, and Sofia Serholt. 2020. **Computational Alternatives Vignettes for Place- and Activity-Centered Digital Services in Public Libraries.** In Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems (CHI '20). Association for Computing Machinery, New York, NY, USA, 1–12.

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Carla Gröschel, Peter Dalsgaard, Clemens N. Klokmose, Henrik Korsgaard, Eva Eriksson, Raphaëlle Bats, Aurélien Tabard, Alix Ducros, and Sofia E. Serholt. 2018. **PARTICIPATE: Capturing Knowledge in Public Library Activities.** In Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems (CHI EA '18). ACM, New York, NY, USA, Paper LBW060, 6 pages.

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ACRONYMES

AR Augmented Reality

BML Bibliothèque Municipale de Lyon

CMS Content Management System

CSCW Computer Supported Cooperative Work

ENSSIB École Nationale Supérieure des Sciences de l'Information et
des Bibliothèques

HCI Human-Computer Interaction

ILS Integrated Library System

PD Participatory Design

UbiComp Ubiquitous Computing

CODE

Source code of applications presented in this thesis are available at
<https://github.com/Placed-Project/>.

INTRODUCTION

1.1 MOTIVATION

Increasingly, public libraries host diverse events, ranging from public readings, and language clubs, to hands-on participatory activities such as creative workshops and maker events. Events at public libraries are intrinsically open to broad audiences and are complementary to the libraries' rich collections. Not only do these library events offer possibilities for teaching and learning, they can also contribute to the strengthening of local communities [33, 52].

Each of these events happening in the library spark the creation of new resources. In the course of preparing an event, librarians curate a lot of documents: bibliographies, videos, websites, etc. in addition, they themselves also create new resources: they write event presentations, articles, edit video recordings. External organizers, speakers, and patrons also contribute to the knowledge created during the event: related documents and readings, or pictures [24, 89].

This sums up as a very diverse collection of resources that could become a valuable asset the library could offer, alongside traditional collections. This new asset also creates a new entry-point for patrons: from being interested in an event, patrons can access a wealth of documents on specific topics, that come from the library but also from external sources, all curated by librarians.

However, librarians have little control on the visibility of these resources: 1. They are difficult to make visible in the already crowded information space that is the library. 2. Many digital resources are only available through difficult to use websites, or via social media platforms owned by third parties [1, 22]. 3. Many event related elements disappear once the event has past. Others documents such as photos or comments from patrons do not even have a place to be hosted and simply vanish.

From this observation, a question arises: how can we make these resources as visible as the physical collections of the library ? To answer this, public displays appear as an interesting medium as they offer an animated, malleable, and interactive solution to display digital resources. Moreover the technology is well established and offers a solution to allow interaction with this diversity of resources straight-away in the demanding setting that are public libraries.

However, unlike more common digital experiences, public displays existence is tied to a place. Designing them is an opportunity to leverage the environment where they are installed, react to the dif-

ferent people that pass by, or adapt to changes and events happening around. Opportunities for design in a crowded hall vastly differ from a quieter reading room. Understanding the place, and taking these parameters in account during the design process rises questions. While there has now been a variety of tools and methods available to design digital applications, there is not as much available when we shift our focus away from devices to instead focus on a specific place.

Designers who want to leverage a place have to consider elements such as architectural constraints, social context, and changes happening as time passes. Understanding these multiple parameters during the design process is non trivial.

This thesis explores tools and methods to help designers understand place and create situated information displays in libraries.

1.1.1 *Context*

The work presented in this thesis was conducted in the context of the PLACED project. PLACED is a European research project, responding to the call for development of new digital public services. From 2016 to 2020, through PLACED, we sought to support the transformation of libraries from knowledge centers focused on documentary collections, to spaces for sharing knowledge through the organisation of participatory activities and cultural events. Through the development of new digital services, aimed at facilitating the discovery of events, the participatory documentation of these events, and their integration into the collections, the PLACED project took up questions of mediation, participation and visualisation. In practice, this means that this dissertation was conducted in collaboration with HCI and Interaction Design researchers in Aarhus, Denmark and Gothenburg, Sweden.

1.2 THESIS

This dissertation argues that Place-Centric Design, not only benefits from in-situ experience as well as stakeholder implication in order to leverage situated knowledge, but also requires field deployment of probes to properly understand and leverage practices of the place. In order to defend this, this dissertation:

1. Presents expectations and concerns of librarians regarding the development of public displays in the library space through the co-design of a design space with library staff.
2. Presents our reflection on the impact of design tools and activities on the creation of prototypes. We present a novel design tool and a study we conducted to better understand how design tools could shape place-centric design.

3. Presents how the public display probes we developed during our research project integrates with the different dimensions of the library as a place.

1.3 RESEARCH PROCESS

The research presented in this dissertation is written within the field of Human-Computer Interaction (HCI), and draws on Participatory Design (PD) methods practices.

1.3.1 *Triangulation process*

The HCI field being at the crossroad of several disciplines, our work can be seen through perspectives from social science, computer science, and design [60]. Because of this, the different steps we took during the research project could be assigned to one or the other domain. This results in a triangulation process during which different approaches (observations, participatory workshops, artefact design) complement each other. Following a triangulation process, we led our research process as presented next (fig. 1) :

In order to set up theoretical foundations for our work, I conducted a ① literature review of Place-Centric Design. This led to identify promising methods to explore, regarding the design of public displays in a participatory manner while considering Place as a central element to design for.

However, the review also highlighted the lack of proper tool available to support aforementioned methods in a place-centric manner: situated sketching, prototyping, and participatory design. From the specifications resulting from the review, I designed and developed ② Ébauche , a digital sketching tool specifically designed for situated design activities for public displays.

To evaluate Ébauche but also explore situated sketching activities for place-centric design, we setup a controlled study ③ with student designers. From the results we obtained, ④ we identify opportunities offered by Ébauche and situated design activities to envision interactive scenarios and place-centric devices. We also discuss limitations caused by the introduction of our tool, leading us to discuss alternative ways to understand place during design.

In parallel of this work done on situated design, we conducted design workshops ⑤ with librarians to explore how they envision future digital services and public displays in libraries. The design concepts imagined as a result allowed us to come up with a design space ⑥ of public displays in libraries. Among these workshops, a series of six workshops set the ground for the design of our first public display technology probe [50] Explore ⑦.

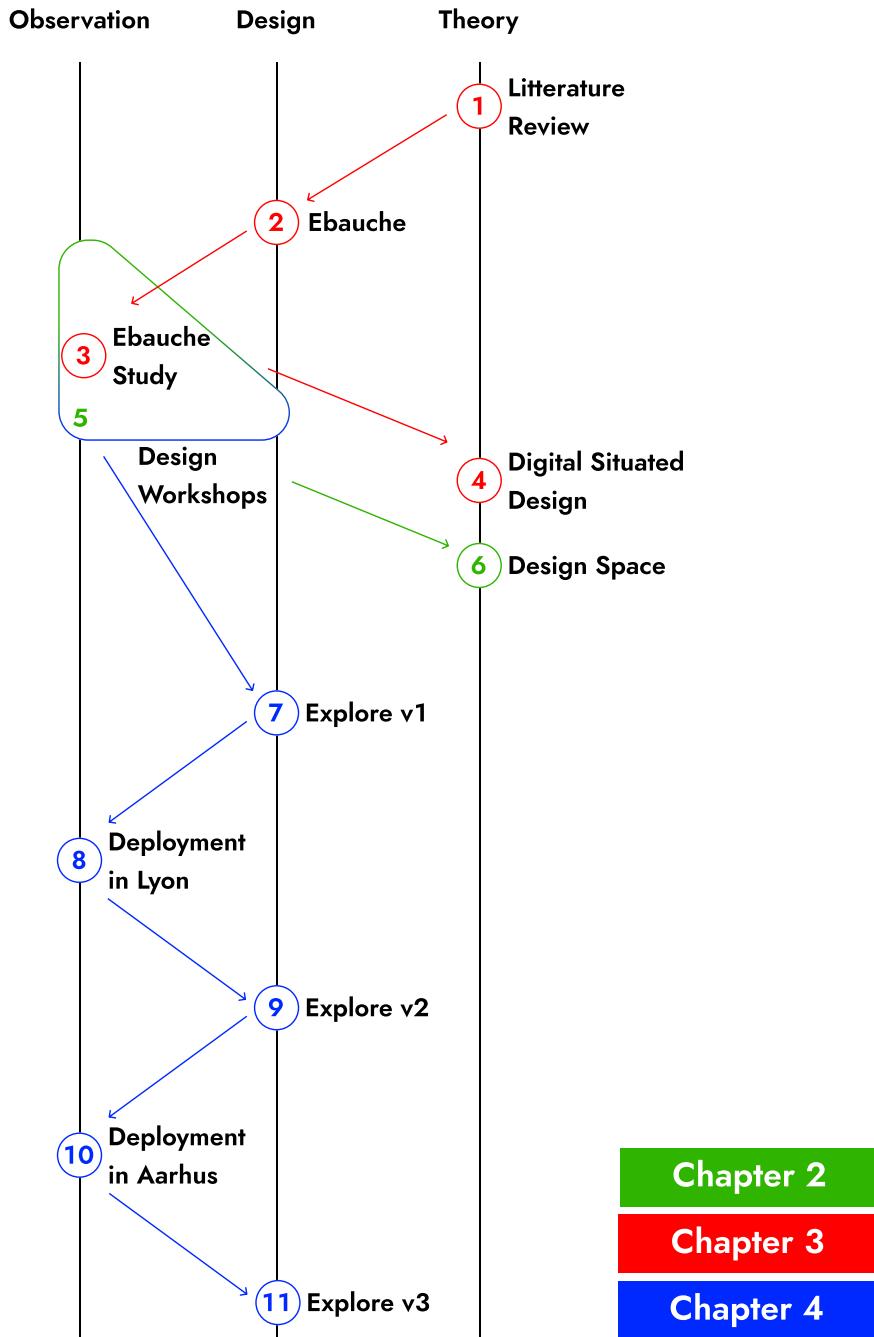


Figure 1: Thesis triangulation process, navigating between Theory, Design and Observation.

With the goal to understand how the use of Explore integrates or impacts the already existing practices of librarians and patrons, we deployed it during a two months period in Lyon ⑧ during which we conducted observations and interviews with librarians.

Observations of Ébauche in use as well as follow-up discussions with librarians provided us with valuable hints to improve the probe. Additionally, integrating with the research prototype from our Dan-

ish collaborators would open Ébauche to new resources. Thus we developed ⑨ a second version of our probe.

Again, we observed Ébauche in use in Aarhus' public library ⑩ leading us to further expand our learnings regarding the design of public displays in library, and how they may transform the place they are installed in as well as the practices of its inhabitants.

With this new knowledge, we developed a third version of Ébauche in collaboration with the music department of the Lyon library ⑪.

1.3.2 *Participatory Design*

Relying on observations only to inform the design process would paint a truncated understanding of the context of public libraries. To get a deeper understanding of the place we were designing in, we followed a participatory approach throughout the research presented in this dissertation.

Participatory Design involves processes drawing from multiple research methods : ethnographic observations, interviews, and analysis of artifact among others. One of the main goals of this method is to discover the invisible aspects of human activities [92]. In this regard, as we consider that one of most difficult to approach dimension of Place is the tacit knowledge of the human activities, Participatory Design impose itself as a very relevant approach.

However, we should not limit our consideration of Participatory Design to a set of methods that allow designers to obtain a better knowledge of a human activity. Instead, it seems important to also consider this practice through the lens of Citizen Participation [4] and see participants not only as a source of knowledge but as full fledged stakeholders of the design and have ownership rights on the process and outcomes.

The Participatory Design process we followed made us work closely with multiple library employees with different backgrounds: librarians, staff, and contractors. The observations, interviews, and workshops we did with their help allowed us to considerably augment our knowledge of their work reality and the life of the library. Moreover, their involvement from the beginning to the end of the design process led to the making of prototypes based on demands coming from their visions and respecting the concerns they voiced.

1.4 THESIS OVERVIEW

This dissertation, although based on articles that have been written over the last three years, will present my work in an order more suitable to the understanding of the progress of my thesis. The thesis is organized in three main chapters as follows.

1.4.1 Designing Situated Displays in Libraries

First of all, I will present the general context in which my thesis took place and the stakes involved. All along our exploration of public displays in libraries, we partnered with public libraries to design and evaluate our research prototypes. We conducted a series of design workshops with librarians to build an understanding of places of the library and propose designs. This process also allowed us to discuss concerns and expectations librarians had regarding upcoming digital public displays and draw a design space out of it. We aim to give an answer to the following questions:

- What do librarians expect from public displays?
- In which places do librarians envision new information displays and digital services digital services?

1.4.2 Sketching and Enacting Pervasive Displays

Holding design workshops in libraries led us to raise questions on how to conduct participatory design activities while leveraging the place we design for. Place can be considered as a combination of several dynamic material, social, and cultural factors [63]. Public displays, along with other Ubicomp technologies, are rooted in different places and contribute to shape them in return. To design these devices it implies to consider all those dimensions that make a place. Designers must explore: the structural organisation of the space, its inhabitants, activities held there, and how these parameters change over time.

Considering all these parameters is a challenging task during the design process. We focused on three main approaches: 1. Understanding the place by being there, 2. Understanding the place by involving its inhabitants, and 3. Facilitate testing of ideas at early stage of the design process.

Design tools from the scientific literature and professional sphere are already plenty and answer various use cases. However, in the specific case stated above, we felt short of options. This observation motivated us to design Ébauche to be used during workshops with librarians and evaluate it. In this chapter, in order to understand Place during the design process, we propose tools and activities to designers and propose an answer to the following questions:

- How does a digital sketching tool impact design outcomes compared to usual paper tools?
- Besides in-situ activities, how can we understand space during design?

1.4.3 Explore: Public Displays to Support Events in Libraries

As a result of the design workshops we conducted, we developed and deployed several iterations of a public display probe in libraries: Explore. With the design of Explore, we focused on two main goals. A first objective was to convey information related to events and digital resources originating from patrons and librarians. The second objective was to explore with librarians how to place this digital artefacts in the library, amid physical resources. We describe in this chapter the design process and the decisions we took as well as the challenge we faced. Throughout the deployment, we were able to observe how patrons and librarians interacted with the displays in the various setups. We share the learning we were able to make regarding the use and the design of these public displays in libraries. As a result we intend to answer the following questions:

- How can a public display leverage the places and the collections of the library?
- How does a digital resources platform such as Explore integrates in the practices of patrons and librarians?

1.5 CONTRIBUTIONS

In this dissertation, I present the research and design work we have done in collaboration with librarians and how librarians envision public displays in the library. We thus present empirical findings from these workshops. This process led us to investigate methods for Place-Centric Design, we studied how tools for situated sketching impact design outcomes and present a tool we developed to challenge our hypothesis. From our discussions with librarians, we developed Explore, a public display technology probe, and deployed it in three libraries. In this dissertation, the contributions we present are split in three: empirical findings, theoretical results, and technological artefacts.

1. Empirical findings

The results from eight workshops with librarians allowed us to establish a collection of design concepts for public displays. From this collection we develop a design space reflecting librarians' preferences and expectations of public displays in libraries. Through this, this dissertation contributes with domain-specific insights on how situated public displays may support library professionals.

2. Theoretical results

From the study we conducted on situated sketching activities during design workshops, I present how traditional and digi-

tal tools lead to different design outcomes. Where classic pen and paper tools tend to encourage designers to be creative and explore various ways to leverage a place in their design, our digital sketching tool fostered interactive devices that benefited from more refinement. I extend these results by presenting a critical feedback on situated design and offer pointers to different ways to consider a place.

3. Technological artefacts

In the course of our research process, we developed two main artefacts:

- a) **Ébauche**, a digital sketching tool for tablet. Its primary aim is to enable collaborative drawing while being in the place designers are designing for. Sketches of user interfaces made on the tablets can be sent effortlessly to nearby displays in order to test interactive scenarios.
- b) **Explore**, a series of public display probes for libraries. Designed in collaboration with librarians. The displays showcase events of the library, and offer additional resources in relation, curated by librarians. A first version of Explore focused on its integration with the physical collections of the library, the second version focused on enabling the display of participation from patrons, and the third version was designed as a mediation tool for librarians to communicate on events.

2

DESIGNING SITUATED DISPLAY FOR LIBRARIES

In order to get a better comprehension of public information and displays in libraries, we followed a participatory design process with library professionals to imagine public displays in this context. We conducted a series of design workshops to understand the places that make a library and propose designs of public displays. This process allowed us to discuss concerns and expectations librarians had regarding public displays and draw a design space out of it. We use these observations to define characteristics for public displays so they can support activities in libraries.

2.1 INTRODUCTION

The advent of ubiquitous computing, and more specifically the ever increasing presence of interactive public displays in public spaces challenges design practices. As computing devices become integrated in the environment, the place where technology is deployed becomes increasingly important in the design process.

The apparition of public displays already happened in public libraries. Such institutions can easily be equipped with dozens if not hundreds of displays to communicate with their patrons in a near future. For these displays to better leverage the different places they will be installed in, Messeter argues that the design process must be “grounded on its social, cultural and material conditions but should also account for the dynamics of place that continually change these conditions” [63].

Yet, deciding on the relevance of these public displays, their location, and what resources to meaningfully show on them is challenging. More broadly, complex sociocultural contexts are difficult to consider in designs. In public libraries, the use of public displays still raises many questions, either in regard to their situation in space or their appropriation by librarians.

Therefore, in order to get a better understanding of the roles of public displays in libraries, we conducted participatory design workshops with library professionals.

Out of the eight workshops from the PLACED research project we are focusing on in this study, I planned the first six with the goal to understand expectations and emerging interests around the use of displays in public libraries. Their results were used as a basis – or at least inform – the design of some of the PLACED prototypes. The other two workshops were part of a dissemination effort led by

Raphaëlle Bats and thus their results did not translate into prototypes. From the analysis of the outcomes of this series of workshops, 18 design concepts emerged, focusing on the design and use of public displays. Based on this, I propose a design space that reflects librarians' preferences and expectations regarding the design and use of public displays in libraries.

With this design space, I contribute with domain-specific insights on how situated public displays may fit in the space and the socio-cultural context of public libraries. I then highlight recommendations for design of public displays in libraries.

2.2 RELATED WORK

2.2.1 *Public Displays*

The term "Public Display" can be understood in various ways if we look at the existing literature. The formulation is seemingly able to include many concepts that display some form of information in public places. The domains of situated [67] and embedded [102] visualization would fit especially well into this description and provides numerous inspiring visualization of information using various display mediums such as smoke clouds [35], chalk drawing on the street [9], or augmented reality projection [81] (see fig. 2).



Figure 2: (a) Nuage Vert, one of the Pollstream proposals, (b) RFIG lamps, an augmented reality situated visualization, and (c) TidyStreet, a street-wide visualization

Similarly, literature on media architecture offers a design space [44] of displays not too far away from the visualizations aforementioned.

Aspects such as the location, environment, interaction modality, and information displayed are core parameters that have to be considered in both domains. As pointed out by Moere et al., media architecture displays, like other situated visualizations rely heavily on "context" [68], and as we also identify, the dynamic nature of the places and their activities remains an important challenge.

Our work takes inspiration from the rich corpus of situated visualization, and in a lesser way from previous works on media architecture, the emphasis from both on context has been core to our work. However, the public displays I worked with in our research project are mostly screen based. Narrowing our scope in such a way might seem limiting at first sight, but the interaction possibilities, the malleability offered by pixel displays, as well as their general availability make them an ideal medium for real life deployments in public libraries.

The design of public displays has been a concern for researchers for some time and previous literature offers insights on their design. The reflection around representation of data in a situated manner may be traced back to early research on ubiquitous computing at Xerox PARC [100]. With the notion of calm technology [101] introducing digital experiences at the periphery of our attention, it opened the way to ambient displays [103] that relied on the leveraging the surroundings of the user to convey information. Whether by using ambient sounds or discreet animations at the periphery of vision, this kind of device is quite different from the public displays I consider. However they were pioneering in integrating the surrounding context as part of the design of the device.

The advent of affordable LCD displays paved the way to extended possibilities to visualize content. Whereas ambient displays conveyed focused bits of information, the large screens of public displays allowed for extensive content display. While design principles can be transferred from traditional poster graphic design to create digital public displays, their dynamic and interactive possibilities offer extended interaction modalities. Müller et al. [69] build on this to classify public displays according to mental models applying to them (poster, window, mirror, and overlay) and suggest interactions fitting one or the other mental model. Bendinelli et al. [8] through the presentation of a design space propose a set of aspects to guide the design of public displays (contextual, content, and presentation).

However, in the ever growing ecology of information and signs in public spaces, digital public displays compete for attention. Similar to the "Banner Blindness" [19], where users have been accustomed to see uninteresting content and ads in specific place of a web page, the use of public displays for advertisement developed "Display Blindness" [70] for passers-by. The study presented by Dalton et al. [26] leveraging eye-tracking offers deeper insight on this blindness. In

In this dissertation, our use of the term "public display" will relate to such screen based devices and not to other types of displays.

stead of being blind to the display, passers-by only spend a very short time looking at the display, in the order of a third of a second. Designers must leverage that time span to spark curiosity in passing-by users and lead to an interaction. Multiple strategies have been recommended to alleviate display blindness, either using specific design guideline to design the content [70], using “curiosity objects” [49], but also leveraging context in which the display is installed [26, 27].

For a passer-by to notice the display and get a grasp at its content is already a tedious task. Inviting them to interact with the display is an additional challenge for the designer. The way a passer-by progressively comes to interact with a public display can be compared to marketing or sales funnels [99] and consist of several progressive steps. There are typically six steps defined in previous work [65] going from just passing-by, to direct interaction with the display and finally leave the place. At each step, the user has varying attention levels. In order to progressively get him interested in interacting, the display should adapt its appearance accordingly [85]. This evolution of use through several steps reveals the fluid nature of public displays. First being similar to an ambient displays, appealing to the peripheral awareness of passer-bys [103], to then become an individual device an user may have complex interactions using personal information [98].

2.2.2 *Public displays in libraries*

As other public places, such as malls and stations, public libraries embraced public displays as a medium of communication. If we look at how they are used on the field, we may already distinguish patterns. Because libraries by nature offer access to large volumes of documents to their patrons, public displays have been used to act as a digital entry point into the collections. If we stretch our definition of public display to include publicly available computers in libraries, an example common in public libraries, one would remark that their main use is to offer a digital access to the search engine of the library collections.

This example is borderline considering our focus on public displays and really does not offer any situated experience to users who can access the same search portal from home.

Close to our definition of public displays we may find various commercial digital signage solutions in libraries to display news, floor plans, and upcoming events. In some libraries as is the case with Dokk1, Aarhus’ public library (see fig.3), we may even find interactive screens at the end of some shelves, showcasing books related to the shelves they are attached to.

Because curating and giving access to collections is still one of the core mission of libraries [88], it is unsurprising to observe that HCI research offers multiple examples of novel library services using public displays. Hinrichs et al. [48] re-imagined traditional search portals through the use of tangibles and collaboration around public displays.



Figure 3: (a) A display embedded on a shelf at Dokk1 (b) Bibilotouch, a collection exploration tool, and (c) Bohemian Bookshelf, a serendipity exploration device

Researchers have also explored how digital tools could augment children’s exploration of libraries, e.g., by exploring combinations of tangibles and large touch screens [29], or augmented floors and tabletops [34].

Going beyond traditionally available focused search, Thudt et al. sought to support serendipitous search [95] using large touch-screens and playful exploration. These unique installations facilitate collaboration and enable multiple users to interact together, but they also offer leverage for the library space in ways that traditional search stations do not.

Moreover, physical collections are not the only type of resources that libraries have to offer. Digital resources are becoming increasingly important. With InfoGallery, Groenbak et al. sought to promote awareness of libraries’ digital collections on large public displays [82] as such resources has little presence in the physical space of library. Building on this work and taking inspiration from zoomable user interfaces [11], Bibilotouch [62] leverages public displays to blend digital and physical collections and offer patrons a fluid and serendipitous exploration.

With libraries hosting more and more public events, communicating about activities surrounding the collections has become increasingly important [89]. This shift creates additional data the library has to work with: event information, partners presentation, public participation, etc. Once again situated public displays offer an interesting medium to host this kind of content that has to frequently be updated. In many libraries we were able to observe lists of events displayed on screens, or slideshows presenting curated events (see fig.4).

On the research side of this domain, projects such as UbiLibrary [56] or BiebBeep [53] paved the way to prototypes from the academic community displaying more than the collections. They aggregate and display multiple sources of information (events, news and social media, locally relevant information, new acquisitions, etc.). However this rising usage of public displays in libraries is still not well covered by HCI research.

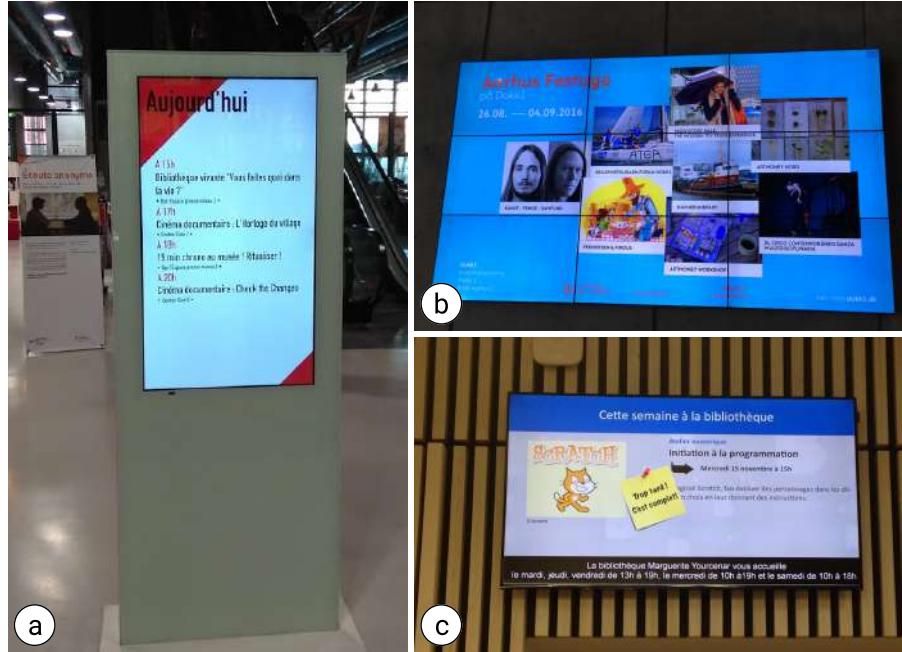


Figure 4: (a) Upcoming events in the hall of the Centre Pompidou library, (b) a showcased event in Dokk1, and (c) a slideshow of curated events in one of the branch libraries in Lyon

2.2.3 Designing for a Place

HCI research is often associated with Human- or User-Centred Design process. However, in addition to the criticisms that may apply to this approach [74], the advent of ubiquitous computing challenges interaction design practices. Especially for public displays that are meant to be embedded in a specific place, user-centered design is not enough and successful design should take in account the surrounding context [26, 27], the building they will be in [3], and the various activities of passers-by [96].

As computing in general becomes increasingly integrated in the environment, designers must consider the places in which they will deploy technology as being integral to the design [31, 46]. Messeter argues that designing for a place must be “*grounded on its social, cultural and material conditions but should also account for the dynamics of place that continually change these conditions*” [64].

This recommendation is particularly relevant to us. Public libraries are a perfect example of third places [77]. This term coined by Oldenburg in the 80’s designates social places separate from home and workplace (respectively first and second place). Typical examples are clubs, cafés, or churches, these are places favoring interactions between individuals indifferently from their social origin. Public libraries also are usual examples of third places and as such they not only fulfill a traditional role of giving access to collections of documents, but also increasingly take on the mission to foster community,

cultural, and educational activities [90]. This sort of diverse and rich human activities are what shapes a place and drive how it evolves. If we consider the activities happening in public libraries [55], they then are a paragon of the definition of place. Thus, a Place-Centric approach to design new technological devices in public libraries seems extremely well suited.

However, considering Place in the design process is challenging to achieve. Managing the social, cultural, and material conditions that evolve as time passes by and in reaction to events is no simple task.

Public libraries are an example of a place that welcome very heterogeneous populations coming with various goals in mind. Social and cultural aspects there are especially complex to understand and integrate in design. In the partner public libraries we worked with, in order to apprehend the cultural specificity of the place and its inhabitants, we first relied on methods well known in HCI.

To build a stronger knowledge of who the patrons are and what are their activities, we chose to first immerse ourselves in the place and practices of the main library in Lyon. Using methods from ethnography is now common in HCI [23], and have been adapted to fit the rapid cycles of technology building [66]. While such observational methods indeed helped us to build the sort of knowledge we seek, many aspects of life in libraries came from extended interviews with stakeholders, either event organizers or librarians.

Nonetheless, even with all the data from various observations and interviews, as outsiders it is easy to still form misconceptions. Involving inhabitants of the place during the whole design process is thus especially important. Not only does it allow the designers to be constantly challenged on their understanding of the context, but it makes possible to collect tacit knowledge that could not have been gained without deeper and hands-on discussions with tenants.

Citizen participation already has decades of existence in domains such as city planning [2, 13], where participation of citizens will create important every-day impacts. Of course this way of doing has been adapted early on by HCI practitioners willing to involve their users [12] and evolved into Participatory Design methodologies [92]. It would however be limiting to consider participatory design just as a set of methodologies. Within HCI, the term covers various definitions: from using it to gain field knowledge to more advanced consideration of the rights of people to have a say on (design) decision influencing their lives [45].

While participatory design appears ideal to ground the design of public displays in the surrounding socio-cultural context, we did not want to limit our approach to context understanding. Following Arnstein's ladder [4], a process of participation needs that decision power has to be delegated to the participants. Besides the political implication of such a delegation - on which I will not expand - it helps build

an increased sense of community across participants [84] and encourage everyone involved to take an active part in solving the problem.

2.3 A DESIGN SPACE OF PUBLIC DISPLAYS IN LIBRARIES

In order to develop a new technology, it is crucial to review and understand what are the constraints of the context we are working in, and what was already tried by others. To obtain this understanding we must look at how former prototypes and research explored the “space of possibilities”. In the Design and HCI community, such a space is commonly referred to as a Design Space.

In the context we set ourselves in with the PLACED project, it quickly appeared that the Design Space of “public displays in libraries” remained barely explored and even less delimited. In order to advance research in this domain, and help future designers getting leads to promising exploration spaces, I sought to define a Design Space of public displays in libraries. To achieve that, I rely on the numerous design concepts coming from workshops with librarians.

2.3.1 *Design Space Definition*

The notion of "design space" is often used in interaction design, although with different understandings of what it refers to. I offer an overview of these works and position our development of a design space for public displays in libraries in relation to them.

One of the early mentions of design space is found in the sub-field of design rationale, in which MacLean et al. [59] refers to it as a "space of possibilities", which — in line with design rationale — can be analysed so as to make informed decisions and select the optimal possibilities. Beaudouin-Lafon and Mackay offer a wider definition, proposing that a design space "constrains design possibilities along some dimensions, while leaving others open for creative exploration" [6]. This definition emphasises that the design space at the same time presents the designers with constraints and opportunities, delimiting what can be explored but also making clear the possibilities within this bounded space. This perspective mirrors several contributions that explore the notions of problem and solution spaces in design, such as Dorst and Cross' study of the co-evolution of problem and solution spaces [30].

Inspired by Dorst and Cross as well as Heape's thesis on the notion of design space [47], Dalsgaard and Halskov [25] and subsequently Biskjaer et al. [10] add to this the understanding that the design space can be seen as a conceptual space, which the designer(s) co-construct, navigate, and transform through the design process. It is a co-constructed conceptual space in the sense that it is composed not only of concrete constraints, e.g. physical conditions and fixed

budget and time constraints, but also of parameters that designers identify, articulate, and explore. Our understanding of design space is in line with Biskjaer et al.'s definition of the design space as "a conceptual space, which in addition to being co-constituted, explored and developed by the designer encompasses the creativity constraints governing the design process." [10]. This definition underscores that the design space is not given a priori, but that a central part of design is concerned with examining and building an understanding of constraints and possibilities. This echoes Schön's understanding of design as reflective inquiry [87], in which the task of the designer is not just to provide optimal solutions within a predefined space of possibilities, but also to explore and establish this very space of possibilities. Biskjaer et al. moreover propose a simple format for mapping the main features of the design space in a parametric matrix, i.e. one in which the main parameters that designers can address form the main categories, and the different conditions that designers can somehow manipulate or select amongst are listed for each parameter [10]. I use a similar but somewhat expanded parametric mapping of the design space for public displays in libraries in this chapter. The approach is furthermore inspired by the notion of boundary objects [93], in that mapping out a design space can serve as a boundary object between collaborators in a design process. This process can help collaborators develop a shared understanding of the problem they face, the options they have, and the dilemmas they might need to resolve.

2.4 METHOD

To build this design space, I rely on design concepts co-created with librarians during the PLACED project. The workshop participants generated several concepts, sketches, and narratives, which I collected and analyzed to generate a design space.

2.4.1 Workshops with librarians

Throughout my doctoral program and the PLACED project, our team conducted a series of participatory design workshops to explore the relationship between events organized in libraries and the library collections. The workshops investigated how to document events and how public displays could be leveraged to communicate about events in the library space.

In total, we conducted eight workshops, in three countries, involving a total of 88 librarians, between from 2017 to 2020 (fig. 6). The workshops presented below all focused on how to incorporate events within the physical space of the collections. As such we privileged any form of public display located in the library space, rather than

public websites or mobile apps that can be accessed from anywhere. I detail the workshop themes, participants, and organization below.



Figure 5: (a) Workshop 2 and 3 took place in Lyon with 10 participants (b) Enactments were recorded to produce video prototypes of design concepts.

Workshop 1 involved 25 librarians split in six groups during a 1h30 session.

The workshop took place in a university library. Each group was invited to work on a concept with a situated sketching activity [15]. Participants were invited to conduct a reflection on the collections related to events in the library, and how to create a space for events in the library. Out of the six, only three groups produced sketches complete enough to be analyzed in the scope of this study.

Workshop 2 & 3 involved six librarians and four researchers during 1h30 to 2h sessions. These two workshops were part of a series of six participatory design workshops taking place in a major public library. During those, participants took part in situated sketching and enactment activities. The goal of the workshops was decided in a collaborative process with the participants: giving events a physical form in the library, by leveraging paper artifacts or by situating them in the collections. These two workshops led to the creation of four design concepts in the form of sketches, storyboards and video prototypes.

Workshop 4 & 5 involved three librarians from the music department of the aforementioned public library and two researchers during two sessions of 2h. The workshops took place in the office of the librarians. In this series of workshops, participants were invited to reflect on the events they organize, the resources they manage, and the places of the library where digital information about events could be relevant. The workshops led to the design of three design concepts with sketches and textual descriptions.

Workshop 6 involved five HCI researchers, two library researchers, and three librarians split in two groups during a 2h30 long session. This

workshop took place in a different public library and participants performed situated sketching and enactment activities. During this workshop, participants were asked to create concepts that would give visibility to past, current and upcoming events in the library by leveraging the library space. Each group created a video prototype of their concept.

Workshop 7 involved 26 librarians during a national conference for music librarians. Participants split in four groups for 1h30. We invited participants to reflect on how to create links between events and the music collection of the library. Three groups proposed concepts around public displays, with sketches and scenarios.

Workshop 8 involved approximately 25 librarians and students in library science during a Summer School in North America. The workshop lasted 2h and participants split in four groups. We invited participants to propose a concept that would help link events and collections in the library, considering 4 types of publics (collection users, events attendees, participative activity attendees, non-users of the library). Three groups proposed concepts with sketches and scenarios.

All workshops shared similar goals and instructions, with the following specification: Workshops 1, 2, 3 and 6 had an emphasis on enacting the concepts and served as a field to explore situated sketching [15] and the use of digital prototyping tools for displays [32]. The workshops took place in public libraries spaces in order to foster the use of contextual elements. In workshops 2, 3, 4 and 5, participants had the expectation that the design activities would ultimately lead to development and test of prototypes in their own libraries. In workshops 1, 6, 7 and 8, it was clear to the participants that the design activity was exploratory and would not be followed up with developments.

I filtered the concepts that involved public displays of one form or another. This resulted in 18 design concepts. I aggregated the concepts in a single document for coding and analysis, together with the compiled observation field-notes. In total, I gathered seven video prototypes and eight sketches to complement my notes to feed into the analysis.

2.4.2 Developing a coding schema

The collection of design concepts I gathered enabled us to identify directions librarians deemed promising. This was particularly relevant for an area where the literature is sparse, i.e., place-centric public displays in libraries.

I conducted a thematic analysis of the concepts as this method is well suited for identifying, analyzing and reporting patterns within

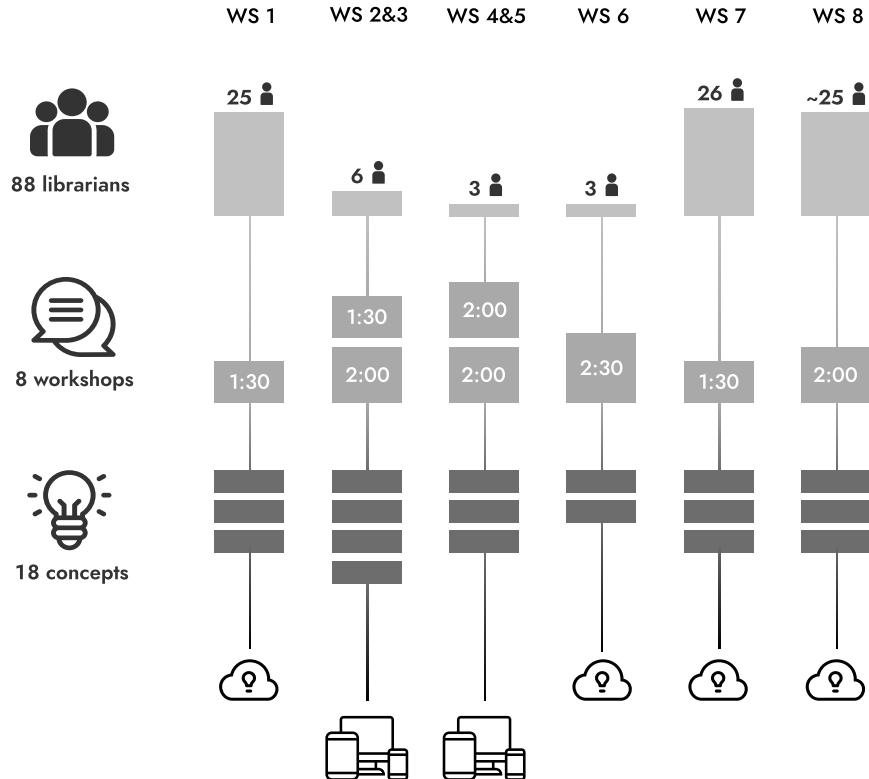


Figure 6: Overview of workshops including from top to bottom, for each group: participating librarians, sessions, concepts, and later development.

qualitative data [14]. The core analytical process consists in developing a coding schema by associating data to codes and to find out the repeated patterns that describe the relationship between codes. I built the codes by following our research questions, and used inductive analysis to challenge our initial assumptions, through several coding iterations.

I started by collecting and transcribing the sketches and scenarios in a shared document of design concepts. I went through multiple coding iterations with a triangulation approach [40] to improve the validity and reliability of the coding schema. The first iteration of the coding schema was developed by me while I was attempting a first classification of the concepts. Then, this first version of the coding schema together with the entire data set was then discussed with another researcher from library science. Then Clemens, Aurélien, and me independently coded the same subset of cases on the basis of the second version and aggregated their produced data together to ensure agreement over the coding schema. Once a definitive coding schema was agreed upon, I analyzed the 18 concepts as they appear in tab. 3.

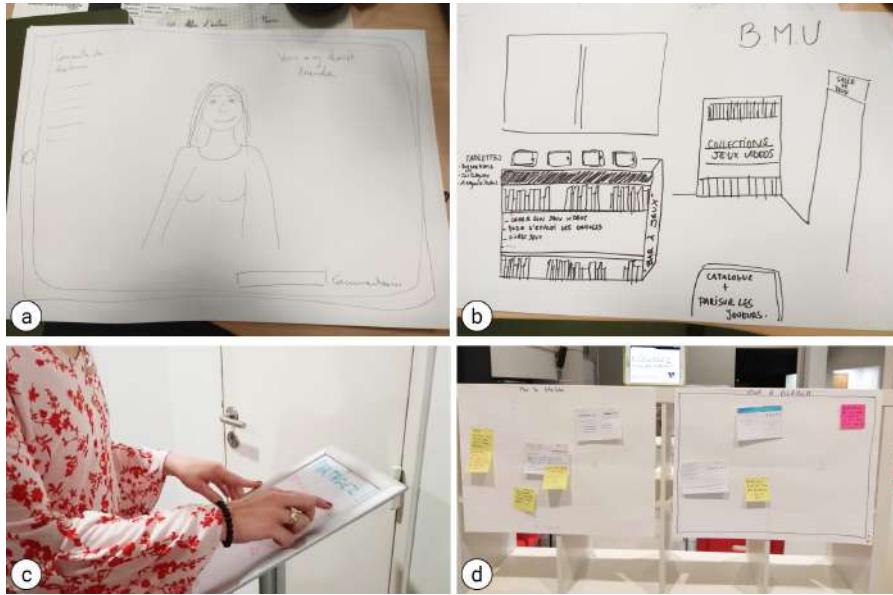


Figure 7: Four of the 18 design concepts. a: (2) Tell your Story, b: (3) Live Stream, c: (8) Live from the Library, d: (5) ChitChat Wall

To develop the design space, I drew from the literature on workbooks [37] and framed our work with the definition of constraint-based design spaces [10]. With this definition, the design space schema takes the form of a table. Each column of the table corresponding to an *aspect* of the design space, and for each aspect a number of *options* that are available. As an example in the design space, the aspect "Display Medium" has the options "Paper", "Object", "Screen", or "Interactive Screen".

2.5 A DESIGN SPACE OF PUBLIC DISPLAYS IN LIBRARIES

The aspects of the design space derived from our coding schema. I distinguish between four main themes. Given the focus of the workshops we conducted on events organized in the library, it came up naturally that an *event-centric theme* was commonly shared across all concepts. Similarly, every concept leveraged in a way or another either information about an event and resources from the library collections, thus making a *content-centric theme* come up. Regarding the *user-centric theme*, it relates to interactions proposed to users, but also the responsibilities they can take regarding the device. Last, the *display-centered theme* gives an idea of the variety of the concepts: big or small, interactive or paper-based, single or multiple. It also hints at technical needs to implement the concept.

	Action	Patron Role	Librarian Role	Event Spatial Indirection	Usage time	
Themes						
Interaction-centered	Watch from afar Navigate content Consult an item Personal access Write content Create Media	Data consumer Curator Editor	Editor Curator of external content Curator of internal content Moderator Mediator	Embedded Situated Non-situated	Before the event During the event After the event	
Content-centered						
Event-centered	Content source	Content type	Content Spatial Indirection	Display medium	Display size	Multiplicity
Display-centered	Librarian Patron Partner Library collections Web	Event information Bibliography Picture (local) Picture (external) Video (local) Video (external) Other external media Post Reaction Other event production	Embedded Situated Non-situated	Paper Object Screen Interactive screen	Small (smartphone/ticket) Medium (tablet/A4) Large (large display/poster)	Single device Multiple devices Swarm of devices Combination of devices

Table 1: The 11 aspects of the Design Space for public displays in libraries, structured into four themes.

2.5.1 Interaction-centric theme

Four aspects of our design space relate to the question of how do users interact with public displays, and what kind of role do they endorse. The three *Interaction* aspects focus on how people can interact with the displays. Those range from very lightweight interactions such as "Watch from afar" that are a shared by most public displays to the more elaborate actions such as "Writing content" or "Suggesting an item from the collections" that require devices with interactive capabilities and even suggest a connection to some collection database.

I focus two broad classes of public display users, *Patrons* and *Librarians*. Reflecting the traditional role of patrons in the library as "Content consumer" (or book borrower), public displays primary focus is often on giving access to information: bibliography, videos, etc. However, if devices allow participation, patrons can gain the role of "Editor of content" or "Curator" when they are invited to share their thoughts, suggest books or other documents they appreciate, or even their own writings and productions (e.g. photos or artefacts).

The concepts also reflected librarians' traditional roles: "Curating content" to make them available in the library, be they books or anything else. But as devices and content becomes more participatory, librarians are also expected to fill new roles such as "Moderators" of the content proposed by patrons, or act as "Mediators" between patrons and devices, either to facilitate interaction or to foster participation.

2.5.2 Content-centric theme

Our second theme centers around the displays *content*, and the relationship between the display content and its surrounding space.

Content source refers to where the information comes from: it can either be from the library itself for example when we are talking about a bibliography of documents, or information about an upcoming event organized in the library. The information can also be sourced from event partner's websites, or curated by a librarian from the web, or even created by patrons.

Type of content refers to the diversity of content that can be displayed. Content type is associated to device capabilities: some only can display simple static information about upcoming events whereas others offer access to videos, bibliographies, articles, and more.

The content displayed by the device relates in one way or the other to the broader library information ecosystem. I refer to this aspect as the *spatial indirection* of the device content in relation to the library space. A tablet installed in the shelves of the library displaying content associated to the surrounding collections is be considered "Embedded" in terms of spatial indirection, whereas the same tablet installed in the hall, far away from the anything related document or space would be considered "Non-situated". In between I would consider to be situated if it was within the relevant library department.

2.5.3 Event-centric theme

Our third theme focuses on how the concepts position themselves relative to the events they showcase. As libraries organize an increasing amount of events, this question was present in all the workshop we ran.

The aspect that kept re-occurring throughout the concept is *Usage time*, i.e., when the device is supposed to be used relative to the event. Its values are before/during/after, with some concepts covering many temporalities. A majority of concepts allowed advertising an event *before* it happened. On the other hand eight concepts enabled the visualization of past events, envisioning of events could be relevant "after" they happened, for instance by giving access to recordings

or resources that were shared during the event. Only four concepts were designed to be used during the event unfolding. For instance one proposed to live stream videos or social network activity.

I also identified spatial indirection in relation to the event. An "Embedded" device here meaning it is used where the event is taking place. "Situated" means that the device is close to the event, whereas "Non-situated" meaning that the device is not used anywhere close to the event.

		1 - Explore Music Dept: A portrait large screen showcasing content the Music Dept. provides in relation to events. An associated tablet allow patrons to consult shocased content.	2 - Tell Your Story: In the context of writing workshops, a touch-screen is installed in the reading area of the library. Patrons can watch videos of the reading of the text and leave comments.	3 - Live Stream: During an event on video games, a live stream of the tournament is projected in the library. Tablets are also placed near exposition desks to propose additional content.	4 - Guest: After a conference, an interactive desk is setup and give access to multiple content about the speaker: biography, bibliography, recordings, websites, etc.	5 - Chichat Wall: In the hall of the library, a screen displays posts from patrons and librarians. Patrons can flash a QRcode to post content. Patrons without smartphones can use a tablet that is placed besides.	6 - Events Summary: In departments of the library, tablets showcase upcoming events. A large display in placed in the hall to give an overview of all tablets installed in the library. Patrons are invited to read more on tablets in the library.	7 - Screen in the Shelf: A screen in embedded in the shelf, patrons interested in the collections can consult content about an upcoming event. They can also print a ticket with a link to access content from home.	8 - Live from the Library: During an event, attendees can share tweets from their phone or from a shared tablet. Tweets are then shown in a large screen in the hall live.	9 - Musical Chair: In the hall of the library, where showcase usually take place, a chair is installed with a tablet. It give access to past and upcoming showcases and listen to recordings.
User-centric theme	Action	Watch from afar & Navigate content	Watch from afar & Navigate content & Consult an item & Write content	Watch from afar & Navigate content & Consult an item	Watch from afar & Navigate content & Consult an item	Watch from afar & Navigate content & Write content & Moderate content & Suggest items from external source	Watch from afar & Navigate content & Get personal access / keep a copy	Navigate content & Consult an item & Get personal access / keep a copy	Watch from afar & Write content	Watch from afar & Navigate content & Consult an item
	Patron Role	Data consumer	Data consumer & Editor	Data consumer	Data consumer	Data consumer & Editor & Curator	Data consumer	Data consumer	Data consumer & Editor	Data consumer
	Librarian Role	Curator of external content & Curator of internal content	Mediator	Editor & Curator of internal content	Curator of internal content & Curator of external content	Editor & Moderator & Mediator	Editor	Editor & Curator of external content & Curator of internal content	Mediator & Moderator & Editor	Editor & Curator of external content & Curator of internal content
Content-centric theme	Content source	Librarian & Library collections & Web & Partner	Patron	Librarian & Library collections	Librarian & Library collections	Patron & Librarian	Library collections	Librarian & Partner & Library collections & Web	Patron & Librarian	Librarian & Partner & Library collections & Web
	Content type	Event information & Other external media & Video (local source)	Video (local source) & Post	Bibliography & Post & Video (local source)	Event information & Bibliography & Video (external) & Video (local) & Other external media & Picture (local source)	Post & Event information & Picture (local source)	Event information	Event information & Bibliography & Video (external) & Other external media & Picture (external)	Post & Reaction & Picture (local source)	Event information & Bibliography & Picture (local source) & Video (local source) & Video (external) & Other external media
Event-centric theme	Content Sp. Ind.	Situated	Non-situated	Embedded	Non-situated	Non-situated	Non-situated	Embedded	Non-situated	Non-situated
	Event Sp. Ind.	Non-situated	Non-situated	Situated	Non-situated	Non-situated	Non-situated	Non-situated	Situated	Situated
	Usage time	Before the event & After the event	After the event	During the event & Before the event	After the event	Before the event & During the event & After the event	Before the event	Before the event	During the event	Before the event & After the event & Long after the event
Display-centric theme	Display medium	Interactive Screen	Interactive Screen	Screen & Interactive Screen	Interactive Screen	Interactive Screen & Screen	Interactive Screen	Interactive Screen & Paper	Screen & Interactive Screen	Object & Interactive Screen
	Display size	large (poster/large display) & medium (A4/tablet)	medium (A4/tablet)	medium (A4/tablet) & large (poster/large display)	large (poster/large display)	large (poster/large display) & medium (A4/tablet)	large (poster/large display)	medium (A4/tablet)	large (poster/large display) & medium (A4/tablet)	medium (A4/tablet)
Multiplicity		Combination of devices	Single device	Combination of devices	Single device	Combination of devices	Combination of devices	Multiple devices	Combination of devices	Single device

Table 2: Design space overview: design concepts 1 to 9 of public displays for libraries structured around 11 aspects.

2.5.4 Display-centric theme

Our last theme focuses on material considerations regarding the devices involved in the concepts.

10 - Interactive Poster: A big interactive screen displays in a graphical way digital content available around a specific theme. When a patron interact with the screen, she can get links to consult these content.		11 - Step by Step: Signs on the ground lead patrons to presentation desks with documents, and finally to the event place.	12 - Ghosts: Once an event has happened, share information and content using paper flyers on documents relevant to the event.	13 - Wanderings: Tablets and smartphones are used for an AR visit in the collections of the library in relation to an event.	14 - Print your Event: Each time you borrow a document, the printed ticket you get recommends you upcoming events in relation to the documents.	15 - Book & Recommend: Patrons can use their smartphone to get event recommendations based on their loan history and their metadata.	16 - Food Literacy: During the food literacy event period, patrons can access through an app to new recipes every day.	17 - Find your Way: Signs placed on the ground lead patrons to events. If it is before the event, they there have access to an interface that allows them to book the event on their calendar and access related content.	18 - The Fox Experience: Patrons entering the library may take bipers. Those will vibrate when an event is about to start and invite patrons to get more information on nearby public displays.
User-centric theme	Action	Watch from afar & Navigate content & Consult an item	Watch from afar & Navigate content & Consult an item	Navigate content	Navigate content & Consult an item & Get personal access / keep a copy	Get personal access / keep a copy & Navigate content	Consult an item & Get personal access / keep a copy & Navigate content	Navigate content & Get personal access / keep a copy & Consult an item	Watch from afar & Consult an item & Get personal access / keep a copy
	Patron Role	Data consumer	Data consumer	Data consumer	Data consumer	Data consumer	Data consumer	Data consumer	Data consumer
	Librarian Role	Editor & Curator of internal content	Curator of internal content & Mediator	Curator of internal content	Curator of internal content	-	-	Curator of internal content & Editor	Editor & Curator of internal content
Content-centric theme	Content source	Librarian & Library collections	Library collections	Library collections	Library collections & Patron	Library collections	Library collections	Library collections	Library collections
	Content type	Bibliography & Picture (local source) & Video (local source)	Bibliography	Event information & Other event Production	Event information & Bibliography & Picture (local source) & Video (local source)	Event information & Bibliography	Event information & Bibliography	Event information & Bibliography	Event information
	Content Sp. Ind.	Situated	Situated	Embedded	Situated	Non-situated	Non-situated	Situated	Non-situated
Event-centric theme	Event Sp. Ind.	Non-situated	Situated	Non-situated	Situated	Non-situated	Non-situated	Situated	Non-situated
	Usage time	-	During the event	After the event	Before the event & During the event & After the event	Before the event	Before the event & After the event	Before the event	Before the event
Display-centric theme	Display medium	Interactive Screen	Paper	Paper	Interactive Screen	Paper	Interactive Screen	Interactive Screen	Object
	Display size	large (poster/large display)	medium (A4/tablet)	small (ticket/smartphone)	small (ticket/smartphone)	small (ticket/smartphone)	small (ticket/smartphone)	small (ticket/smartphone)	small (ticket/smartphone)
	Multiplicity	Single device	Multiple devices	Swarm of devices	Swarm of devices	Single device	Swarm of devices	Swarm of devices	Swarm of devices

Table 3: Design space overview: design concepts 10 to 18 of public displays for libraries structured around 11 aspects.

The first aspect I consider here is the medium used to display content. With little surprise, interactive display were a very popular medium across the design space, along with non-interactive screen. However we may observe that three concepts chose paper as sole medium, in the form of posters or flyers.

Size is the second aspect I consider. Here there are 3 options: *small* that is the size of a smartphone or a flyer, *medium* that correspond to a tablet, and *large* that describes large displays or posters.

The third aspect, multiplicity, comes from the observation that most concepts did not actually involved more than one display. Where options such as "Single" or "Multiple" easily make sense when thinking about public displays, I considered that some concepts involved a "Combination of devices". The last option, "Swarm of devices", differentiates itself from "Multiple" devices by the scale it represents. Depending on the concept: dozens of flyers disseminated in the collections, or leveraging the smartphones of all the patrons for example.

2.6 PUBLIC DISPLAYS: CONCERNs AND EXPECTATIONS

The design space I created from the concepts we designed with librarians is different than those we usually see in the literature. Those ones include in their corpus prototypes from previous research while ours present conceptual ideas. The interpretation the results is thus to be approached differently. Here, the design space put librarians concerns and expectations forth.

2.6.1 *Beyond collections*

Digital resources in libraries are generally associated to digital collections of ebooks. Previous research explored ways to make them available within the library space [62, 82]. However, a number of concepts designed by librarians showcase a different kind of digital resources from what we usually expect to find in libraries. Concepts such as "Musical Chair", "Screen in the Shelf", or "Guest", to name a few, display content ranging from live videos, to galleries of pictures and websites (as "Other External Media" in tab.3) that do normally not have a physical presence in the library. Moreover, these resources do not only serve to advertise events, they are in line with libraries role as places of knowledge: they serve as sources of information that complement the collections, often with content created by librarians themselves (bibliographies, short articles) or Internet sources: Youtube videos, Wikipedia articles, blog posts, etc.

Event-related content usually has a short lifespan and disappears from the physical library or the libraries websites, and becomes difficult to discover once the event has passed. With concepts such as "Guest", or the "Musical Chair", public displays become access points to archives of the library activity by focusing on giving access to the resources from past events.

2.6.2 *A more participatory information landscape*

In libraries, most of the information offered to the public, i.e., collections, are curated by librarians. Public displays change this dynamic, by enabling patrons to be at the origin of content that will be displayed in the library. Concepts such as "Live from the library" or "Tell your story", proposed to "Write content" as an with the displays. Other forms of participation are possible, "Stream event" features participation through the live stream of attendees playing a game and "Chitchat Wall" propose to participate by allowing suggestions of CDs or books.

By opening public displays to participation in a library context, the question of moderation became central to librarians. This covers both the type of content that is acceptable (or legal) to publish, but also raises questions of coherence or tone. This concern was notably present in the "Chitchat Wall" concept and during discussions surrounding the workshops.

2.6.3 *Placedness*

Place is a multifaceted concept touching on space, time, and social aspects. Public displays are not only physically located, but also display content with a temporality of its own, and the way people will engage with them will depend on relevant social dynamics. The 18 concepts of our design space allowed us to explore numerous combinations of those aspects.

In practice, placedness relates to the physical location of the displays in respect to collections and events, but also temporal aspects related to use. In our design space, it relates to the spatial indirection dimensions, of both content and events, but also to usage time.

In many concepts we find a tension between anchoring displays in the collections or in the events. Concepts such as "Screen in the shelf", or "Interactive Poster" are closely tied to the collections but are thematically close to events as well: both are designed to be installed in the room of the department responsible for the events they showcase. The first one goes even further as to embed the display in the collections themselves.

Devices can also be physically close to the place where events will happen. It is the case with "Musical Chair" or "Live Stream", where the first is installed in the hall of the library where music shows usually happen, the second leverages the wall outside the room of the event to display a live stream.

In order to foster engagement or relate to more people, it may be more relevant to be situated in a space that foster exchange and participation, rather than a space that is thematically relevant. For instance "Tell your Story" is placed in the reading area to encourage consulta-

tion of the content, "Event Summary" is placed in a popular pathway of the library to be more visible, and "Print your event" leverages devices already placed in the library.

2.7 A DESIGN SPACE IN USE

The design space I presented focuses on concepts librarians envisioned when asked about the use of public displays in the library. As I developed just above, it allows us to describe emerging interests librarians have regarding the introduction of digital devices in their workplace. I hope this work will first help designers and researchers get a better understanding of the possibilities offered by the library for creating novel digital experiences and ground these ideas in the different places of the library and with the field expertise of the librarians that helped us create it. In addition to that, together with the other researchers taking part in this work, we wish to make our results available outside the design and HCI community and give back to librarians whose participation was essential.

Participatory Design, using methods such as e.g. future workshop and collaborative prototyping [71], do not only produce concepts. The outcome of the workshops are scenarios, sketches, storyboards, or video prototypes, reify questions that participants bring forward, and delineate possible outcomes. Through the design activities, a shared understanding of the context, people, problems, and practices can emerge among participants whether they are researchers, designers, or in our case librarians. In order to give the knowledge we were able to build back to librarians who worked with us all along the research project, we synthesized the design space into a design catalogue (see appendix A.1).

This synthesized version of the Design Space offers not only the reading of the project through the 18 concepts, but also serves as a projection tool so that librarians can choose to test one of the concepts as well as to repeat the experience of digital service design based on the proposed design space.

Thanks to the participation of librarians from the beginning to the end of the design process, I was able to frame a better understanding of their expectations for public displays. The 18 design concepts we co-created were as many leads for us to inform our upcoming developments. However, as described earlier, the design of public displays situated in a specific place has to leverage at the same time socio-cultural and spatial contexts. The implication of librarians during the design process helped considerably in the creation of concepts adapted to the social and cultural aspects of the library, but often lacked of an anchoring in a real place. In order to include an extended consideration of the space in the design process, I chose to

explore the use of situated enactment techniques with designers and librarians.

3

SKETCHING AND ENACTING PUBLIC DISPLAYS

Public displays are often rooted in a specific place. To design such devices, in addition to general guidelines for public displays that have been extensively studied in the existing literature, designers have to consider the place itself during the design process. Place is a combination of several spatial, social, and contextual factors, it is challenging for designers to consider them all at once. To help consider place during the design process, we propose a new tool, Ébauche to support in-situ enactment activities.

3.1 INTRODUCTION

In our effort to center our design around places, we first explored how to obtain a deep situated knowledge about the place. Working with librarians to this end not only allowed us to access expert knowledge of the place, but also uncover underlying expectations towards technological artifacts.

However, being in a place is an embodied experience. Even using all the knowledge we were able to gather during our interactions with librarians, considering all the dimensions of the place requires a physical experience of the library. Much of the social, cultural, and material conditions of a place [64] are tacit elements that can be experienced by being there.

The technological and methodological tooling for designing digital applications has matured over decades. However, as we move away from device-centric applications and move towards digital services anchored in a place, such as content for public displays, tooling becomes scarce.

This is especially noticeable for tools supporting early explorations of design ideas. Bodystorming [20] and its variants have proven beneficial in exploring in-situ early design ideas through brainstorming and enacting scenarios of use [78]. Such practices are gaining in popularity, but their tooling is still limited to physical props and pen and paper to envision interactive systems. This lack of adapted tooling is increasingly problematic. Recent work suggests that in a situated design context, static sketching tools such as paper could hinder the exploration of rich interactive and context aware elements [16].

We designed Ébauche to investigate situated digital sketching and enactment practices. Ébauche is a collaborative sketching tool for public displays that supports bodystorming. We iteratively refined it through a series of design workshops in a library context.



Figure 8: Ébauche is a digital sketching tool that enables designers to visualize their sketches on nearby displays.

To identify how the environment shapes design ideas and how digital sketching tools influence sketching and enactments, we conducted a study where we compared the use of regular paper-based materials with Ébauche in designing content for public displays.

We found that paper led to broader exploration of ideas, and that it fostered the design of non-screen displays or non-standard form factors, but also deeper physical integration in the environment. Whereas, Ébauche encouraged designers to iterate and refine their design ideas further, but also led to more sophisticated interactive enactments due to its support for simulating basic interactivity.

3.2 TOOLS FOR PLACE-CENTRIC DESIGN

The issue of detachedness in design [94] remains an important design challenge for public displays and more broadly for Ubicomp, i.e., how can designs (and systems) be grounded in the social and cultural practices of a particular place, as well as their physical environment (e.g. [61, 64]). Situating design practices is a first step to ground the design process in a place, but just being there is insufficient. To get a better understanding of activities happening in a place and how novel devices would integrate with them requires additional attention. I discuss below research on techniques to do so, including bodystorming, enactment strategies and sketching.

3.2.1 *From body- to embodied storming*

Bodystorming covers a number of practices ranging from brainstorming activities in a given place, to more advanced enactment of ideas, with sketches, physical props, or reconfiguration of the surrounding space. Burns et al. can be credited for the term and popularizing the use of bodies and space in the design of digital systems [20]. In their case, brainstorming involved props in a studio, something that

was already used in non-digital design practice. One of the most striking aspect of bodystorming is how it has been used since its inception for multiple purposes: the development of empathy [18, 20], richer creativity through an enactive process [20, 78], more egalitarian contributions of ideas [20], better communication with peers and users [20], or clients [18], and even evaluating designs [18, 75]. Overall design activities happening *in-situ* over time help create a shared understanding of the context and facilitate the integration of ideas into existing practices [43].

Looking back at four design activities in which bodystorming was used, Oulasvirta et al. [78] observed that being in the place encouraged participants to consider contextual elements in their discussions. They also found that ideas generated during the bodystorming sessions tended to “stick” more after the sessions, and to be more inspiring. But they also remarked that preparing and running bodystorming sessions could be very time consuming, leading them to question the overall value of bodystorming.

Reflecting critically on past bodystorming practice, Schleicher et al. proposed to shift the focus of bodystorming, to its experiential and embodied nature. They argue that the real value is on experiencing the place and setting a “communicative mode of rapidly expressing ideas and proposals” [86]. This relates to the argument made by Márquez Segura et al. who emphasize playfulness and aesthetics in design. They proposed *Embodied Sketching* [72] as a way to “elicit creative physical engagement”, through three different ways: bodystorming of ideas, which we already discussed, co-designing with users which we discussed in the previous chapter, and sensitizing designers which we both discuss below.

3.2.2 Enactment

Building upon bodystorming, several strategies have been proposed to explore designs through enactment, ranging from improvisation [38, 39], to actors playing scenes [73, 97]. With *Experience Prototyping*, Buchenau and Suri [18] developed enactment strategies using improvisation techniques with a professional actor involved as a supervising moderator, with a motivation close to what we wanted to achieve: empathizing and understanding context.

Enactment techniques can also enable design teams to evaluate systems by letting participants stage situations in a speculated setting [7, 75]. Other strategies rely on domain experts staging interactions in an improvised manner [91]. Although it does not anchor the process in the “real” place, it builds upon similar staging practices to focus on the context and the use of prototypes.

To approach the place in a more encompassing way and explore its spatial, social, and dynamic aspects, the study presented in this chapter combines methods from both bodystorming and enactment.

3.2.3 *Creating props for design expression*

With the goal to support some of the design workshops with librarians we presented in the previous chapter, I am particularly interested in the early design phase, and in the generative exploration of possible designs. During such early phases, sketching is a common process to support creativity in many domains [36], and also in HCI [21]. Buxton distinguishes sketching and prototyping, with sketching dominating the early stages, and prototypes the later stages [21]. He characterizes sketches as being low cost, timely, produced in large quantity, and being disposable, in comparison to prototypes that are more focused. He notes that the process of sketching and the inherent ambiguities of the created artifacts stimulate creativity and foster the emergence of insights [21].

In collaborative settings, sketching proved to be beneficial. The sketching process itself can be effective at involving participants and generating insights [2]. And it has been used in participatory design contexts to explore new concepts with non-designers [28]. Some research prototypes explored collaborative sketching [105] and how to leverage pen-based interaction for creating prototypes and storyboards that can be tested rapidly [58]. Existing collaborative drawing tools such as Sketchtogether¹ support collaborative sketching, but do not support the enactment / testing of the sketching in-situ. Interactive hand-drawn prototyping tools such as Marvel POP support interactivity, but fail to support the enactment and in-situ deployment of sketches as well.

Sketching has an emphasis on low-tech and throw-away materials. Yet recent work suggests that static media may hinder the exploration of interactive and context-aware design opportunities [16]. Bressa et al. suggest that digital and hardware sketching tools could overcome some of these limits. For instance, the Gambit system [83] explored the ability to draw and visualize sketches on displays of different sizes (tabletop, tablet, smartphone). But Gambit only ran at a room level, and it did not support interactive previews and enactment. We seek to understand how richer sketching and enactment media can support more context sensitive design.

3.3 SKETCHING AND ENACTMENT FOR PLACE-CENTRIC DESIGN

Based on our experience designing for public displays and previous research, we sought to explore how to better support the early ex-

¹ <https://sketchtogether.com>

ploration of design ideas for interactive public displays. This led us to create Ébauche, a collaborative sketching tool for situated sketching that supports bodystorming and enactment. Through a series of design workshops to explore public displays in libraries, we refined Ébauche, assessing which features were most relevant.

3.3.1 Ébauche features and use

Ébauche is a digital sketching and enactment tool for pervasive displays (see fig. 9). Our initial goals with Ébauche were to: 1) Support collaborative sketching; 2) Enable seamless transfer and display of sketches on surrounding screens; 3) Facilitate enactments building upon the sketches; 4) Offer an easy onboarding to the librarians who would participate in our workshops.

With Ébauche, sketches are drawn on tablets and sent to displays that are situated in the environment with a single tap (see fig. 9.2). Designers start by sketching with a stylus in a free-form manner on their tablet (see fig. 9.1). The ink color can be changed via a palette and strokes can be deleted with a touch stroke. Designers can create new sketches (see fig. 9.4), or duplicate an existing ones at any moment (see fig. 9.5). Designers can push a sketch to any target display connected to Ébauche (see fig. 9.6).

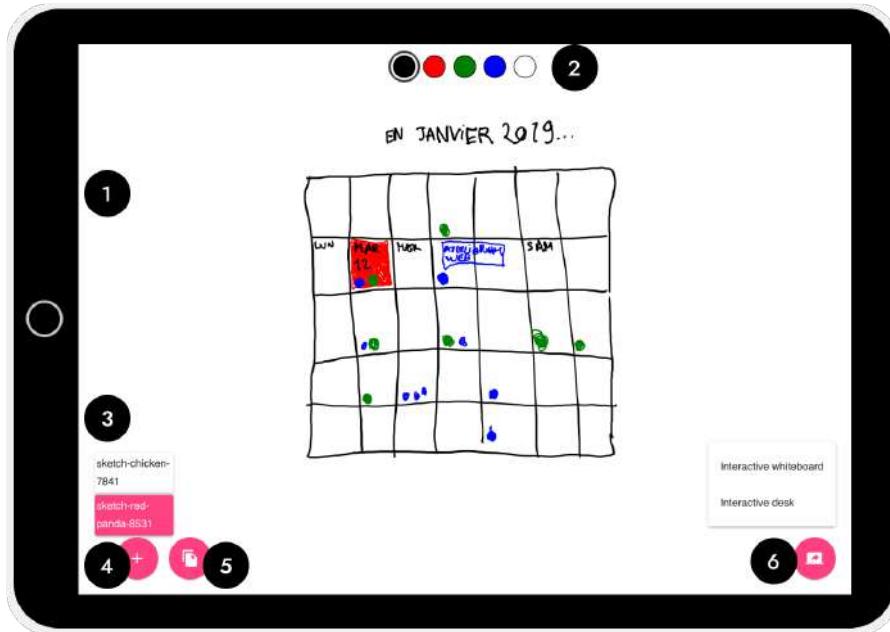


Figure 9: ① The sketching area takes most of the screen space, ② a color picker enables users to change the ink color, ③ the sketches created are listed on the left, ④ the “+” button creates a new sketch, ⑤ the button next to it duplicates the sketch currently opened. ⑥ The button to the right opens a list of nearby displays on which to push the active sketch. Inking works with a pencil, and touching deletes strokes.

In Ébauche, sketching is collaborative and changes made to a sketch are propagated in real-time to all the devices, both to tablets and to situated displays where they have been pushed. This enables collaborative drawing, but also critiques, and last minute refinements while enacting scenarios (see fig. 9.1).

When multiple sketches are pushed to the same target display, they are queued. Touching a display will move to the next sketch in the queue. This enables simulating interactions.

If a sketch has been pushed by mistake to a target display, it can be removed from the display by tapping on a small trash icon. This also enables designers to re-order sketches or rework their scenarios.

Ébauche is a Web application, opening its URL on any device will load the application, in a ready to use set-up. Ébauche is built on VueJS² for the UI, and Webstrates [54] for the collaborative sketches. We used Codestrates [80] as a development environment.

3.3.2 A Technology Probe to explore Situated Sketching and Enactment

I developed Ébauche as a research tool to investigate sketching and enactment practices in situ. I sought to create a simple, flexible, and adaptable tool, retaining the three goals of Technology Probes [50]: “*the social science goal of understanding the needs and desires of users in a real-world setting, the engineering goal of field-testing the technology, and the design goal of inspiring users and researchers to think about new technologies.*” I iteratively refined Ebauche design in order to understand situated sketching and enactment, not demonstrate its benefits over other forms of bodystorming, enactment strategies, or paper based situated sketching:

We conducted several workshops with Ébauche to field test the technology, reflect and iterate on design choices, and see how it would influence sketching and scenario generation. At a user level, this led us to better understand collaboration, situated sketching workflows, and how contextual elements were considered in the design process. At an engineering level, we identified technical opportunities and related challenges. At a design level we could assess the benefits and drawbacks of Ébauche features, and iterate on their design.

3.3.3 Designing (with) Ébauche

Over a year, we conducted six design workshops, in which we used various versions of Ébauche. In the workshops we explored the use of pervasive displays in public spaces, primarily in library contexts [41]. They focused on how to convey, and interact with, information about past, present, and upcoming events in public libraries, but also with

² <https://vuejs.org>

digital collections in the physical library. The workshops took place in three different libraries, in France and Denmark. All but one workshop lasted between 1h30 and 2 hours, with approximately 1 hour of situated sketching activity. Together with my Aurélien Tabard, we took part in all the workshops both as organizers and as participants when stated so. Moreover the library researchers always refer to the same persons B and R. The librarians in workshops 3 and 4 were the same, and different from workshop 2 and 5. While the librarians who took part in the workshops did not have significant experience with sketching on tablets, the other participants had some experience. Four of the workshops were presented in the previous chapter, as indicated below.

Workshop 1 involved Aurélien, two library researchers, and myself, in an university library. Four target displays were set up, although only one was used, and participants created six sketches.

Workshop 2 involved 25 librarians split in six groups (half of them using Ébauche, the others paper). Five screens were set up, three were used and participants created twelve sketches using Ébauche. It corresponds to Workshop 1 in the previous chapter.

Workshop 3 and 4 involved two library researchers and six librarians, my advisor, and me. These two workshops were part of a series of six participatory design workshops. They took place in a public library in which it was challenging to set-up large screens, or take-over existing ones. Instead we relied either mobile tablets acting as mock public displays or paper. During those workshops, eight sketches were made using Ébauche and 13 using paper. They correspond to Workshop 2 and 3 in the previous chapter.

Workshop 5 involved two HCI researchers, three librarians, two library researchers, both my advisors, and me. They were split in two groups, one using Ébauche, the other using paper. This workshop was split in two sessions. A first session of 1h30 was dedicated to ideation and a second one hour session was dedicated to situated sketching and enactment. This happened in another public library in which it was also challenging to set-up large screens or take-over existing ones. We relied on mobile tablets acting as mock public displays. It corresponds to Workshop 6 in the previous chapter.

Workshop 6 involved Aurélien and one library researcher. This workshop happened in the same location as workshop 1 and 2, it focused on representing digital collections in the physical space of the library and the visualization of events by leveraging the library space. The set-up consisted in one 27in touch screen and four mobile tablets.

3.3.4 Lessons learned and design iterations

We used these workshops to reflect upon and adjust the design of Ébauche, but also the design process associated to it.

3.3.4.1 Iteration 1. Coupling sketching tablets and target displays

At first, we envisioned Ébauche as being used in close proximity to the displays being sketched for. As designers envisioned scenarios of use, they would go toward a display, which would open on their tablet a sketching area associated to that display, either manually or automatically (e.g. through proximity sensing). They could then start sketching. This workflow and its strong spatial constraint came in the way of participants.

Lesson 1: Sketch first, broadcast after. Our first trials showed that people tended to sketch first on tablets, and then only set-up the content on a public display. We hypothesize two reasons: (1) a wish to keep design explorations private until one is satisfied, and (2) the decision to display content on one screen or another is tied to scenarization, which tends to happen after an initial sketching and exploration phase, even when the scenario of use is already broadly defined.

3.3.4.2 Iteration 2. Exploring embeddedness

While running workshops in public libraries during opening hours, it proved difficult to take over existing screens or re-organize the space. We also noticed the need to explore unconventional display size, shape or location. E.g. content projected on the floor, large banner like displays hanging from the ceiling, etc.

We explored two alternatives that enabled designers to better embed digital sketches in their environment and explore display for factors more freely:

1. We introduced the ability to take and add pictures as a background to sketches, which enabled to embed screens in a variety of ways on the picture (see fig. 10-left).
2. We explored the ability to attach sketches in an augmented reality (AR) fashion to QR codes laid out in the environment. The sketching tablet enabled designers to push sketches to QR codes, like they could do with target displays, an extra feature enabled designers to switch to an AR mode to preview the sketches overlaid in the environment (see fig. 10-right).

Lesson 2: Augmentation strategies make it difficult to incorporate sketches in enactments. While both strategies enriched the expressivity of Ébauche, they both presented problems in the enactment phase.

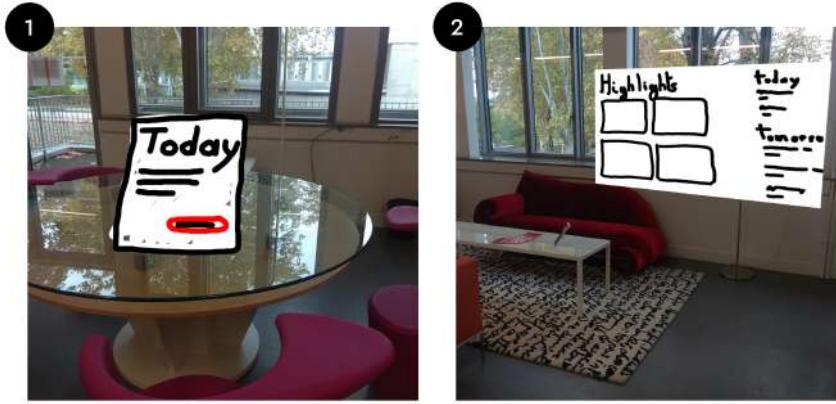


Figure 10: Left : sketch drawn on a still picture. Right : augmented reality display.

It was challenging to enact a scene with the sketches “inside” the tablet (drawn upon an image) or only “virtually” present (with AR).

When sketches can only be viewed on the tablet, either drawn or in AR, the video recording of the enactment becomes more challenging. Participants could not enact any interaction with the content in AR or on a drawn image. In one workshop, participants even forgot about the sketches that were not physically present in space, and skipped the related step in their enactment without noticing. In practice, such a set-up would require more sophisticated video editing such as [57] or a set-up with AR glasses.

3.3.4.3 Iteration 3. Leveraging digital benefits

In the last iteration, we refined Ébauche with improvements to leverage the benefits of digital sketches, and remove some practical hurdles. We introduced the ability:

1. to duplicate sketches,
2. to delete content that had been pushed to a screen, and
3. to simulate interaction by looping through sketches pushed to the same screen.

Lesson 3: sketch duplication and simulating interaction streamlines design exploration and enactment. The three features depart most from what is possible with paper sketches, alongside the ability to draw on sketches already set-up on a display. These features, were the ones we received most feedback on, and once introduced made the use of Ébauche much more seamless.

3.4 SITUATED SKETCHING AND ENACTMENT STUDY

To understand how the sketching medium and the environment influence the ideas, the sketches, and the enactments produced by design-

ers, we conducted a study in two locations using paper or Ébauche. I take inspiration from Jensen's et al. study of digital remediation of post-its [51], but shift the question to another design activity: sketching and enactment, and analyse the influence of both the tools and the environment on design outcomes.

3.4.1 Pilot studies

I conducted four pilot studies, with four pairs of designers, to explore the impact of study factors on the design process and its outcome. I tested the following factors:

1. Situated vs. non situated design activity. Our initial hypothesis and most work on bodystorming assumes the inherent benefits of being in-situ. However, as I saw in the workshops I conducted, designing in-situ comes with a set of challenges in taking over a space for design activities. I aimed at testing whether it would make sense to compare designing in-situ to designing in a remote space.

In this pilot a pair of designers worked on one scenario in-situ with Ébauche, and on another scenario with Ébauche at a desk in an office, after they visited the space. The main challenge here was defining a study set-up in which the non-situated condition was realistic enough, e.g., visiting the space and only conducting the design activity a week later. This proved difficult to conduct and control for, but could be explored in future research.

2. Ébauche vs. paper. I used Ébauche as a probe to investigate situated sketching and enactment activities. With the four pilot groups I compared a paper-based activity to Ébauche, to identify whether I observed variations (and invariants) in the design process, and in the design outcomes. Preliminary results hinted at paper fostering more variations and breadth in the exploration, whereas Ébauche tended to be more in-depth exploration of a design idea. I also validated that Ébauche could be appropriated quickly without usability issues.

3. Four design scenarios. I sought to identify which design scenarios were most promising to test. The scenarios were set in four different settings: two in a large open space (a small library) and two in smaller spaces (a smart-room and an exhibit space). For each scenario I created a design brief: (1) designing interactive services to convey information about digital collections in a library, (2) to convey information about library events and activities, but also (3) augmenting a smart-room for remote participation, and (4) augmenting an exhibit with relevant digital resources. Two scenarios, the communication about events in the library, and the remote collaboration in a smart-room, were the ones that fit best the space used in the studies, and participants also appropriated the design briefs rapidly on these two topics.

The pilots helped us to identify two scenarios, confirm the relevance of comparing paper and Ébauche, and to focus on situated sketching, leaving out the non-situated condition.

3.4.2 *Main study*

Based on the pilots insights, I conducted a study to investigate situated sketching and enactment in two situations: a smart-room or a library, with two tools: paper or Ébauche.

3.4.2.1 *Participants*

I recruited 16 interaction designers: eight pairs of design students at a masters level (age 20-23) and one pair of professional designers (age 24 and 28). All had sketching experience and 11 had experience in designing for public displays.

3.4.2.2 *Procedure*

The study lasted approximately 1h45. It started with ten minutes of introduction, and a short questionnaire about previous design experience. After the introduction, participants had a five minutes training task with both paper and Ébauche, which consisted of reproducing a UI sketch, placing the sketch either on a wall or on a display, enacting a tap on a button, and capturing this through a photo or video. I answered any questions that arose. Participants were then invited to conduct two situated design tasks, in two different situations. I teamed participants in pairs to reflect a collaborative design session. The order in which participants used the tools and the situations were counterbalanced across the groups.

Each task lasted 30 minutes using either paper or Ébauche, they could not switch tools during a given task. Participants had five minutes to read a design brief and go through design material (a broad scenario, and resources related to previous user-research), they could ask questions to clarify the goals, the procedure, or the expectations. Then participants were invited to generate ideas and sketch together in the space they were in. After 15 minutes I handed them a tablet with the camera application set-up in order to shoot an enactment in the remaining ten minutes. Participants could keep sketching, as long as they recorded the enactment within the time left. In case participants needed extra time to finish shooting the video, I allowed up to three more minutes. Participants had a break before moving to the second task using the tool they did not use already, in the other situation.

Once both tasks were completed, participants filled a second questionnaire focusing on their design process and their experience. Then they presented to us their video enactment, which was followed by a

semi-structured interview of 15 to 30 minutes. Due to the length of the tasks I did not deem it feasible to perform a third task with mixed tools (as, e.g., done in [42]).

3.4.2.3 Tasks and situations

Participants had the task to design collaboratively for two different situations: a library and a smart-room. When Ébauche was used, I set-up in advance three public displays in the environment (see fig. 11 and 12).

The library task consisted of designing public displays that enables patrons to discover the events that happened, are happening or are going to happen in a library. I conducted this task in a university library within a small information science school (see fig. 11 for the set-up and layout).

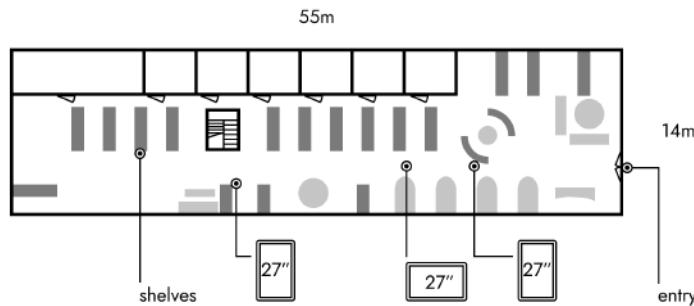


Figure 11: Library situation

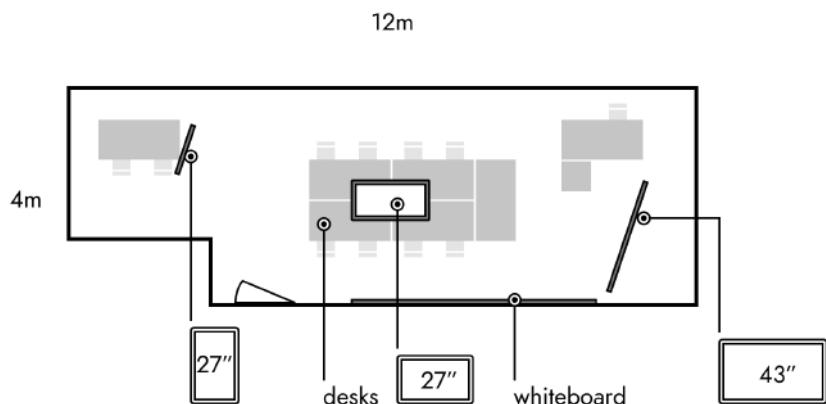


Figure 12: Smart-room situation

The smart-room task consisted of designing a system that would allow remote collaborating students to participate in group tasks such as brainstorming, document analysis or preparing a group presentation. I conducted this task in a room dedicated to group work equipped with a whiteboard, modular desks and a 43 inches interactive display (see fig. 12 for the set-up and layout).

3.4.2.4 *Materials*

Participants were given a five page leaflet for each task containing: a presentation of the context they have to design for, design goals, a generic user story in the context, and some examples events for T1. Participants were told the design goals and the user story were for inspiration only and they had the possibility to explore other ideas. The enactments were recorded using an iPad.

In the task using paper, I provided participants with A4 and A3 white paper, tape, masking tape, scissors and pens (blue, green, red, black and white).

In the task with Ébauche, each participant was given an iPad with a pen. Three large touchscreens were installed in the environment and two tablets (10in) could be placed at the participants will. The 27in displays had a size close to A3 sheets, while the tablets were similar in size to A4.

3.4.2.5 *Data Collection and analysis*

Participants answered a survey before and after the study. The first survey focused on background information, especially about participants' experience with bodystorming, public display design and, familiarity with sketching with tablets or paper. The final survey focused on participants' perception of the design process in both activities, the tools and the situation they designed for.

After both tasks were completed, I debriefed participants. They started by presenting the video of their enactment (generally taking 10 minutes) and I followed with a semi-structured interview of 20 to 25 minutes during which I went back to:

1. the design concepts the participants created and how elements from the environment were incorporated,
2. their perception of the design process during the activity, and how did they collaborate.

I collected, reviewed and analyzed the video enactments and the debrief interviews. I analyzed and coded them in order to identify and quantify key elements in the design concepts such as the interactions enacted, the number of states of screens, the use of contextual elements, etc. To clarify participants' motivations or the influence of environmental factors, I went back to the video recordings of the design activity, which I recorded using two wide angle action cameras.

3.4.3 *Limitations*

Participants could have benefited from more time to explore the space, and to explore ideas. However, all the participants were used to gen-

erating designs under time constraints and they managed to produce one enactment or more per situation.

I could not control for the presence and influence of external people in the library, I discuss their (lack of) influence in the results. This may be due to the late afternoon time slot that I used for the study, which was relatively quiet.

I reflect on the workshops and study, and their implications for situated design activities, ranging from body/embodied storming, to situated sketching, and enactments.

3.5 RESULTS

In the following, a sketch refers to a drawing on a tablet or on paper. A design idea refers to one or many sketches centered on one idea, device, or screen. And a scenario refers to several design ideas chained together to illustrate a use case.

The participants enacted 25 scenarios in total (mean=1.6, sd=0.9) per situation (table 4). The video enactments lasted from a few seconds to three minutes.

	# Sketches	Ebauche	Paper	# Design ideas	Ebauche	Paper	# Scenarios	Ebauche	Paper
Mean (per group)	6.88	5.00		2.75	4.13		1.25	1.88	
Standard deviation	3.09	3.82		1.83	1.46		0.46	1.13	
Total	55	40		22	33		10	15	

Table 4: Sketches, ideas and scenarios created

3.5.1 Exploring the space

3.5.1.1 Considering the space in the design

Before starting to sketch, all the groups explored their surroundings. In the large open space of the library they moved around to explore the space, whereas in the smart-room they could orient themselves at a glance.

In both situations, participants explored more ways to take advantage of their surroundings with paper, 25 environmental features leveraged (mean=3.1, sd=1.2), against 17 using Ébauche (mean=2.1, sd=1.3). Environmental features include structural features such as a wall, permanent furniture such as shelves, and more movable objects like screens, books and lamps. Overall, participants felt it was easier

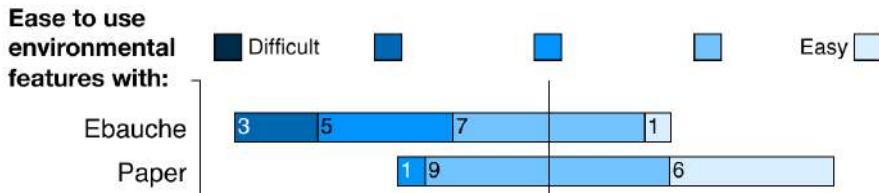


Figure 13: Ease to leverage environmental features with Ébauche and paper.
Answers on a Likert scale from 1 (Difficult) to 5 (Easy).

to leverage environment features using paper than with Ébauche (see fig. 13).

The library setting was particularly inspiring for the participants and they focused their attention on environmental features in mostly two places: the entrance, and the collections area. There, they could develop scenarios depicting the arrival of a library user and his wandering through bookshelves.



Figure 14: Left: Interaction with a bookshelf. Right: Interaction with the entrance screen.

Seven groups decided to work on scenarios at the entrance of the library. They were particularly inspired by a vertical screen already installed there, and a pillar close to the doors that was suitable for prototyping.

Five groups worked with envisioning how users could navigate through the shelves. They imagined using the sides of the shelves to display related information. Here, the use of the space was opportunistic and participants did not pay attention to the theme of the shelves. The sides of the shelves were only used with the paper prototypes given the affordance of paper to be stuck on surfaces (see fig. 14).

In the paper condition both in the library and the smart-room participants used paper sketches or tape on the floor to mark areas relevant to the designs. In the smart-room, it consisted in giving remote collaborators a physical presence while practicing for an oral presentation (see fig. 15.2).

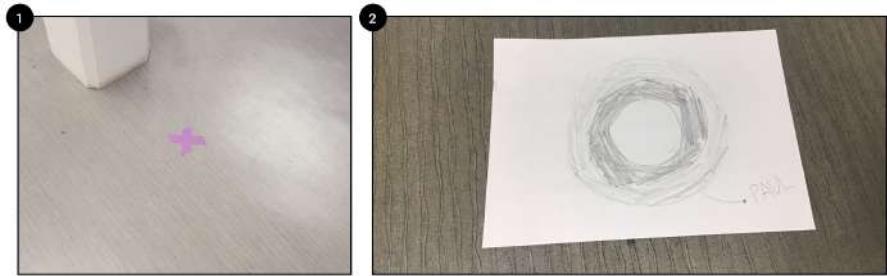


Figure 15: Marks left on the ground by participants.

3.5.1.2 Unused spaces and devices

Not all spaces were treated equally in the library. The entrance and the collections area inspired most design ideas to the participants, whereas the information desk and the copy and printing space led to only two design ideas. The lounge area with sofas close to the entrance was not used at all by the participants. Out of the seven times participants used screens, the entrance's vertical screen was used four times, and the horizontal screen, installed a bit further was never used in the enactments.

Unlike what I observed during the previous workshops and pilots, the tablets I handed to participants as movable/ad-hoc displays were almost not used. They were used twice in the smart-room, and not at all in the library, although our workshops showed that they lend themselves well to integration on shelves. In the smart-room and the library, however, group G and F respectively used their own sketching tablets in the enactment to showcase design ideas.

3.5.1.3 Map sketches

During the study, in the smart-room situation with Ébauche, group C and G created maps. Those did not represent useful content for enactment, but rather high level ideas to discuss or graphical depiction of the idea integrated in space (e.g. fig. 16). Group C was especially proficient regarding map production and made five different maps. Three of them formed a sequence used to picture the activity of users in space and how they would move during three different steps. The other maps listed devices and users involved in the design idea as well as their placement in the room. I did not observe any instance of this in the previous workshops I conducted.

Maps as well as other intermediate sketches were useful to the thought and discussion process of designers, as stated by group D: “*The first thing we did was to draw a diagram [...], that was not used after, but we needed it to explain the process.*”.

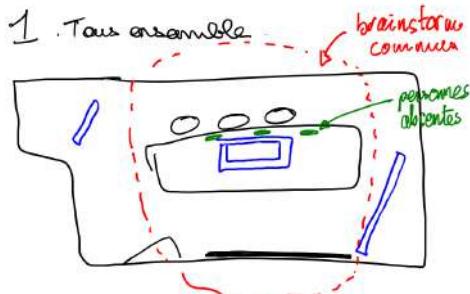


Figure 16: One example of meta sketch from group C

3.5.2 Enactments

Enacting scenarios enables designers to get a better understanding of how their ideas would unfold in practice. Ébauche tended to encourage more complex scenarios and more interactive details.

3.5.2.1 Use of space in the enactments

The majority of scenarios focused on one place at a time. Leveraging more than one place often meant creating multiple video enactments. Nonetheless, in seven enactments, participants embedded their design ideas in representations of typical user activities of the place, leading them to depict a journey through several places in a same scenario. Group C was particularly proficient in that manner, their three enactments followed the user from her entrance in the library, through multiple places to then pick a book in the end. Groups A and B on the other hand focused only on the entrance, but their scenario involved a screen that would react to the movements of the incoming user by progressively displaying its content.

In the smart-room situation, the constrained space was less inviting to envision rich navigation in space. The two scenarios leveraging space I could observe highlighted how a user shifted between activities by moving around the room.

3.5.2.2 Interactivity in the enactments

If we do not consider group F (discussed below), we observe a mean ratio of UI change per design idea³ using Ébauche of 0.98, while using paper the mean ratio is equal to 0.39, with standard deviation of respectively 0.66 and 0.34. These results suggests that Ébauche led to design ideas that were more animated than those with paper. Most of these state changes were in response to some form of interaction, but two groups also leveraged the collaborative drawing features of Ébauche to design and enact with interfaces that were changing through context awareness, i.e., without input from the user.

³ computed using the third degree Taylor expansion of the $(ui_change)/(design_idea)$ variable

Group F acted differently from the others: right after the training tasks, using paper on their first design activity they filmed a scenario with more than seven state changes. They were the only group that came to us with a question during the task, it was: “*Can we use Ébauche instead of paper?*” They explained it by their need to draw progressively, and to duplicate content. While this is an extreme case, participants found sketches easier to modify with Ébauche than with paper, and also deploying/setting up a sketch with Ébauche rather than paper (see fig. 17).

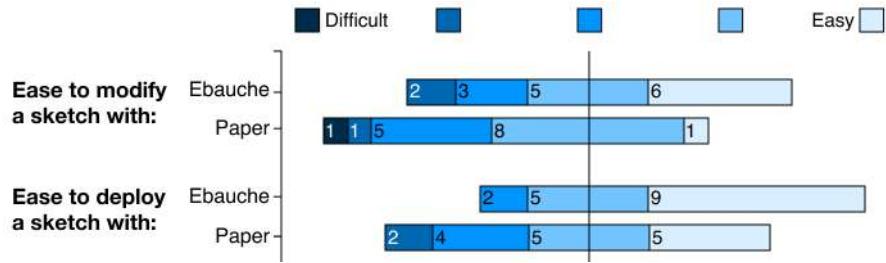


Figure 17: Ease of modification and deployment with both tools. Answers on a Likert scale from 1 (Difficult) to 5 (Easy).

3.5.2.3 Using contextual resources in the enactments

Among the 42 environmental features used in the enactments, nine of them were objects found in the place. Their use enabled designers to ground the enactment of scenarios in the activity context. Books were a popular asset and represent 50% of those. They were used to enact activities typical to the library: group C enacted a scenario where a user searches a document, group D proposed printing an augmented ticket when borrowing books, group F imagined a device scanning books, etc. Other elements, like chairs in the smart-room were leveraged by group E to serve their evolving workplace idea.

3.5.3 Sketches

3.5.3.1 Paper led to more design ideas

Participants explored more design ideas with paper than with Ébauche (33 vs. 22, mean=4.1 vs. 2.75, $sd=1.8$ vs. 1.5), which led them to envision more scenarios in the allocated time with paper: overall 15 scenarios using paper and ten using Ébauche. Participants also considered that paper supported creativity better, six preferred paper, two Ébauche, and eight considered both equal (see fig. 19).

3.5.3.2 Ébauche sketches are refined over iterations

Except group E, all the groups created more sketches with Ébauche than with paper. In total, Ébauche led to the creation 55 sketches

against 40 with paper. Of these sketches, participants used 25 of them in the enactments with Ébauche, and 33 with paper.

I looked at iterations, i.e., modifying a sketch or redoing part of it. Participants using paper did not iterate on their design ideas at all once a sketch was done, it was used as is. I also did not record participants erasing anything on paper, or replicating part of a sketch to explore an alternative. With Ébauche, five groups out of eight did significantly modify their sketches before using them in their video enactments and all of them used the erasing capabilities. While most sketches only needed to be modified once, one sketch from group A benefited from four iterations (see fig. 18) and one sketch from group E went through three iterations before being used.

Ébauche also enabled two groups to work synchronously on the same sketch. In the library, Group A used a shared display to try four different versions of design idea, although they did not use it in the video enactment. Group C used the collaborative drawing feature of Ébauche to work on diagrams in the smart-room situation.

The real-time distribution of sketches proved to be useful for collaborating while looking at a target display. Rather than focusing on one's tablet, participants could look at the large display and make quick changes on their tablet. For updating target displays on the fly, the real-time nature of Ébauche enabled participants to quickly simulate a change during the enactment phase without preparing all the sketches before-hand.

3.5.3.3 Paper, Ébauche and design ideas

Screens already set-up framed the design ideas of participants. As one participant from group A told us, “*the presence of the screens made me want to try to integrate all of them in a single scenario*”, and one from group E: “*we had a tablet, so we thought we should create something digital*”. All but one of the 22 design ideas created using Ébauche were screen-based and mostly leverage the screens already set-up. This lack of usage of the tablets is different from what I observed during the pilots and the workshops I conducted before with more participants. Here, when they did use a tablet to display a sketch, they preferred to use the sketching one, which is something I already observed in the workshop. This means that the sketching UI was still visible and that simulating interaction was not available, but the speed and convenience of using the device was considered more important.

On the other hand paper offered more freedom regarding the nature of the sketches and in their positioning. With paper, nine design ideas out of the 33 represented media or devices not screen-based, e.g., posters, bookmarks, or even drones. The malleable nature of paper also allowed participants to cut it or fold it to fit their needs. As participants from group A and B put it during the interview “*Without*

I considered a significant modification the erasing of at least one third of a sketch followed by the addition of new elements.

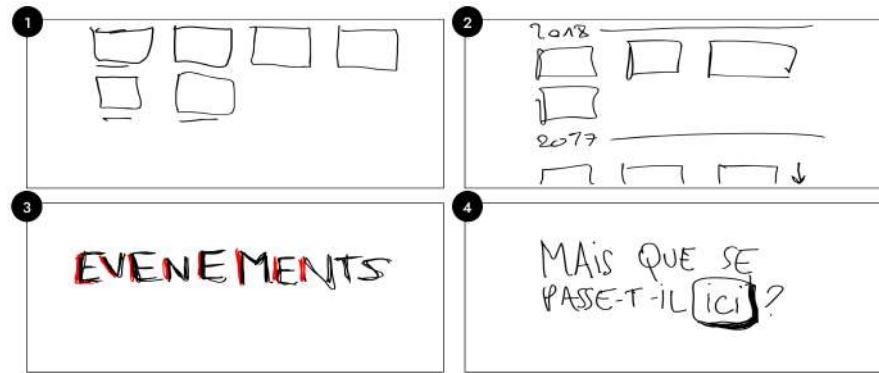


Figure 18: Four iterations of a design idea from group A

paper, we were more limited in our range of possibility". In the final survey, participants also tended to consider paper as better supporting creativity (see fig. 19).

3.5.3.4 Familiarity with paper as a sketching medium

Although participants expressed interest in the possibilities offered by Ébauche. During the interviews, they insisted on their familiarity with paper and how they felt more comfortable using it over Ébauche. All the participants already had extensive experience with sketching on paper, and the training with Ébauche lasted less than 5 minutes, which seemed enough. As participants from group E and G put it "Collaborating with tablets was not easy right away" and "We were more comfortable with paper sketching rather than with tablet [...] which are not the one we are used to." Another reason would be that they felt more in control with paper as stated by group E and H "Quickly materializing ideas, and mixing them, it is simpler on paper" and "We have more control over paper."

Despite the comparative disadvantage Ébauche could have, I did not get negative impressions about the tool and participants were rather pleased about its opportunities, one participant from group C was particularly enthusiastic "We are used to paper, but the tablet tool is quite extraordinary I think, it has a lot of potential."

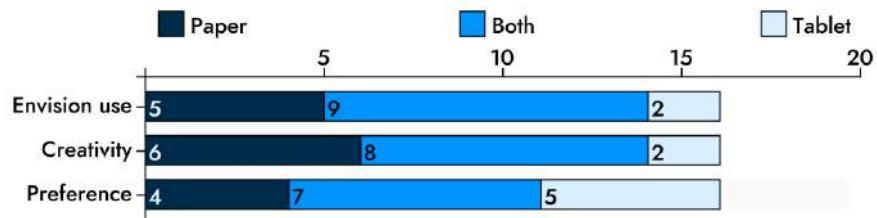


Figure 19: Participants' preference between paper and Ébauche in respect to envisioning their idea, supporting creativity, and overall preference.

3.6 DISCUSSION

3.6.1 *Situating design*

Sketching and enacting scenarios in-situ was a source of inspiration for participants, they explored the place and took note of interesting design opportunities such as spatial features, objects, and activities that were taking place. All groups from the study leveraged at least one environmental feature in their enactment and five groups created scenarios that unfolded in space, leveraging different devices and locations through the enactments.

Real world places are, however, not always accessible for doing design activities, or only for short periods of time, and often involving an extra preparation cost [78]. This was particularly true for workshops three and four, where I grounded the process in the main public library of the city and could only make use of the space during one hour before opening to the public. Setting up Ébauche with big displays was an additional challenge in this context.

There is more than “being there” to situate design. As I could observe during the study, the use of maps gave participants another way of envisioning the space and supported their discussion. During workshops, drawing upon photos taken with Ébauche was also a strategy used to situate design while being away.

Both in the workshops and the study, participants explored the space first, then sketched in a fixed location, before trying out their enactment and “deploying” their sketches in the space. If participants did not move while sketching, they still benefited from a rapid access to the place. We could imagine splitting place exploration from sketching, with a preliminary capture of pictures and maps of the place to start brainstorming, before going there to adjust the design and enact scenarios.

We should also consider that situated design relies on a deep understanding of the social context of the place and the activities that occur there. During the study, participants had a tacit knowledge of the activities that take place in a library or in a working room. During the workshops that involved professional librarians we were able to leverage their expert knowledge about the place. Knowing areas of interest in the library, they encouraged the use of an “ephemeral library” shelf, they also revealed the existence of curated resources that are usually not publicly accessible, but could be used in the design. Librarians were also much more aware of day-to-day challenges of deploying technology in a library such as locations with the highest visits, or security challenges related to public screens.

3.6.2 *Breadth of ideas vs. refined sketches*

I observed that participants explored fewer design ideas with Ébauche, and that participants were mostly sticking to displays already installed in their environment. However, they created more sketches with Ébauche than with paper. From our observations and the logs analysis, it appears that participants iterated on design ideas not only by modifying the corresponding sketch, but also by creating other sketches for the same idea. While there was one sketch and no iteration per design idea using paper, Ébauche encouraged the creation of multiple sketches and iterations for a same design idea.

In our study, paper encouraged broader exploration of design ideas, and led to more use of environmental features. However the ease to create and modify sketches offered by Ébauche enabled the participants to explore screen-centric design ideas more in-depth and refine them quickly.

In practice both media seem complementary. Similarly to more classical interface design, paper appears to be a good medium in the early exploration, and digital tools such as Ébauche more suited for more focused iterations where interactivity and context awareness are explored.

3.7 SITUATING CONCEPTS

Place-centric design is challenging as it requires to consider a multitude of parameters that are sometimes fuzzy and dynamic in both social and physical dimensions of the place. I previously presented our effort in involving some of the inhabitants of the place, the librarians, to leverage their tacit knowledge of the place.

The study in the present chapter aimed at exploring tools to situate the design process in an embodied manner and how it impacts the placedness of a design concept. As our results suggest, an embodied approach supports an understanding of place and plays a important role in making a design fit in the physical and human environment. However, just as I identify paper and digital tools as being complementary, embodied activities may gain value if combined with other activities situated in a different manner. The use of pictures, maps, or even VR, are disembodied situated elements that emerged naturally in the course of the study as valuable ways to consider the placedness of a concept. Maps were an especially promising medium and I used them in later workshops with librarians as central elements during design activities. These “proxies” for place would benefit from further research effort to get a better understanding of how they can be used to design situated digital services.

After these efforts to design public displays in a place-centric manner, and anchor them in the existing practices, activities, and physical

settings, I moved to test our concepts in the field. By following a technology probe approach, I developed and observed the use of the public displays concepts we co-designed with in several libraries.

4

EXPLORE: PUBLIC DISPLAYS TO SUPPORT EVENTS IN LIBRARIES

We deployed multiple versions of public displays in libraries. We describe their design, their development, and the observations we conducted. Throughout the deployments, we were able to observe how patrons interacted with the displays in the various setups. From these observations, we discovered existing hidden practices of librarians offering opportunities for design and discuss the relevance of different places where public displays were installed.

4.1 EXPLORE: TECHNOLOGY PROBE IN LIBRARIES

As we have seen in previous chapters, libraries host an increasing number of events, and each event is an occasion to create, curate, and share resources. Their organization is now an established task in the every day work of librarians. Yet, despite the efforts put into their organization, information about events is not always easy to find and resources related to them even less so. In the course of the PLACED project, we asked ourselves the question: *How can a public display leverage the places, the collections, and the practices of the library?*

The development of the public display technology probe Explore attempts to give an answer to this question. The design of Explore was conducted during participatory design workshops we briefly presented in the previous chapters, in collaboration with librarians and researchers in library science.

Explore's aim is to make visible in the physical place of the library the events happening there and provide access to the resources linked to those. It takes form as a collection of interactive public displays that can be installed in shelves, reading area, and the hall.

The participatory process we followed for the design of Explore was not only to design a device suited to three libraries, but also create a Technology Probe [50]. The Technology Probe approach allows us to consider the deployment of Explore through three disciplinary influences: social science, engineering, and design. On the social science side, Explore as a technology probe allows researchers to collect real-world data on how it is used and how it impacts the behaviour of the people around it. On the engineering side, the probe is a demonstration of what is technologically possible in a specific setting and inspire design and engineering based on real life settings. On the design side, technology probes must act as open tools so their everyday

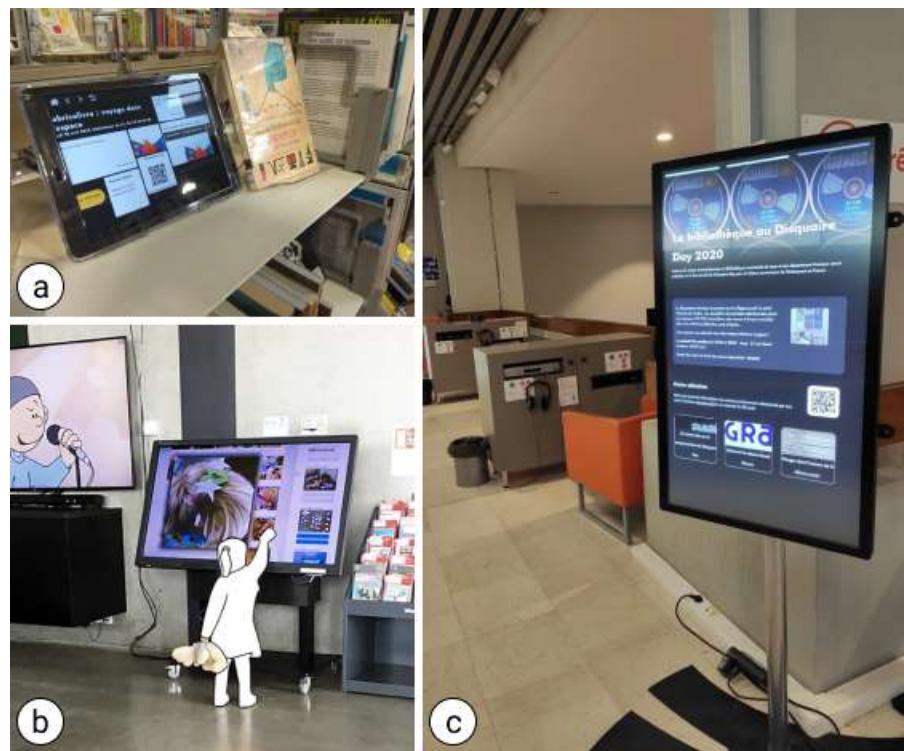


Figure 20: Explore took several shapes over the iterations it went through.
 (a) the first version was embedded in shelves while the second
 (b) and the third (c) version were leveraged larger displays.

use can inspire users and designers to reflect on their activity in a different way.

Thus, following this technology probe approach, we designed Explore as a robust and malleable platform in order for it to function in libraries with minimal care from librarians. We integrated in the software a logging system and planned observation days to collect data on the use of Explore. With these steps, we sought to understand how this new piece of technology could be used and complete our understanding of the every day practices of patrons, librarians, and event organizers.

The timeline (see fig. 21) of the design, the development, and the deployments of Explore spanned over two years and a half. This long period allowed us to ground our design through various observations, design workshops, and led to the development of two different versions of Explore. This chapter will detail these steps and the lessons we learned from the deployments.

We started first with ethnographic observations in the main and branch libraries in Lyon at the end of 2017. Following this step, we co-designed the first version of Explore with a group of librarians from the Lyon library and developed it during the end of the year 2018. We did the deployment of the first version of Explore during the first quarter of 2019 and quickly followed with the design, devel-

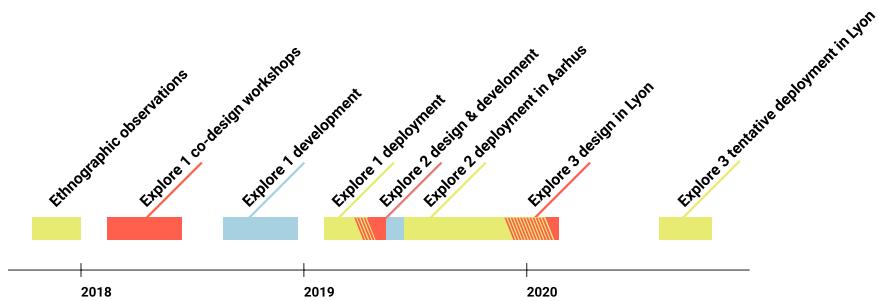


Figure 21: Timeline of the development of Explore

opment, and deployment of the second version in Aarhus. In 2020, we designed the third version of Explore and attempted to deploy it in the music department in Lyon.

Through the observation of the use of Explore as it was designed, we wish to explore the following questions: 1. How can a public display leverage the places and the collections of the library? 2. How does a digital resources platform such as Explore integrates in the practices of patrons and librarians?

4.1.1 Preliminary observations

Before starting any design workshops with our librarian partners, we conducted ethnographic observations in the library [5]. Under the guidance of Raphaëlle Bats, I participated in these preliminary observations in the field. We focused those observations on the events happening in the library. Out of the ten events we observed, I conducted the observation of three of them. These events were diverse and included short presentations of magazines, meetings with partner associations, conference with an invited author, and many others.

During these observations, we did not take part in the events but instead stayed aside in order to avoid impacting their course. In each, we were particularly interested in the place of the event, the people attending, and the objects that were used. We categorised our observation by their time relative to the events. In addition, when possible we took a few minutes to discuss with the organizers once the event was over.

Before the event, we noted that events were not uniformly advertised by the library. Only a subset of events were advertised on public displays or using flyers leading sometimes to confusion when looking for information about an event about to start.

During the course of the event, we observed that librarians regularly made links between the event topic and documents from the library. However this could take many forms: presentation desks, paper and digital bibliographies, or wall projections. Surprisingly, we never observed recommended resources from outside the library or the Web.

After the event, we noticed that any information about past events, whether the related bibliographies or the event description themselves disappeared from the website. The only resource patrons had access to at this point of time are the videos of conferences that were sometimes recorded.

This series of observations allowed us to familiarize ourselves with the practices around events in the library and get a first taste of pain points and opportunities for design. It also served as a basis for our discussions with librarians that followed in the course of the design workshops to design Explore.

Our observations led to proposing a public display that would allow patrons to have an exhaustive view of the events happening in the library. More importantly they stemmed our interest in the resources created and curated by librarians for events, as well as how patrons can access them.

4.2 VERSION 1 : SCREENS IN THE SHELVES

4.2.1 *Design workshops*

The workshops to design Explore took place in the context of the PLACED project. Although we wanted to give as much space as possible to the voices of the participants, the series of workshops was introduced with a set of goals. The aim was design digital services for the library with the following goals:

- Encourage visual and interactive exploration of events and collections
- Provide experiences adapted to the different places of the library

The design occurred during six participatory design workshops (see fig. 22) over four months in 2018, some of them were presented earlier in previous chapters. We partnered with librarians from the Lyon Public Library (BML) to co-design the probe that would be tested in their library. The participants to the workshops were as such:

- 2 HCI researchers: Aurélien Tabard and myself
- 2 researchers in library science from ENSSIB
- 6 librarians from Lyon library network, from different libraries and from all levels of hierarchy

One of the goal of the workshops, besides co-designing the Explore with librarians, was to anchor the design process in the place of the library. To achieve this, the sessions were organised in the morning,

just before the opening of the library so we could leverage the different spaces of the library to enact scenarios and shoot short videos of user journeys.



Figure 22: The first version of Explore was designed during a series of six participatory design workshops.

The main design activities occurred between the *Ideation* ② and the *Iteration* ⑤ workshops and followed a classic design progression with video prototypes. The second workshop centered around “ideation” mostly consisted of brainstorming activities to address the main problems we co-defined earlier. Then the scenarisation workshop allowed us to embed some of the best ideas into storyboards, that were then staged and recorded during the following session. We spent the fifth workshop to critique the video prototypes and iterate on them. The last workshop served as a time to discuss with the participants about the development of the technology probes and reflect on the design process.

At the end of the workshop series, we came up with five video prototypes describing four different design concepts. Two of the video prototypes were iterations made during the fifth workshop.

4.2.2 Initial concept

This first version of Explore was defined by combining and refining several ideas from the design concepts from the design workshop with librarians from the Lyon library. At the time, two main themes emerged from our discussions: *paper artefacts* and *situated information*. We split participants (us included) in two groups of five, each group working on a design concept related to one of two main theme. At the end of the *Staging* ④ workshop (see fig. 22), we had devised two design concepts:

Screen in the Shelf: an interactive screen is embedded in the shelves of the library. It displays the information about an upcoming event, related to the books surrounding the screen. A patron interested in the books can have a look at it and print a ticket for the event.

Chitchat Wall: a board in the hall of the library allows patrons and librarians to share thoughts, book recommendations, and news of the library. They can share to this board using either their own device or a tablet setup next to the board.

During the *Iteration ⑤* session, after a critique of the previous design concepts, we came up with two other design concepts:

Live from the Library: during and after events patrons can share thoughts on their smartphones or on publicly available tablets. A large display at the entrance of library gathers all those messages and warn users of events about to start.

Events Summary: in departments of the library, tablets showcase upcoming events. A large display is placed in the hall to give an overview of all tablets installed in the library. When interacting with a displayed event, patrons are invited to learn more about it on tablets in the library.

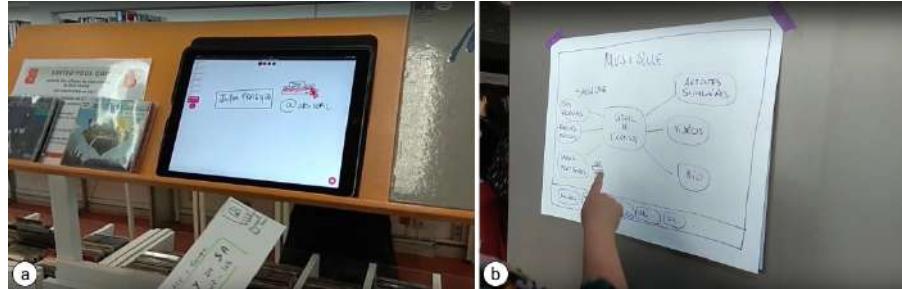


Figure 23: The design concepts Screen in the Shelf (a) and Events Summary (b) were the main inspirations for Explore.

Out of those design concepts we decided to focus on *Screen in the Shelf* and *Events Summary* (see fig. 23) to develop our public display probe. We thought it was particularly interesting that the *Screen in the Shelf* design concept envisioned devices that were embedded in physical collections and expected this sort of situatedness to be promising. Moreover, the *Events Summary* design concept was designed around a patron journey starting from the hall of the library to the rooms and included the previous design concept *Screen in the Shelf*. On the other hand, the two other concepts included participatory elements related to the other demonstrator from the PLACED project: Participate [41, 104].

We then focused our development in order to offer patrons an access to a broad selection of documents (both physical and digital, from the library as well as from the outside) using the event as an entry point. Considering the devices available to us and the technical implications we, HCI and library science researchers, decided that I

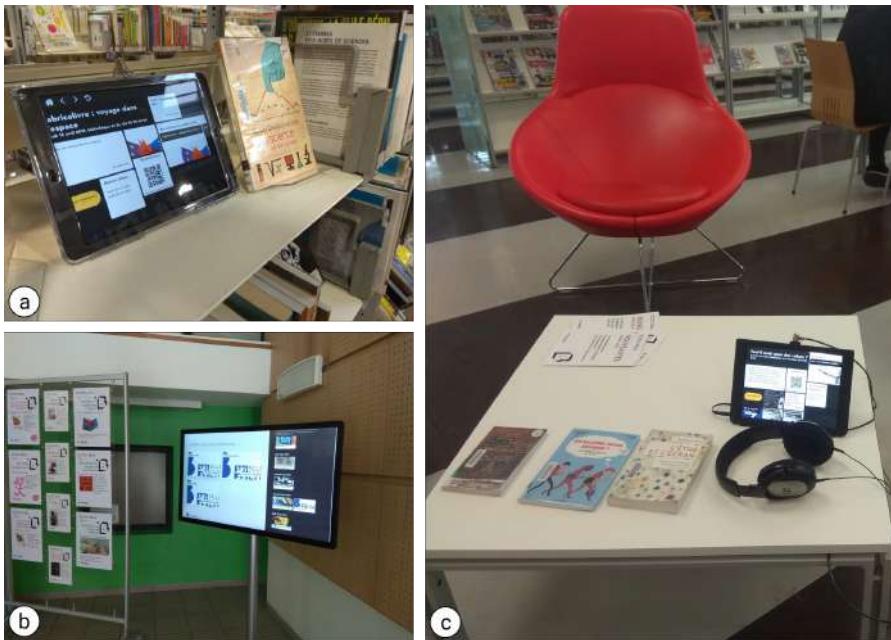


Figure 24: The probes we chose to develop took two forms: tablets (a & c) that can be embedded in shelves and in reading areas, and large displays (b) in the hall of the library.

would develop small interactive displays that could be embedded in shelves. Each display would be set to showcase one event and give access to event information and additional resources: articles, videos, websites, etc. In complement to these small displays we decided to develop a larger public display that could be placed in the hall and give access to both a timeline of upcoming events and showcase a selection of four events. In addition, using both displays patrons have the possibility to flash a QR code to access an adapted version on their smartphone.

4.2.3 Implementation

For the first deployment, Explore was planned to be installed in the public library of Lyon. It is a big building with a complex agency, causing the public Wi-Fi network to be very unreliable depending on the place and time. Explore thus needed to be resilient to degraded network access. In addition to that, it quickly appeared we would have to leverage various types of devices for the probes we envisioned: fixed and movable displays, small and large screens, interactive and static, etc. Leading to the need for us to have a portable platform.

To achieve these goals, Explore has been developed using Web technologies as a Progressive Web Application (PWA) on top of the Vue Javascript framework. This set of Web technologies allows us to build probes with two main advantages:

- *portability*: Explore can be used on any device with a web browser. For the deployment in libraries, Explore was installed on iPads for the embedded screens, and on Intel Compute Sticks running Windows for the larger displays. Using standard Web tools allowed us to keep a single code base across devices.
- *resilience*: while the displays placed in the main hall were assured to get a stable and strong Wi-Fi signal, tablets placed in metallic shelves do not have this chance. PWA tools allowed to create web applications that could load and work offline when network was inaccessible then update once in a while.

Another requirement that appeared during the technical design of Explore was the need for a facilitated and rapid updating of the content displayed on the screens. To achieve this, we relied on the real-time database offered by Firebase so any change made by librarians would be deployed instantly to the public displays without any other step. On the back-end side (see fig. 25), Explore combines data from Firebase and the API from the Lyon library. Using Firebase allowed us to have an easy storing, and syncing of data, as well as a good resiliency to network loss. Each event recorded in there is a simple JSON object containing arrays of links to additional resources and files curated by librarians. Event information are retrieved directly from the library API and stored in the local storage of the web application.

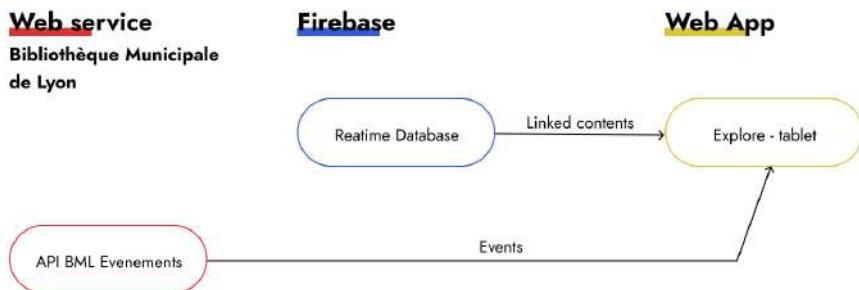


Figure 25: Back-end architecture of the first version of Explore.

The tablets were our main focus between the two types of displays as it was meant to offer a broader variety of resources than the larger screens. In order to show the various elements linked to an event, we chose to develop specific widgets. We styled and structured them in a tiled layout following a regular grid. This way the type of the resource and their profusion can pop-out in a single glance. In practice, librarians were invited to attach URLs to events, each of them was then parsed to identify what sort of resource it lead to and display an adapted thumbnail or widget. The most common resources were articles from the library online magazine, videos, and social media

pages. In addition to such links, it was also possible to attach files so librarians could share documents such as bibliographies or leaflets they printed for the event.



Figure 26: Explore has a layout that adapts to (a) smartphones and (b) tablets.

As a mean to attract the passer-by attention and signify that the display was interactive, we developed a stand-by screen that showed an animation when someone passed by. We achieved this using the JavaScript library *tracking.js*¹ and taking one picture every few seconds. If a face was detected on the picture, the animation started. Unfortunately, it was an energy consuming feature, also very dependent on the lighting of the scene. In our case, it proved to be too difficult to ensure its functioning in all the places tablets were deployed, and thus deactivated this stand-by screen.

The large display in the halls, on the other hand, displayed a much simpler interface (see fig. 27). The timeline on the right lists all the upcoming events that are planned to happen in the building the display is installed in. In the mean time, the main area on the left showcases bigger or ongoing events such as conferences, exhibitions, etc.

4.3 VERSION 1: USAGE & LEARNINGS

4.3.1 Field Deployment

We deployed this first version of Explore in two libraries in Lyon during February and March 2019 to fulfill two goals: 1. *Appropriation* and 2. *Coverage*.

Appropriation: In the main library, Bibliothèque de la Part-dieu, we installed two tablets, one in the *Civilization* department and another in the *Culture and Society* department. The deployment in these two departments allowed the librarians who took part in the design of the

¹ <https://trackingjs.com>



Figure 27: The hall display main view (a) lists all the upcoming events of the library day by day, and give access to basic event information on click (b).

probes to appropriate its outcome and continue to reflect critically on the device concept. Each tablet displays one event related to the department it was installed in, as well as resources curated by librarians on the topic. The large display was deployed in the main hall of the library and displayed the list of the upcoming events in this specific building. Due to the lack of accessible wall sockets in the walls in this library, the tablets had to function with the assistance of an external battery during the day and recharged every night.

Coverage: the other library, is a significantly smaller branch building in the 2nd district (approx. 150m²). There, visitors were mostly families from the nearby neighbourhoods. The size of this branch library as well as the fact that we were able to keep all tablets pluggged at all time meant that we were able to provide an important coverage of the space using the limited number of tablet at our disposal. This

Library	Place	Device	Number
Part-Dieu	Civilization	Tablet	1
	Society	Tablet	1
	Hall	Large Display	1
2nd District	Children	Tablet	1
	Literature	Tablet	2
	Hall	Large Display	1

Table 5: Deployment summary of devices of Explore version 1.

way, we could get closer to an “ideal” setup we envisioned in the video prototypes. We deployed three tablets in the main room and a large display in the hall.

In order to understand how the displays were used, we relied on three approaches: interaction logs, observations made by librarians day by day, and occasional observations made by researchers. Unfortunately, the logs we gathered were hardly usable and we had to rely on observations made by librarians and by researchers which were on the other hand much more useful.

4.3.2 *Explore usage*

A first observation is that both the large displays and the tablets were not used extensively. During the times we were watching their use, the behaviour of the patrons did not match our expectations. The number of passers-by was limited, and actually few people strolled the alleys looking for something to read. Most people present in the room instead were here to take advantage from the quiet atmosphere to study and work on their computers on the desk present all around, they did not interact with shelves at all. The few patrons who took books from the alley knew already what they were looking for and did not pay attention to their surroundings. From interviews with librarians, we learned the tablets that got used were those installed in reading areas (see fig. 24.c), a place where it is much more convenient to sit and browse the various resources offered on the display.

On the other hand, while usage by patrons was below expectations, the use of the probes by librarians led to encouraging insights. As they were uploading resources related to showcased events, it highlighted the fact that they used and curated many valuable documents from the library and from the Internet while preparing an event: videos of previous talks when inviting a speaker, bibliographies of a visiting author, news articles related to the event, etc. Being able

to display and give access to those resources was a way for them to revalue the work done upstream as well as extending their role of *resource specialist* [5]. Moreover, Explore allowed the events to exist even after it was over and could then be used by librarians as another resource in the library collection.

4.4 VERSION 2: PUBLIC PARTICIPATION

The installation of Explore in Lyon allowed us to better understand the technical challenges relative to the deployment of public displays in libraries. More importantly it revealed that our first approach to embed displays in collections had to be revised, and suggested that Explore should also consider librarians as first class users of the device too.

The first version of Explore was thought as a tool to understand the link between collections and event, through the use of public displays. In this second version we investigated how to support patron's participation through the joint development of a second probe: Participate.

4.4.1 *Participate: a place for public participation*

Participate is a smartphone web application that allows anyone to document events taking place in the library, before, during or after the event. Before the event, librarians can associate documents from the collections or from external sources with the event. During the event, patrons and librarians can post photos, videos, comments, polls, documents, produced in real time. After the event, librarians can add footage, additional bibliographies or link the event to a future one. The Danish research team of the PLACED project led the design of participate. Its design relies on ethnographic work and interviews conducted by all the project partners that echoed the rising interest of librarians regarding patrons' participation.

Our Danish partners developed and tested a first version of Participate [41] in 2018. The test of this prototype uncovered several usability challenges that informed the design of a second version of Participate. The last stages of design of the second iteration of Participate coincided with the design of the second version of Explore. We aimed at integrating the two applications so they could be used in combination and share a same source of data. This effort on the Participate side was led by Daisy Yoo and the CAVI² developers. I traveled to Aarhus from April to June 2019 to design and develop the second version of Explore in collaboration with them.

Building on the knowledge acquired from first versions of Participate and Explore, we turned to develop a new probe that could be

² <https://cavi.au.dk/>

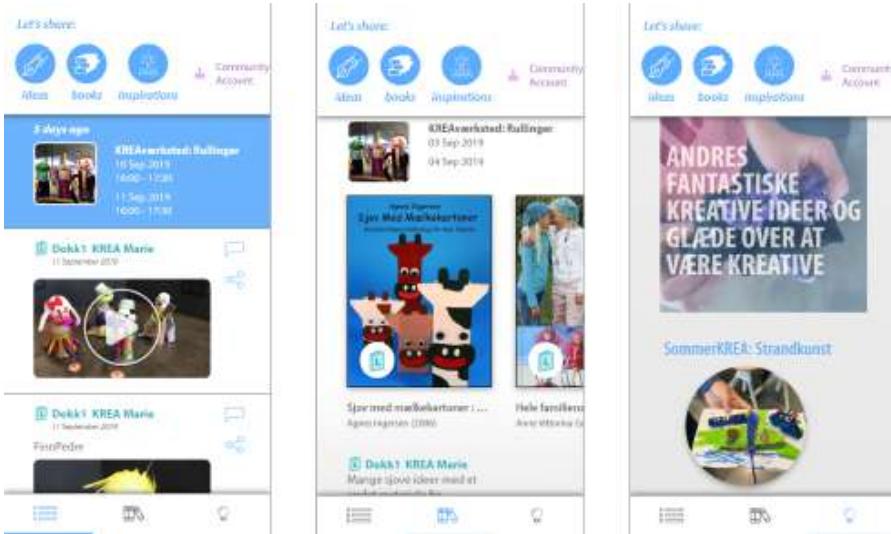


Figure 28: The second version of Participate proposes three panels (from left to right): a posts feed, curated documents related to the event, and an inspiration board.

deployed in the field for an extended period of time. We focused on one particular series of events in one particular library in order to offer in-depth descriptions and analysis of the system’s use.

Compared to traditional user-centered approaches, our “users” are highly varied, and include among others library patrons with a particular interest in the collections, those who come to the libraries for the events but who may have little interest in the collection, newcomers and frequent attendees, multiple generations of patrons, and very different levels of digital literacy. Moreover, our previous deployment of Explore highlighted the need to also consider the needs of library staff and external event organizers, and more broadly the library’s mission of providing and mediating access to knowledge.

Given the broad audience we designed for, rather than focusing on a well-defined group of users, we hand-picked a selection of particular events to design for. We thus developed a custom-made version of the service for each specific event type in situ, with the intent of creating grounded insights into the sociotechnical implications of introducing these services, and of envisioning concrete design opportunities. From the knowledge we gain from one particular case, we can proceed with another particular case as the next step to expand upon [79].

We selected the Creative Workshop series at the main public library of Aarhus, Denmark for our case study based on two important criteria: 1. *Frequency*: The Creative Workshop sessions occur twice a week all year long. Such frequency granted us time to develop the necessary trusting relationship with the event organizer, go through multiple design iterations, and deploy our probes for a sustained period of time. 2. *Relevance*: The goal of the Creative Workshop series

is to introduce participants to different creative practices. It is participatory and generative in nature, which resonated with our project goal.

The second version of Participate was developed in close collaboration with the Creative Workshop organizer over the period of nine months (Oct 2018 – Jun 2019) with additional feedback from our partner libraries in France and Sweden via focus groups and informal interviews.

Participate takes the form of a web application to be used on smartphones, with which event organizers and participants can document their ongoing events via three key features:

1. "Share Ideas" (photos, videos, polls, Q&A) similar to a social network feed, which captures and shares local knowledge;
2. "Share Books" which links the library event with its book collection;
3. "Share Inspirations" for more open-ended use (see fig. ??).

Library staff can moderate posts or decide to share specific resources on the visualisation module. The app can be used before, during, and after the event. At anytime, librarians can chose to select a post in the feed and display it on Explore.

4.4.2 *Implementation*

The second version of Explore is a large interactive display in a landscape orientation and close enough to the ground so children can interact with it. It displays the series of events, past and upcoming ones, as well as the posts and book recommendations curated by librarians from Participate.

The second version of Explore is a Web application, relying on the same field-tested stack as the first version. The back-end side however was adapted to integrate with data from Participate. Instead of using Firebase to store posts and files, nor using the library API, Explore uses the DOM of Participate as a data source (see fig. 30).

Participate was developed using Webstrates [54] and did not store data in a dedicated server I could plug Explore on. I developed a lightweight data transformation application to parse on the fly the data contained in the web page of Participate and expose a JSON API to Explore. Participate received continuous updates over weeks of deployments, this approach allowed me to develop Explore against a stable API and only adapt the data transformation application without impacting the codebase of the Web application.

The revised user interface of Explore is a combination of the two previous devices (see fig. 31). The timeline on the right allows users to scroll through the events showcased on the display, either past events or upcoming ones. When tapped, the elements associated with



Figure 29: Explore was placed one meter above the ground making it low enough for children to reach and interact with.



Figure 30: Back-end architecture of the second version of Explore.

this event are displayed on the central panel, as tiles adapted to their associated resource. The tiles either display the text, the pictures, or the videos that were posted, or if a link is detected, Explore tries to parse it to fetch the associated content: Youtube videos, playlists, etc.

The interface was developed to be usable both on large-size landscape displays and tablets.

4.5 VERSION 2: USAGE & LEARNINGS

4.5.1 Field Deployment

We deployed the second version of Participate and Explore in Aarhus, with the collaboration of the organizer of Creative Workshops. Marie is a library staff member, she organizes this event twice a week, all year long and participants are free to drop-in at any time during the session, registration is not needed. The deployment was initially planned for two months during the summer 2019, but was finally extended until the COVID-19 lockdown in March 2020.

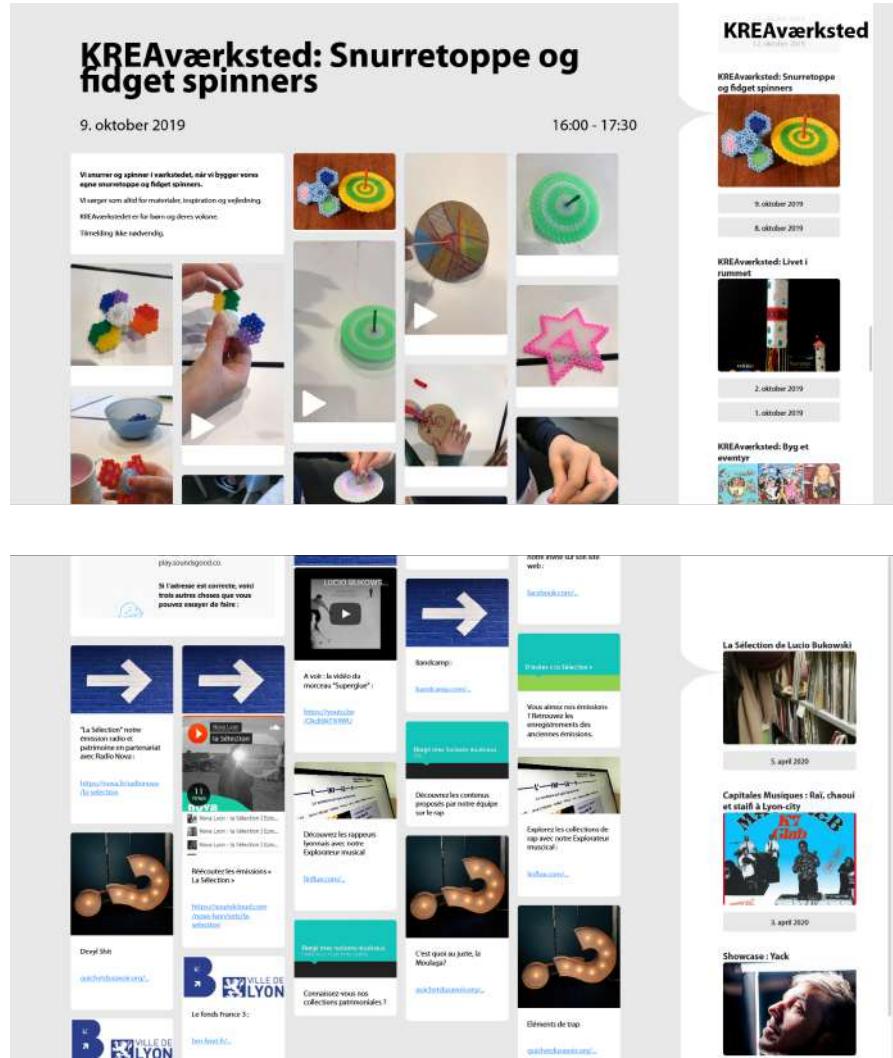


Figure 31: On the top, Explore version 2 at the a creative event from the Aarhus library featured a lot of pictures and videos of the objects crafted by its participants as well as books recommendations. On the bottom, Explore version 2 for music event from the Lyon library proposed on the other hand Soundcloud playlists, youtube videos, and websites suggestions.

The workshop room can accommodate approximately 22 participants at a time (see fig. 33). Explore was set up outside the workshop area, approximately 4.8 meters from the entrance (see fig. 32). Still, participants could see the visualization module from within the workshop area through the glass wall. We used a 55-inch interactive public display for the visualization module. The center of the screen was about 110 centimeters high from the floor (see fig. 29), making it low enough for children to reach and interact with. Next to the visualization module, there was a non-interactive public display streaming short animations without sound. In front, there was a couch facing towards the screens (see fig. 34).

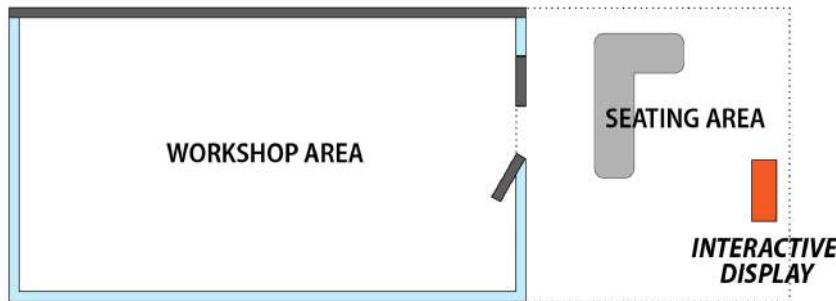


Figure 32: Layout of the research site.

The Creative Workshops series is a family-friendly event open for all ages. Typically, participants attended in small groups of young children accompanied by adults. The workshop theme changed from week to week, and included Music Instruments, Hair Accessories, Mobiles, etc. Throughout each 3-hour session, a mean of 85 visitors – mostly children – participated in the workshop, depending on the popularity of the theme.

In order to observe how Explore and Participate were used, we relied on field notes and photographs taken by Daisy Yoo over a month of observation and interviews with Marie, the organizer. Field notes were taken and analyzed using the situated evaluation method [17], specifically, centering on the following questions: (a) how our system has been used (or gone unused) by different users across different devices, (b) how it has reconfigured physical spaces and (c) how it has afforded new social practices in the library.

4.5.2 *Explore usage*

Explore was set up outside the workshop area (see fig. 32 and 34). This is a seating area where library users may play and watch children's animation films. This area is very close to the workshop space, but not directly connected to it. They used to be separate spaces with distinct functions. However, Explore established a relationship between these two spaces. During the event, the seating area was transformed into a reception area, where event participants spent time before and after the Creative Workshop, to chat and socialize. Thus, it created a new "third place" [76] within the library (see fig. 35).

Before the deployment, the experience of the event effectively began as participants entered the workshop room and ended when they walked out of the room. With Explore, the experience began before entering the workshop room, as people spent time learning about this week's theme, seeing other participants' work, becoming inspired,



Figure 33: View from within the workshop area. The workshop organizer is cleaning up the workshop table after the event.

and mentally sketching what they want to create. After the workshop, participants took time to explore what others had made, and reflect on their work from a different perspective. As the event organizer stated, *“During the activity, people are often so focused on their work, they often don’t pay attention to what other people are making. It is good that they can also see what others have made, to get ideas for how things can be done differently.”*

The content arriving on Explore originated from the event organizer, Marie, using Participate. Before the event, she usually posted books recommendations to prepare the upcoming session, and a few inspirational pictures. During the event, she mostly did not use Participate as she had to focus on the ongoing activity, but once participants were finished, they solicited her to take picture of their work.

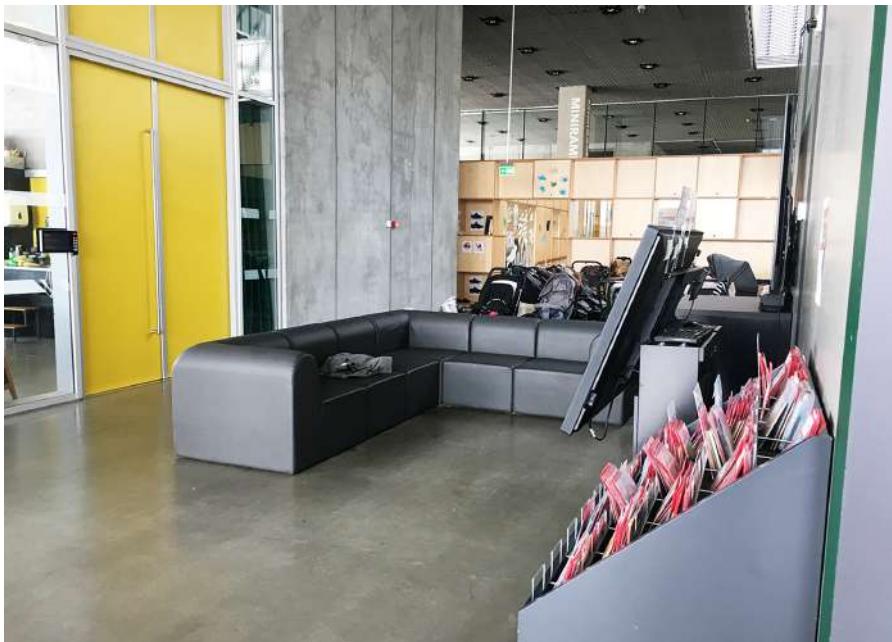


Figure 34: Physical setting of Explore

Interestingly, Explore itself became a popular photo spot. After documenting their work, event participants walked over to the visualization module to check their photos. Here, an unexpected experience emerged from a technical limitation that caused a slight time delay between the input from a mobile device and the projection on the public display. Furthermore, the position of a new photo was randomly assigned on the public display. Such unpredictability generated a pleasant thrill of anticipation among the users who were anxiously waiting in front of the public display, searching for their photos to appear somewhere on the screen. Participants often took a photo of their photo on the public display, sometimes with children posing proudly in front of the screen. It was not the photo itself that was important to the users, but they took pride in seeing their work as part of the library's digital collection.

This second deployment in Aarhus allowed us to explore a very different context from what we did beforehand in Lyon. Our observation this time lead to promising insights on how to embed a public display in the library so it could make sense to events participants and support librarians activities.

4.6 VERSION 3: MUSIC DEPARTMENT

The two previous deployments of versions 1 and 2 of Explore gave us a more precise idea of what a public display supporting events should look like in a library. In addition, the librarians in the Lyon library suggested they would be interested in using it as a mediation



Figure 35: Seating area transformed into a third place. Event participants are interacting with Explore, reading books, and having conversations. No one is passively viewing the animation film.

tool. Thus, for the third version, as it was meant to be deployed in the music department of the Lyon library, we decided to design Explore as a mediation device that could help librarians convey information regarding music events to library users.

4.6.1 *Map-centered design*

To design this third version, I sought to follow a place-centric approach, but this time by using proxies for the place we were designing for. Version 3 was designed over the course of two workshops during fall 2019. Participants to the workshops were three librarians from the music department of the public library in Lyon, one library science researcher, and two HCI researchers (including myself).

For this series of workshops, for planning reasons, it appeared impractical to conduct bodystorming and enactment activities similar to what we presented before (see section 4.2.1). Instead, I took inspiration from the results of our study evaluating Ébauche, and designed the workshops around the use of maps of the library building. The first workshop allowed the participants to discuss over the map, and add information on it through sketches and tokens (see fig. 36). This workshop led to a better understanding of the type and location of the events organized by the music department, the documents and services they offer, and the presence as well as the role of librarians in the different places. From this enriched map I identified a list of ten hot spots where it could make sense to install a new digital service.



Figure 36: The first session led to the creation of enriched maps (left) that then served as a basis to the discussions during the second session over a selection of hot spots (right).

During the second workshop a first half of the session was spent to discuss over the map of the ten spots to decide which ones we wanted to focus on. Then once we agreed on two places, we discussed the kind of devices, the resources, and the interactions we wanted to propose there.

The first design concept that emerged was a public display taking the form of an interactive poster. This display would be installed in the music room and give a view of the upcoming music events and would also showcase digital collection and services that are until now invisible in the physical space.

The second design concept that has emerged is an augmented chair in one of the hall of the library where music showcases usually happen. Equipped with a tablet, it offers a comfortable browsing of past and upcoming showcases, gives access to the social pages of the local groups, and allows to listen to the recordings of past showcases.

4.6.2 *Implementation and deployment*

Due to time constraints and then pandemic events, out of the two concepts, we developed only the interactive poster. It is a very simple VueJS web application, cycling over three pages of content. We used an Airtable³ database as a backend allowing for a straightforward REST API and easy modification of the data. Each page of the application featured a QR code leading to a mobile-friendly version of the page, and giving access to all the featured resources.

The probe was installed at first in the music room against a wall in front of the librarians desk, then in the corridor leading to it where

³ <https://airtable.com>



Figure 37: Explore version 3 took the form of an interactive poster. The QR code give access to a mobile-friendly version of the page.

patrons can sit to enjoy music. A first deployment with on-site observations was planned starting from March 2020 and a second starting from October 2020. Unfortunately, the two deployments coincided with the two lock-downs due to COVID-19 in France. The library was kept close during the first one, and then afterwards saw a significant decrease of visitors in the months after, as well as no events.

However, while we could not pursue with the field deployment of our probe, the design process we went through with the music librarians confirmed learnings from previous versions. The interactive poster concept particularly highlighted the fact that librarians feel a strong desire to make visible all the services, and digital resources that are currently invisible in the library space. On the other hand, the augmented chair, by giving access to past events echoed librarian's desire to make events a part of the collection of the library, rather than letting them disappear.

4.7 DISCUSSION

As a group of researchers and librarians, we designed Explore with a set of preconceptions regarding practices of patrons, the link between technology and place, and even on our own practices. Deploying Explore as a technology probe allowed us to confront these preconceptions by deploying in the field working technology and collect data on its use. This process led us to question the design of these probes and reflect on the usual activities in libraries through a new perspective offered by the probes.

4.7.1 *A Relation between Collections and Events*

An assumption we had during the design of the first version of Explore was that patrons interested in documents on a given theme

could be interested in events on the same theme. This idea is present in more than a quarter of the design concepts (7, 12, 13, 14, 15) presented earlier (see table 3) and is backed by stories we collected from librarians placing bookmarks to advertise events. The first version of Explore was heavily inspired by those design concepts and we planned to explore this relation between the physical assets of the library and events.

The tablet running Explore thus displayed events in relation to the books that could be found in the nearby shelves. However, our observations tended to show that among the people browsing a shelf on a specific topic, very few were interested in the information we presented. As this disinterest can be assigned to many factors, I do not think it invalidates our initial assumption. However, our approach to bring screens among books was not the right one. It requires a too big investment in device handling and in time from librarians to curate resources to reach only a fraction of the patrons that could be interested.

On the other hand, the deployment of updated version of Explore in Aarhus led to the appearance of the reverse of this assumption. The creative workshop initially did not showcased books, but as time passed by, the organizer gradually changed her practice. She started by leveraging Participate digital shelf to recommend books in relation to the event and progressively proposed a selection of physical books in the workshop room.

The relation between events and collection is difficult to grasp. While our first approach can probably be dismissed because it required a heavy technical investment reaching only a very small portion of patrons, a lower-tech approach using maybe paper posters, or integrated in a more encompassing system may yield better results.

4.7.2 *Integration in Space, Time, and Usages*

Throughout the design and deployment of the probes, we maintained a continuous interest in the integration of Explore in the surrounding place. In the case of the first version deployed in Lyon, our unspoken goal was to blend their experience with their context and avoid visually assaulting passers-by. Tablets with diverse resources were embedded in shelves surrounded by books, and the larger screen displayed quick to read information in the hall. However this anchoring did not correctly take in account how to encourage patrons to interact and as stated earlier, this first phase of deployment saw little usage from passers-by.

At the end of the test phase in Lyon, we conducted interviews with librarians responsible of the welcome desk, who were not part of the initial design workshops. As they were quite unfamiliar with the research project, they told us they did not know the large display was

interactive. They thought it was just another flavour of the already present displays showing slides in a cyclic way and static information. These discussions also highlighted that Explore had to integrate the already very rich ecosystem of signs in the library. Not only is it a challenge to get perceived in this crowded space, but conveying interactivity without being too visually distracting is an additional difficulty. The discussion we had with these staff from the welcome desk revealed that if the large display had been placed two meters closer to them its use could have been very different. At the welcome desk, a lot of patrons come with many questions regarding events, place of event, the necessity or way to register to an event. They quickly considered that Explore could be a very useful mediation tool in this context to support this kind of requests.

The Aarhus deployment saw the integration of Explore in a different place. Instead of seeking proximity to collections related to the events displayed, or proximity with places of transit, Explore was installed at the entrance of the room where the event took place. UI hints and the tilted screen of the visualization module invited people to come closer and touch it, making them get up from the couch. Most importantly, Explore showcased a *local*, “native” content that was created and growing in the public library.

The proximity with the event allowed the use of Explore by participants during the minutes before and after the event. While not really useful to advertise the event to people not already aware of its existence, this placement in space and time encouraged participants to interact with the resources made available through Explore and Participate.

4.7.3 *The hidden work of librarians*

After the first deployment of Explore with librarians, although patrons did not interact a lot with the displays, librarians did. Out of the interviews we conducted with them to reflect on the experience they had, it was interesting to observe that the use of Explore made them reflect on their work as librarians. When we designed Explore, we assumed that librarians could provide a selection of resources in relation to an event for the duration of the deployment. From designing it to using it, they realized that they in fact already collected a lot of information, and documents before every event. For example, preparing a conference often means visiting the website of the speaker, verifying how he talks by watching videos of them in other venues, their presence in the news, etc. To that we may add the various documents librarians may then suggest: books by this person, on related topics, videos, etc.

Collecting these documents, or being a “resource specialist” is at the heart of the librarian expertise but they often tune down this role

[5]. Explore turned out to be an ideal platform and proxy for them to assume this expertise and publish these resources. In addition, because Explore keeps event information and its resources online even after it has unfolded, it makes them valuable over time. This work done by librarians for events that was before invisible, now can be imagined as a long lasting part of the collection of the library.

4.7.4 *Applied implications for design*

In the upcoming months, I will develop further Explore. However, rather than iterating over a technology probe designed to pursue research interest, I will follow a product driven process. Librarians we worked with to design and deploy Explore showed a sustained interest all along the research project. To such an extent that, in the case of the display deployed in Aarhus for the Creative Workshops series, the deployment was extended for seven additional months, and librarians from the music department in Lyon expressed the desire to keep the public display if possible.

As a technology probe, and more specifically as a design artefact, Explore was successful in making librarians reflect on their work practices regarding events. Our initial goal – as researchers – with our probe was to investigate ways to encourage visual and interactive exploration of events by leveraging the place and the collections. We progressively discovered that it would raise another slightly different question for our librarian partners: how to give a place in the library and the collections to events and resources that otherwise are invisible or ephemeral? Explore represented for them a possible answer.

To develop Explore further and try to make it a viable product, we plan to focus upcoming developments on the following elements:

- *Librarians as first class users* : a latent limitation of our technology probe was its reliance on the developers of the application to perform even simple administrative tasks and sometimes just filling resources into events. A key feature to develop is to give librarians the necessary tools to use Explore autonomously.
- *Events as a collection* : events in the library information systems are almost as ephemeral as their real life counterparts. Making a persistent collection out of them and their associated resources sparked an enormous interest from librarians as they this way enriches the library's collection.
- *A digital resource haven* : there is a profusion of digital resources gathered by librarians during the preparation of each event. All these elements that were before invisible can now be accessed via Explore, and enhance the value of librarian's work.
- *A mediation tool* : rather than the Explore displays just being "stripped down" interfaces for browsing a few events, they could become valuable mediation tools. To achieve that, they must

offer richer search and filtering options so they can support librarians when they have to deal with questions from patrons.

4.8 FIELD LEARNINGS

In this chapter I presented our steps to design a technology probe, Explore, in collaboration with librarians, the field deployment we conducted, and the iterations we went through. We endeavored to follow a participative and place-centric design approach, by including librarians from beginning to end, and rooting design in the place of the library. By placing Explore as a probe in the wild we were able to quickly confront our design decisions to the reality of the field. This allowed us to reflect on how such devices can leverage the library place, how they integrate with existing practices of librarians, and make our probe evolve.

The library is a space already overloaded with signs and information. Public displays in such an environment are easily subject to display blindness no matter how rich the resources they offer. Integrating them into event venues seems promising in that they this way leverage social and temporal dimensions of the surrounding place as they invite participants to explore the resources offered before and after the event. On the other hand, they appear to be valuable tools in the hand of librarians either as a mediation tool or as a new place to host digital resources that previously were invisible.

The introduction of Explore in the library raised questions on the role of public displays could take in this place. From the usage we observed, they most certainly are an opportunity to enrich events and make them become lasting parts of the library history.

5

CONCLUSION AND PERSPECTIVES

This chapter summarises the contributions of the thesis and highlights future directions for research. This dissertation should help identify emerging needs of public libraries regarding novel digital services. To help designers create such experiences rooted in a place, we proposed Ébauche to support embodied storming of public displays. Our deployment of devices in the wild outlines allow us to describe specifics regarding the development of public displays in public libraries.

5.1 THESIS OVERVIEW

In a first place, despite an already rich corpus of public displays from previous literature in Ubicomp and in the wild, In order to ground our work on a shared understanding of the library as a place and a set of practices, we conducted a series of co-design workshops with librarians. To complement the already rich corpus of public displays from previous literature in Ubicomp and in the wild, we conducted this initial work to investigate expectations librarians had regarding public displays and novel digital services in general.

Our approach to put place at the center of our design process led us to question the tools to support place-centric and participatory design. I developed Ébauche, a digital sketching tool supporting preview on nearby displays and enactment activities. We used Ébauche in several design workshops to refine it and conducted a study to investigate how its use impacts design outcomes and led us to reflect on how to situate design.

Finally, the design work we conducted led us to design several public displays we deployed in libraries in Lyon, Göteborg and Aarhus. Developed as technology probes, their use by librarians and patrons questioned existing practices and how they can be supported by new digital services. The different iterations of the probe also allowed us to explore how a public display may leverages places and collections in libraries.

5.2 CONTRIBUTIONS

The thesis provides contributions at three levels: a design space based on empirical findings, theoretical insights on the use of a novel tool to support situated design, and as a technical contribution the de-

sign of a set of public displays in libraries. I summarize them in the following.

5.2.1 *A Design Space of Public Displays in Libraries*

The result from the eight design workshops with librarians led us to collect 18 different design concepts. From this collection we created a design space of public displays for libraries. The analysis of the design space reveals how librarians imagine the use of public displays in libraries and allowed us to identify reoccurring concerns and expectations. We identified 3 emerging themes:

1. *Beyond collections*, libraries have increasingly the vocation to host new types of documents and knowledge from the digital world.
2. *Participation* from the patrons is sought by librarians who wish to offer a dedicated place to the public.
3. *Place anchoring* of public displays in the library allows to explore multiple combinations of proximity with collections and space.

As part of our participatory process, we sought to share this contribution back to the librarians who helped shape the design space. We have produced a catalogue (see appendix A.1) presenting the design space and additional insights to facilitate the appropriation of these results.

5.2.2 *Ébauche: Supporting Place-Centric Design*

To support some of the design workshops we conducted, we developed Ébauche. Our goal was to explore place-centric design and how a digital sketching tool could better support it. Ébauche is a new collaborative digital sketching tool. It aims to support not only the participatory design and enactment of pervasive displays but also was designed to be used by multiple designers an less technically inclined participants. It achieves this by providing a intuitive sketching experience, by allowing preview of the sketches on nearby displays, and finally the creation of basic interactive scenarios. We improved its design and code throughout the workshops in which it was used and we evaluated it against paper tools.

The study we conducted compared the use of paper and Ébauche in a situated sketching and enactment setup. It revealed that while paper tend to encourage designers to be creative and explore various ways to leverage a place in their design, Ébauche fostered interactive device concepts that benefited from more refinement. Our observations also questioned our understanding of the situatedness of design and highlighted the necessity to involve inhabitants of the place in the design process among other sources of knowledge.

5.2.3 *Explore: Field Deployment of Public Displays*

The design process we followed with our partner libraries led us to develop Explore. With this technology probe, we wanted to investigate how to give events a physical place in the library. For the first version, we explored the link between collections and events and proposed displays embedded in bookshelves to communicate events and related digital documents. The two months deployment in the public library of Lyon revealed that embedded screens would not allow to reach a broad audience, however Explore allowed librarians to finally showcase some of their work that usually goes unnoticed.

The second version was deployed in Aarhus in the context of the Creative Workshops series and focused on showcasing the work done by participants during the events. This deployment highlighted that a placement near the event place played an important role in encouraging participants to interact with the event resources before and after it took place.

The third and last version was designed as a mediation tool for the music department in Lyon. Despite an aborted deployment, it allowed us to explore alternative ways to design for a place and deepen our understanding of how such device can integrate in librarian's practices.

5.3 PERSPECTIVES

Over the course of this dissertation, I proposed place-centric design to define future digital devices in public libraries. The design workshops we conducted allowed us to obtain a good idea of the change librarians wish to see coming. I hope this corpus of design concepts can inspire future developments in libraries, and our field deployments may inform designers of public displays in similar contexts.

However, the results stemming from the workshops and the deployments focus almost solely on the perspective of librarians. Despite early observation of patrons behaviour during our preparatory ethnographic work, their absence in interviews and workshops that followed limits the scope of our results. Our lack of consideration of patrons as first users makes us rely on the vision librarians have of them. While one can expect they have a good knowledge of their public and the usage we saw during the deployment in Aarhus was beyond our expectations, it is also a significant bias that impacted our results. I am looking forward to further develop Explore in the upcoming months following the writing of this dissertation. To ensure the future versions not only fit the needs expressed by librarians but also meets patrons' expectations regarding digital services in the library, we expect to involve patrons more in the design process.

This focus on the librarian perspective may have limited the scope of our results, but this approach nonetheless led to a deeper understanding of the work done by librarians. Getting acquainted with the invisible tasks they perform when organizing events opened many perspectives I will explore in the upcoming months.

5.3.1 *A mediation tool for librarians*

Explore was initially thought of as a devices whose main users would be patrons of the library. The discussions around the first and third deployments in Lyon highlighted that librarians could be as much primary users of these devices as patrons. Librarians from the welcome desk envisioned Explore as a tool to help them communicate with patrons when then ask about events: venues, times, reservation, etc.

Currently, Explore presents a simple interface showcasing a subset of events and resources to patrons, but future developments should consider librarians as first class users and propose “*expert*” interfaces. First to make them able to manage themselves the creation of event items in the system and allow them to easily enrich these event with resources of their choice. But also, in places where patrons and librarians interact, serve as a discussion medium with patrons and support co-located multi user scenarios, for example to perform a deeper search in the collection of events.

5.3.2 *Events as a new digital collection*

Because Explore keeps past events visible, its use sparked discussions with librarians over the ephemeral nature of events in the library systems. It appeared to us that in Lyon, once an event is over, its description page disappears from the library agenda. Moreover, when events such as conferences are recorded and made available in the digital collections of the library, they become difficult to find and are presented out of their initial context.

The first version of Explore allowed access only to a very limited number of past events, but the second version gave access to a collection of older events from the creative workshop series. We observed participants come to the display with friends so they could specifically show them creations they did in previous workshops. The digital existence of the event also allowed remote participation to the workshop from families who could not come to the library.

The SARS-CoV-2 pandemic exacerbated the need to give library events a digital presence. Either by allowing live experiences online, but also by allowing events and their resources to be viewed by as many people as possible despite restrictions on the number of participants. Future developments of Explore should support these new

ways to attend an event while being away from the library or after the event is held.

5.3.3 *The missing brick of the library digital stack*

To support their every day tasks, librarians can rely on their Integrated Library Systems (ILS). These complex software suites often support all the process from acquiring and lending documents to managing patron subscriptions. However, events organized by the library do not benefit from the same support from ILS suites. In Lyon, the library had to resort to the in-house development of a tool to manage events. We observed many other smaller libraries had to leverage the Content Management System (CMS) of the library website to handle the publication of their agenda.

In such a fragmented space, Explore can fill a void in the event management ecosystem of libraries. To pursue this idea, I plan to spend the next year to develop Explore in order to make a polished version out of the current prototype and study transfer possibilities to make Explore available to libraries.

A

APPENDIX

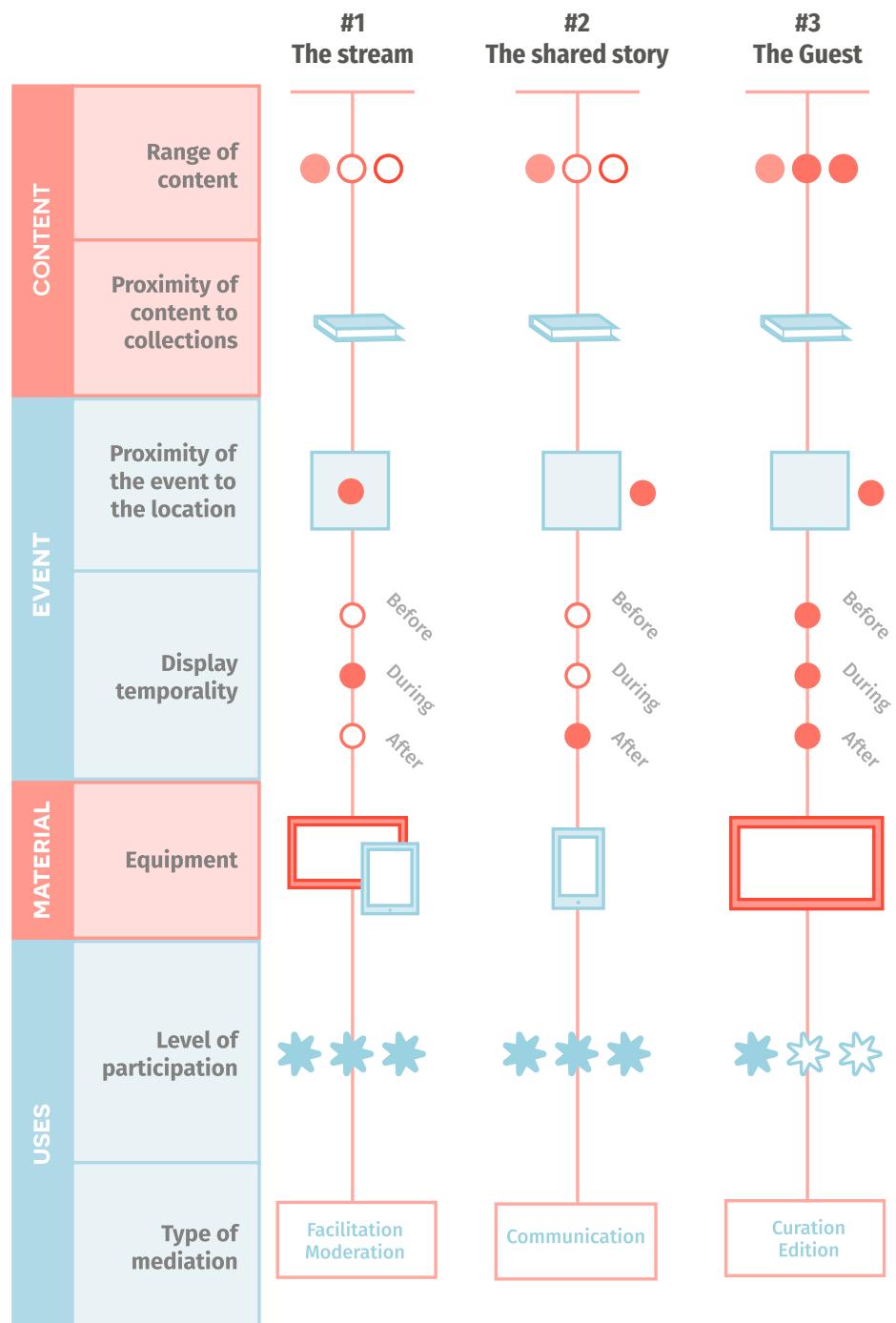
A.1 CONCEPT CATALOGUE

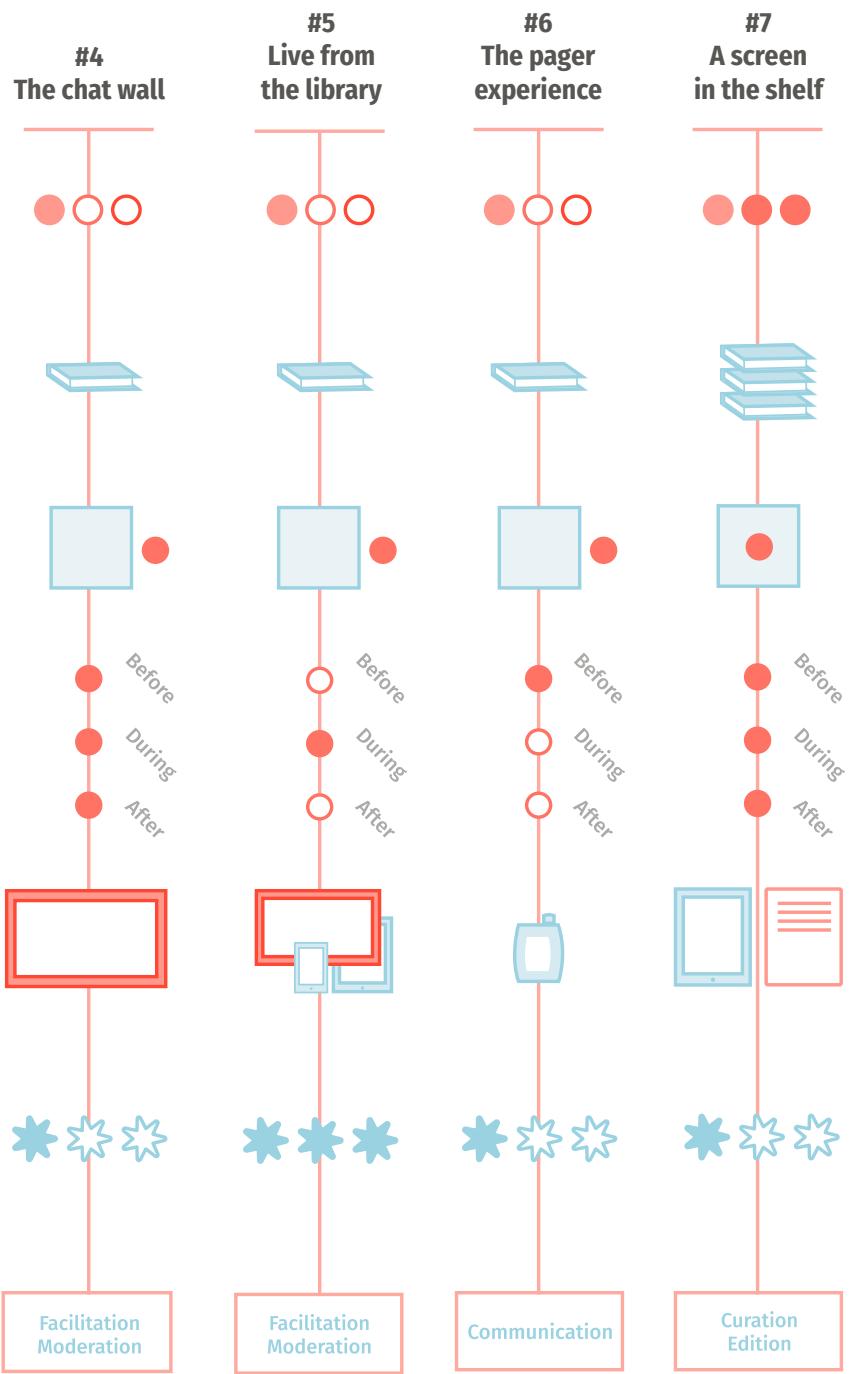
The PLACED project was built with partner libraries and researchers, but also with the more occasional participation of librarians or library students during workshops: the workshop of the French-speaking international summer school in libraries and information sciences (Montreal, Canada, 2017), the Cfibd-Enssib workshop during the meetings of young IFLA professionals (Lyon, France, 2018), the PLACED project workshop (Aarhus, Denmark, 2018), the Rencontres Nationales des Bibliothécaires Musicaux workshop (Lyon, France, 2019).

These workshops were an opportunity to come up with ideas for services or devices to make events visible in the library, to encourage public participation, and to make links between collections and events. We made from it a catalog to consult, test, and discuss, in which you can explore each idea, each device.

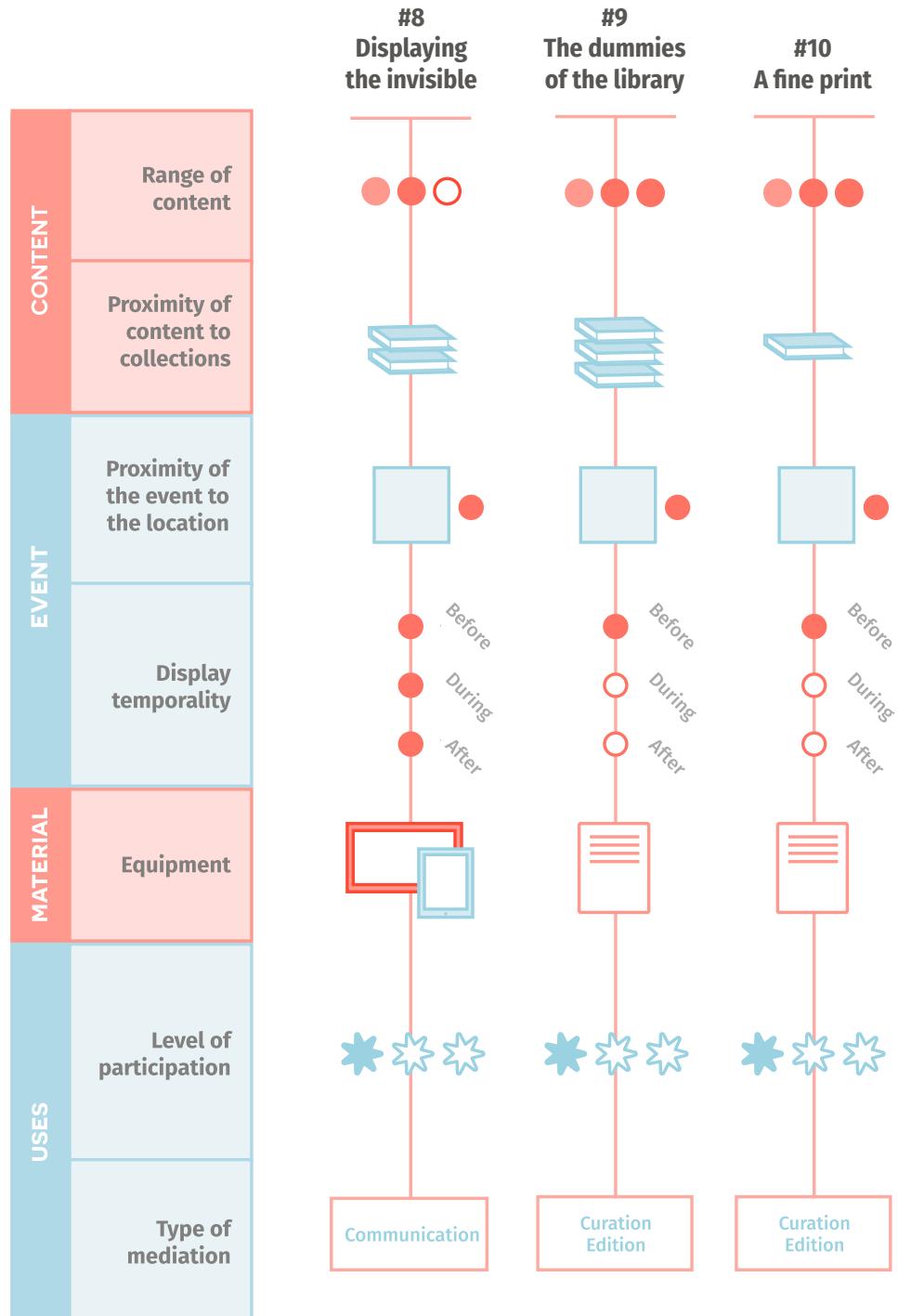
We have also designed a summary and exploration table of these service ideas that will allow you to identify the more or less participatory devices, the more or less digital or printed devices, the more or less localized devices, etc.

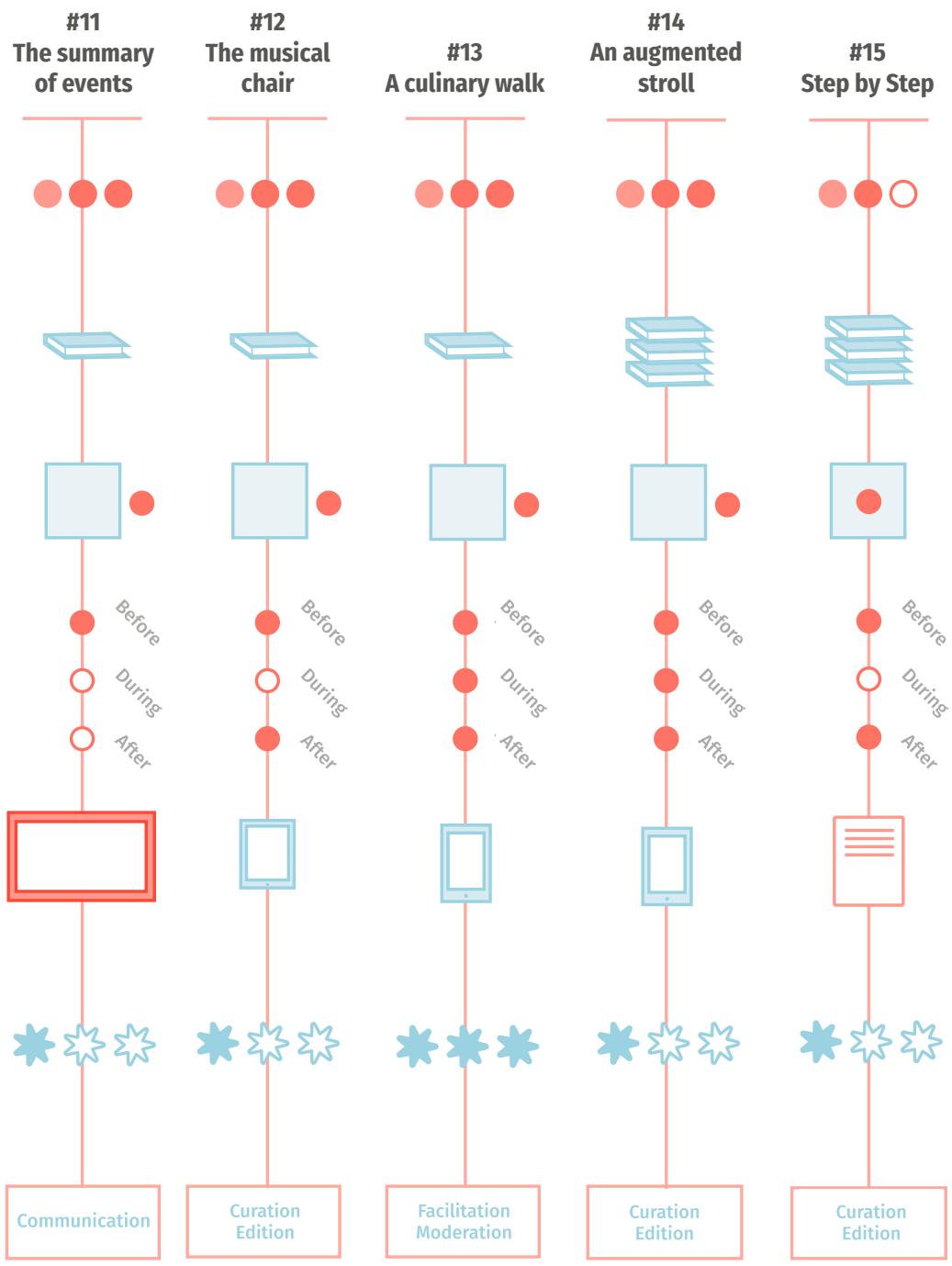
SUMMARY TABLE

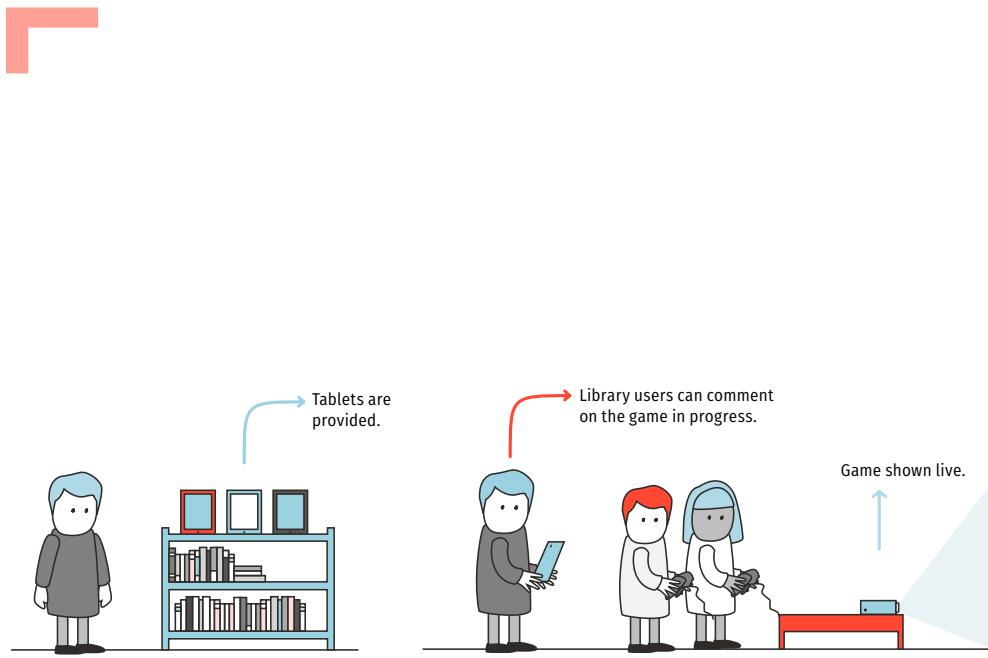




SUMMARY TABLE







#1 THE STREAM

Informations.

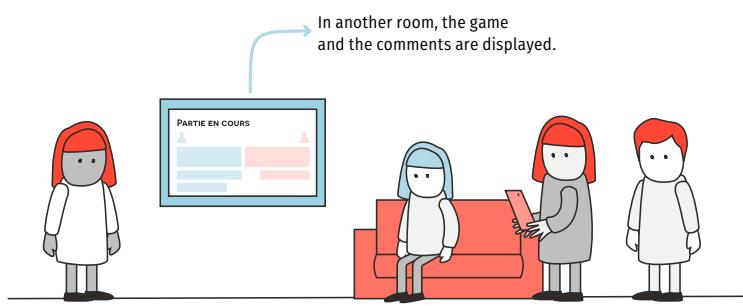
Location	Library spaces
Usage	Collective
Equipment	Public screen /tablets
Timeframe	During the event

Development context :

"Young professionals" workshop organized by IFLA-Cfibd-Enssib, Villeurbanne, Lyon, January 2018

Designers :

Library students and PLACED researchers



Considering an event about video games, tablets are made available to users, who can then comment on the game sessions of a public tournament and take photos and videos of it. The tournament is to be broadcast live on a large screen elsewhere in the library or on the network. The game and user comments appear simultaneously on the screen. This method could also be used for other events in the library.

The aim is to widen the circles of participation for events: the circle of direct participants (in this case, those who play), indirect participants (in this case, those who comment), and of spectators (in this case, those who watch on the big screen). This widening of the participation is created by broadcasting in different areas, in particular those which cannot accommodate the event but can promote it, but also those acting as hosts, allowing them to promote the upcoming event.

#2

THE SHARED STORY

Informations.

Location	Reading areas
Usage	Individual
Equipment	Tablet
Timeframe	After the event

Development context :

"Young professionals" workshop organized by IFLA-Cfbd-Enssib, Villeurbanne, France, January 2018

Designers :

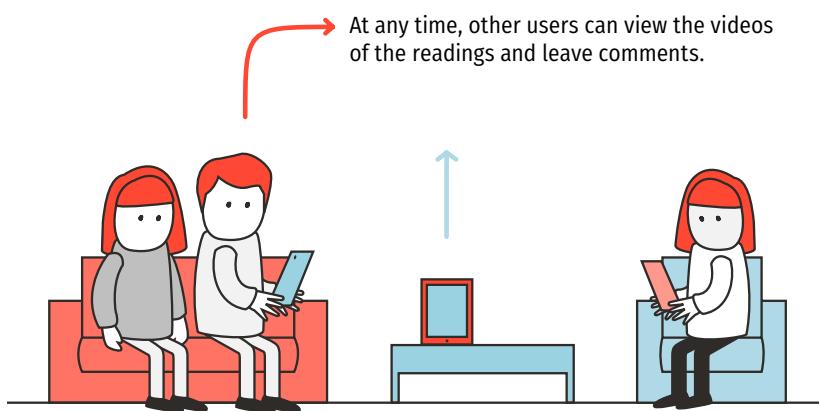
Library students and PLACED

The users produce stories during the writing workshop, these are filmed with a tablet.



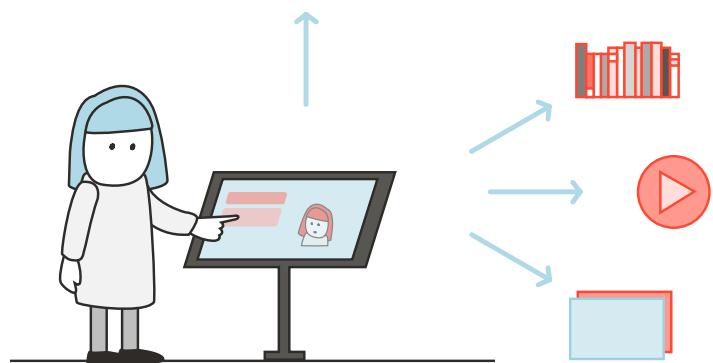
As part of writing workshops, for example, texts created by the participants are read by their creators. By means of a tablet, these readings are used to make a video or audio file (for which the consent of the participants is required.) The tablet is then placed in an area used for relaxation, leisure or media so that other users can listen to these readings and leave comments.

The aim of this process has multiple desired outcomes: raising awareness, generating the desire to participate, bringing the productions out of the workshop and promoting recognition of the participants by other users. As the tablet is portable, the visibility of the workshop and its productions can be created in different spaces of the library, but also of the network, or even of the site (city, campus, etc.).





A touch table offers users access to content related to the arrival of a speaker.



#3 THE GUEST

Informations.

Location	Location of the upcoming event
Usage	Individual or collective
Equipment	Touch table
Timeframe	Before, during and after the event

Development context :

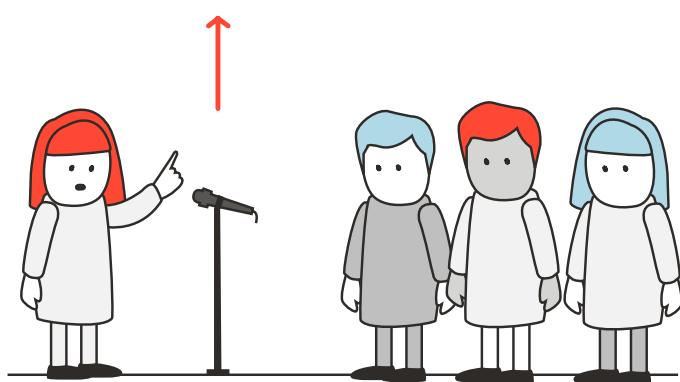
"Young professionals" workshop organized by IFLA-Cfibd-Enssib, Villeurbanne, France, January 2018

Designers :

Library students and PLACED researchers



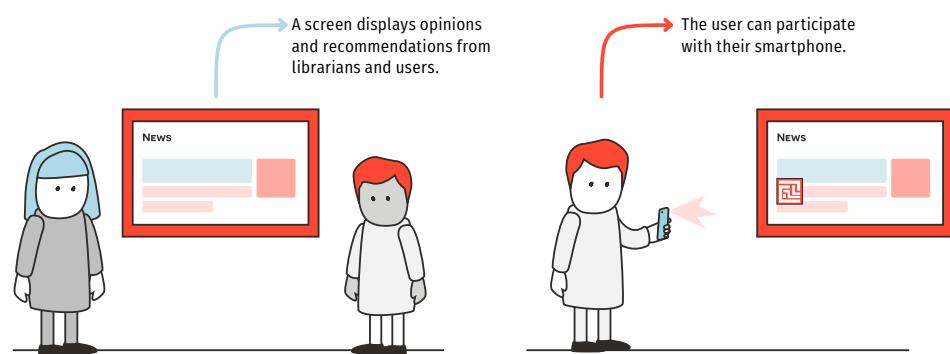
Before or after the conference, users can find information resources.



After the invitation of a speaker, a touch screen will be available at the entrance of the conference room a few days before the event, and for a few days after. The screen displays multiple documents about the guest: bibliography, audio/video recordings, websites, photos, etc.

The aim of this device is twofold:

- (1) For users, it is a means of offering access to resources complementary to the organised event and raising awareness and understanding of the value of the coming guest.
- (2) For the library, it is about highlighting its ability to identify the right experts and its ability to mobilise them for the community. The back-office work, which is usually invisible, is highlighted here, thereby relaying the librarians' own expertise to feed the public debate.



#4

THE CHAT WALL

Informations.

Location	Areas for socialisation and with high traffic
Usage	Collective and individual
Equipment	Screen, tablet, display panel
Timeframe	Before, during and after events

Development context :

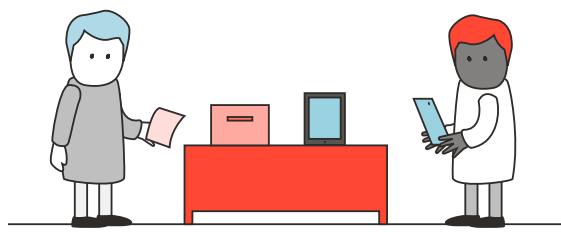
PLACED team design workshop, Lyon, March to June 2019.

Designers :

Members of the PLACED project group in Lyon: librarians from the Municipal Library of Lyon, researchers in LIS (Library and Information Sciences) and HCI (Human-Computer Interaction)



Users who do not have a smartphone have the option of leaving a note, on paper or on an available tablet.

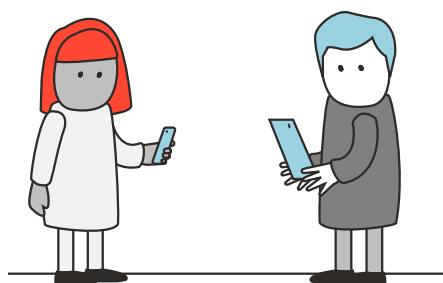


In the library reception, a screen displays publications from librarians and users related to the cultural programme. On the screen, users can post their own comments on the screen by visiting a website (via a QR code, via a very simple link, eg: bm-lyon.fr/blabla, or from the library's WiFi authentication page). Users without smartphones can leave a message on paper or via a tablet provided.

The aim of this system is to make user comments about the cultural programme visible in the library. These comments can be anecdotal or simple expressions of opinion, but they can also provide useful additions to other users: reading tips, hyperlinks, etc. This device makes room for users as individuals, whose opinions of the library programme matters. Recognition and legitimacy are the two driving forces behind this system.



During this event, users post their comments live and share information.



#5

LIVE FROM THE LIBRARY

Informations.

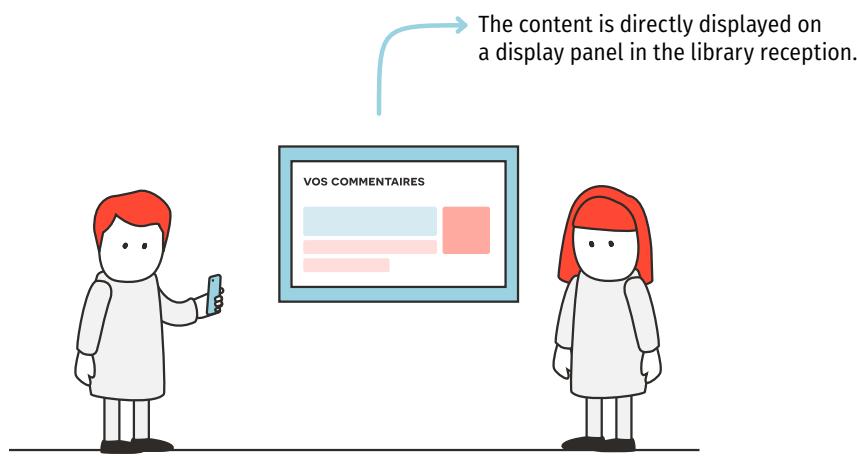
Location	Entrance, hall or reception
Usage	Individual and collective
Equipment	Large touch screen, smartphones, tablets
Timeframe	During the event

Development context :

PLACED team design workshop, Lyon, March to June 2019.

Designers :

Members of the PLACED project group in Lyon: librarians from the Municipal Library of Lyon, researchers in LIS (Library and Information Sciences) and HCI (Human-Computer Interaction)



Users are invited to post on their favourite social networks (or on a dedicated library service) what is happening during an event. By encouraging the use of a predefined hashtag, posts are collated in real time on a screen in the lobby. The display posts consist of comments and photos on the current. These comments are posted by users from their own phones, or from a tablet made available near the event.

The aim of this system is to make user comments concerning the programming visible in the library. It is also about making the activities that take place there visible outside the library. These comments can be anecdotal, the simple expression of opinion and can also provide useful additions to other users: reading tips, internet links, etc. This device makes room for users as individuals, whose opinion of the library matters. Recognition and legitimacy are the two driving forces behind this system.

#6 THE PAGER EXPERIENCE

Informations.

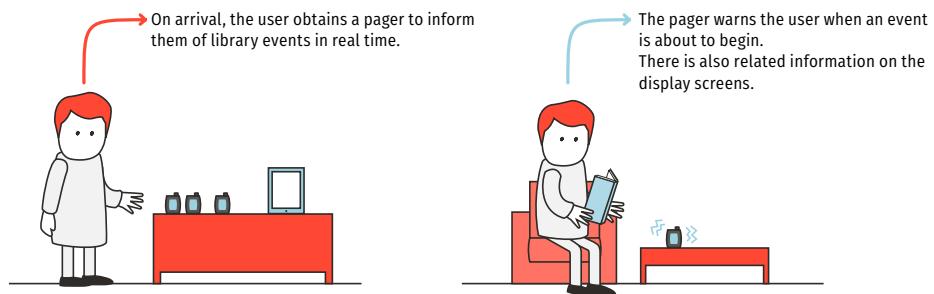
Location	The whole library
Usage	Individual
Equipment	Screen, pager
Timeframe	Before the event

Development context :

Annual meeting of the PLACED-Aarhus project, Aarhus Denmark, April 2018

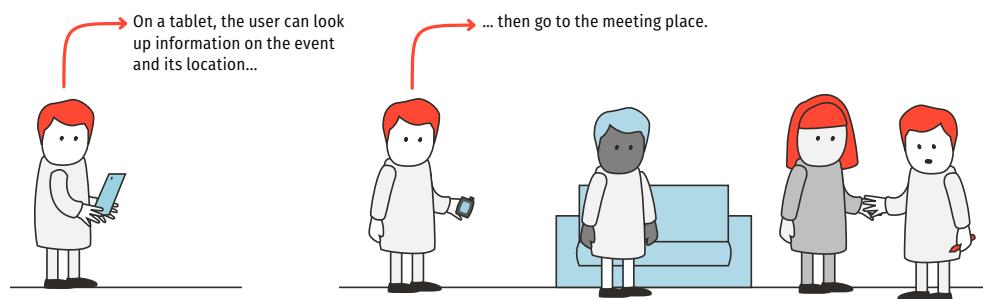
Designers :

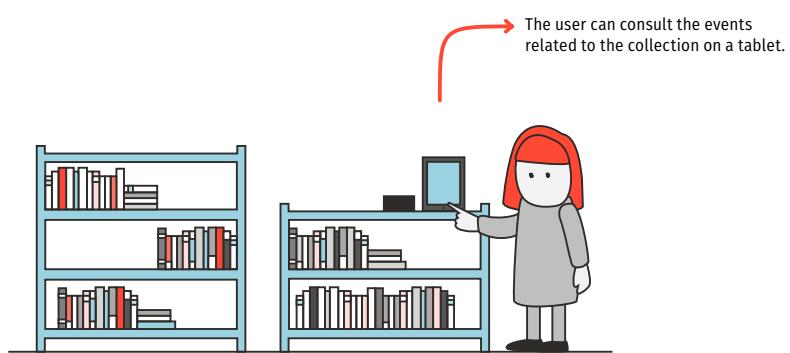
Members of the PLACED project group: librarians, researchers in LIS (Library and Information Sciences) and HCI (Human-Computer Interaction)



At the entrance of the library, pagers are made available to users. The user, who picks it up, walks around the library with this object, which alerts them when an event is about to start. The user can then consult display screens that give them information on the exact location of the event, and possibly on the contents.

This device allows users to be informed, in real time, of what is happening in the library when they are there. The aim is to make events visible and to facilitate participation in them, considering that participation is not necessarily planned and can be a matter of opportunity and occasion. With this system, the library remains in contact with users without overburdening the space with repetitive visual communication that is ultimately not very visible.





#7

A SCREEN IN THE SHELF

Informations.

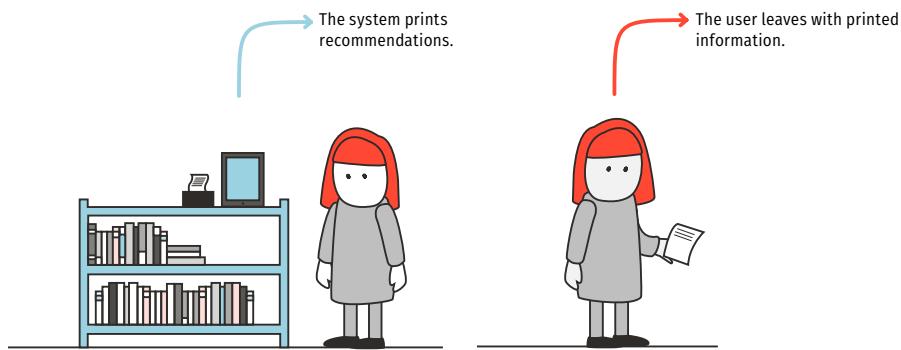
Location	Collection spaces
Usage	Individual
Equipment	Tablet or touch screen integrated into the furniture
Timeframe	Before, during or after an event

Development context :

PLACED team design workshop, Lyon, March to June 2019.

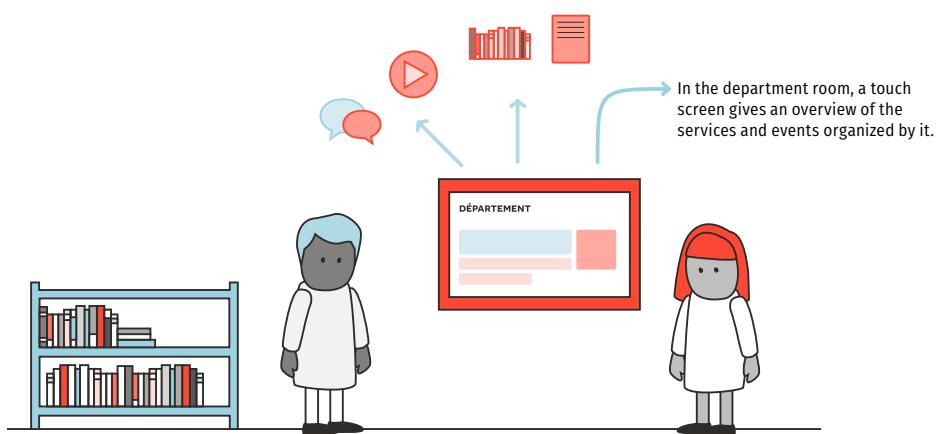
Designers :

Members of the PLACED project group in Lyon: librarians from the Municipal Library of Lyon, researchers in LIS (Library and Information Sciences) and HCI (Human-Computer Interaction)



In the context of the organization of a hip-hop concert at the library, the librarians gather various information related to the event: date, discography and bibliography, videos, texts, etc. In the music room, on a shelf in the "Hip-hop" section, a touch screen offers users the opportunity to discover this event and content selected by the librarians. Through this screen, they can print a ticket that acts both as a concert ticket and as a guide to find all the resources related to this event from home.

The aim of this system is to make the cultural programme known to users who tend to frequent the collection spaces only. It is also about making the dialogue that is created between an event and the resources it produces (audio-visual recordings), the physical and digital resources of the library relating to the theme of the event and the resources external to the library that might complement this set of content visible. As the tablet is easily moved, this dialogue can take place between events and collections that are apparently not very linked. This device thus aims to create bridges between the various fields of knowledge of the library. Moreover, the tablet can be installed in other strategic places in the city and thus initiate a dialogue between the library and its environment.



#8

DISPLAYING THE INVISIBLE

Informations.

Location
Usage

Music Room

Individual
and collective

Equipment

Large touch screen,
smartphones,
tablets

Timeframe

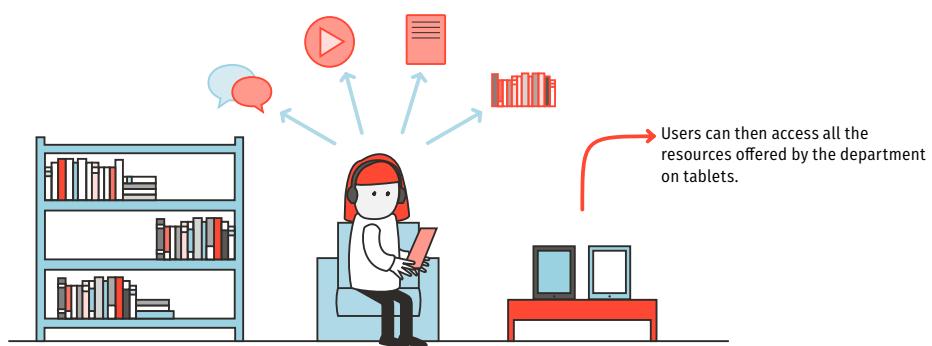
Before, during and
after the event

Development context :

PLACED - Musique team design workshop,
Lyon, September-December 2019.

Designers :

Members of the PLACED project group in
Lyon: librarians of the Music department of
the Municipal Library of Lyon, researchers in
LIS (Library and Information Sciences) and
HCI (Human-Computer Interaction)



In the music room, a large touch screen shows three posters that rotate every 20 seconds. These posters are centred on an upcoming event, for which they succinctly give practical information. The poster mostly features a selection of digital resources created by the librarians: blog posts, radio shows, and more. To go further in the discovery of these resources, a tablet is made available for browsing these contents.

This system aims to give visibility to digital knowledge produced by the library. Usually, this remains unfortunately inaccessible to users who frequent the physical collections or events. For the library, the aim is to promote documentary work carried out by specialists, and to do so on the occasion of events, which themselves are an opportunity to produce new digital content.

#9

THE DUMMIES OF THE LIBRARY

Informations.

Location	Shelves
Usage	Individual
Equipment	Box, paper, pens
Timeframe	Before, during and after the event

Development context :

National meeting of music librarians (RNBM), Lyon-Villeurbanne, April 2019.

Designers :

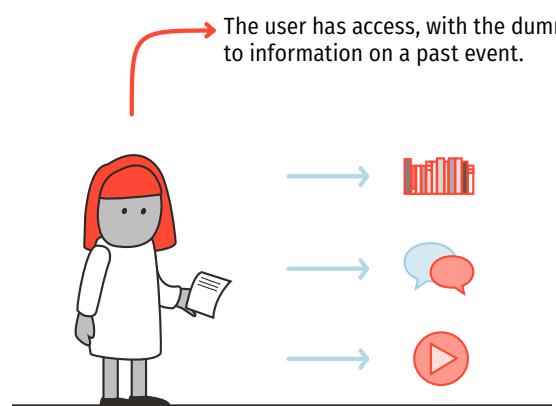
Music librarians, members of the PLACED team

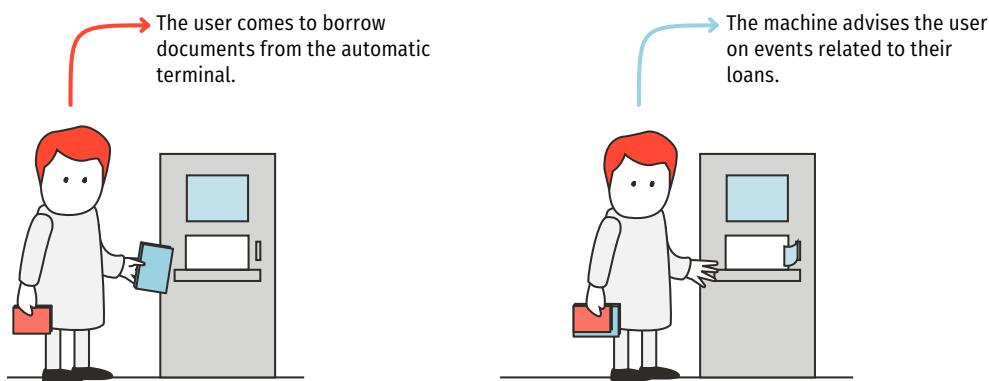
The user finds "book dummies" between the documents in the library.



Users walking through the shelves of the music sector may see book dummies. These boxes or papers are updated with traces of library events. They contain a reminder of the event and various resources related to the artist or speaker who came to the library or related to the theme of the event. The dummy displays a link which leads to an interface allowing to consult these resources.

The aim of this device is to create links between an event and a collection. This link is built by highlighting the common themes addressed by the physical collections, event collections and digital collections, and temporally between past events and the current presence of the collection. For librarians, it is a matter of showing spaces of knowledge which are usually invisible to users and hence their own documentary qualities.





#10

A FINE PRINT

Informations.

Location

At lending machines, wherever they are located

Usage

Individual

Equipment

Lending machine, thermal printer (for receipts).

Timeframe

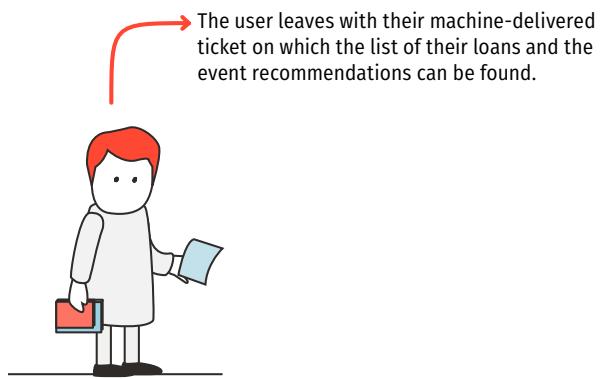
Before an event

Development context :

French-speaking international summer school in library and information sciences, Montreal, July 2017

Designers :

Students and teachers in library science at EBSI (Montreal) and ENSSIB (Lyon), Quebec librarians, members of the PLACED project group researchers in LIS (Library and Information Sciences).



When borrowing a document via a lending machine, users receive a ticket. This lists the loans, indicates the return dates and suggests event recommendations related to the themes of the loans made. The list of loans is preceded by the message: "If you like to read / watch / listen to:" and the list of recommendations by the message: "Then you might like to attend:".

The aim is to introduce users of the collections to the library's event programming. This device targets users who tend to visit physical and borrowable collections rather than events offered by the library in its programming. It also makes it possible to recreate the sort of dialogue formerly reserved for when dealing with a librarian. Finally, this system involves indexing the cultural, scientific and educational events of the programme with the same keywords as for indexing collections, and thus makes it possible to think of the events as a collection in their own right.

#11

THE SUMMARY OF EVENTS

Informations.

Location	Entrance, hall or reception
Usage	Individual
Equipment	Large touch screen
Timeframe	Before the event

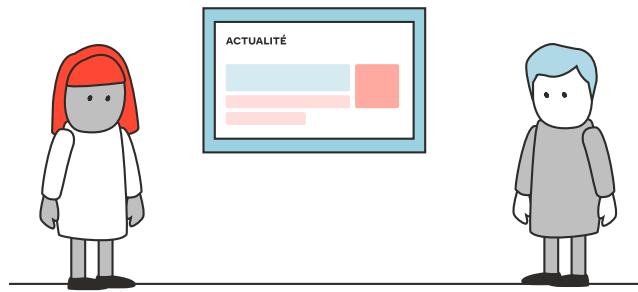
Development context :

PLACED team design workshop, Lyon, March to June 2019.

Designers :

Members of the PLACED project group in Lyon: librarians from the Municipal Library of Lyon, researchers in LIS (Library and Information Sciences) and HCI (Human-Computer Interaction)

A touch screen installed in the library hall provides an overview of the highlighted events.



At the entrance of the library or in one of its central spaces with a high attendance, a large touch screen allows users to navigate through the cultural programming. The screen allows users to discover the next upcoming events accompanied by a short text of practical information and photos. The touch screen also provides access to additional information on each event, such as bibliographies, videos, web magazine articles, etc.

The aim is to make the future events visible in the library and to ensure better visibility for users who are not informed of these events. Furthermore, the tool allows users to navigate between events and see the links between them. Finally, it allows the discovery of the event beyond the practical elements given in the schedule, through the selection of resources carried out by the librarian organisers. Navigating the cultural programme becomes another experience of mediating the collections.



#12

THE MUSICAL CHAIR

Informations.

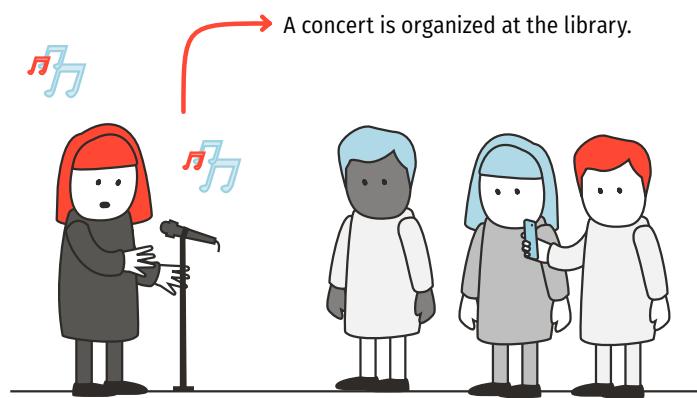
Location	Places of socialization and traffic
Usage	Individual
Equipment	Tablet, headphones, armchair
Timeframe	Before, during and after the event

Development context :

PLACED - Musique team design workshop, Lyon, September-December 2019.

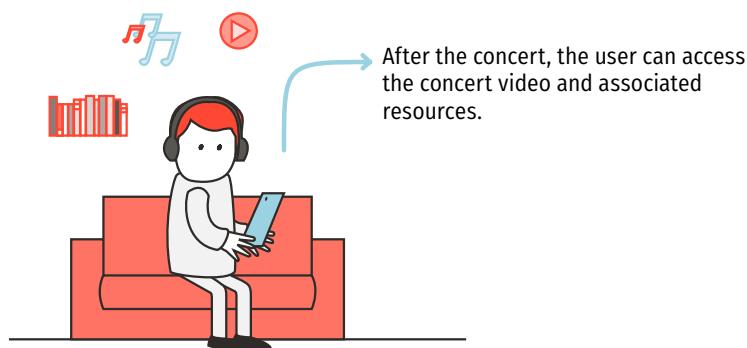
Designers :

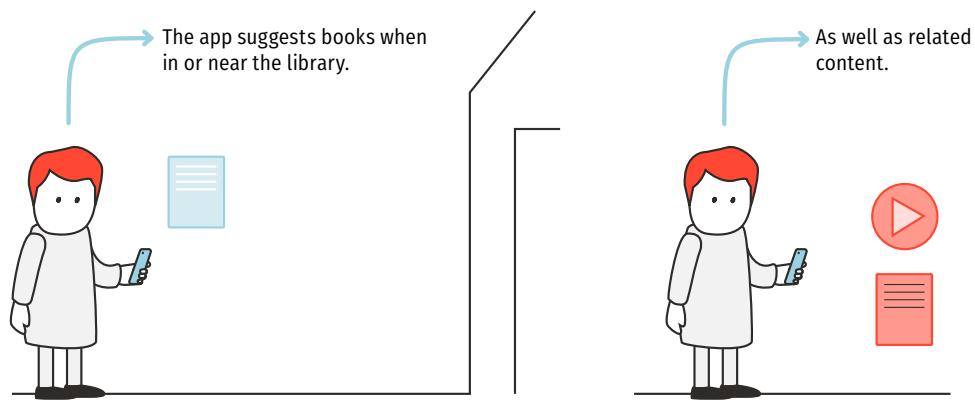
Members of the PLACED project group in Lyon: librarians of the Music department of the Municipal Library of Lyon, researchers in LIS (Library and Information Sciences) and HCI (Human-Computer Interaction).



A concert is organised at the library. After the concert and in the same location, an armchair is set with a tablet and headphones. Users can view the concert video recording and a selection of related resources. The tablet also allows users to watch videos of past concerts and consult the list of upcoming concerts.

The aim is to offer users a route through organized events, concerts or others, between access to past events and information on upcoming events. This listening and viewing station is designed as a display in the library space for digital audio-visual resources. These resources are struggling to find their place on websites or in catalogues but could take their place physically in the library via dedicated devices.





#13

A CULINARY WALK

Informations.

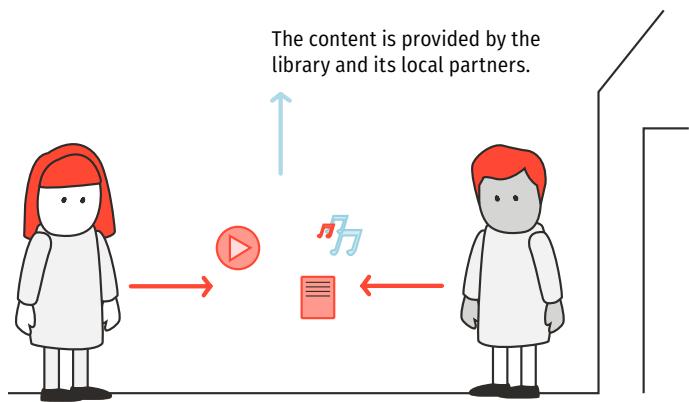
Location	Near the library
Usage	Individual
Equipment	Smartphone
Timeframe	Before, during and after the event

Development context :

French-speaking international summer school in library and information sciences, Montreal, July 2017

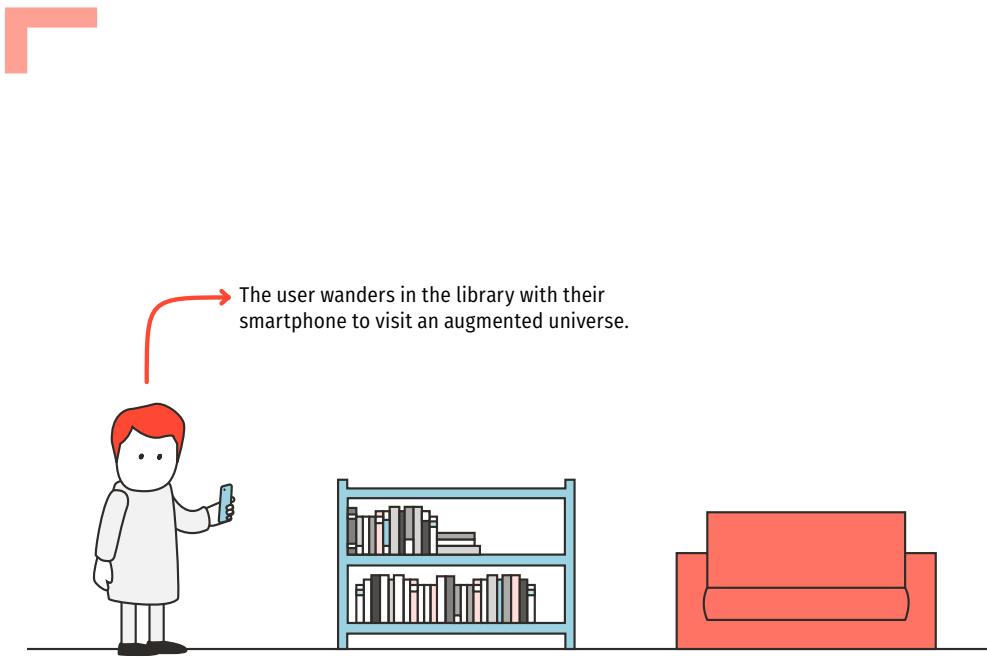
Designers :

Students and teachers in library science at EBSI (Montreal) and Enssib (Lyon), Quebec librarians, members of the PLACED project group researchers in LIS (Library and Information Sciences).



An application provides access to library resources (events and collections) around the theme of cooking. On site or near the library, the user receives cooking recipes, menus from neighbourhood restaurants, cooking advice given by local restaurateurs, tips related to food provided by local associations. The application also offers a selection of books or digital resources acquired or produced by the library. Finally, it informs the user of the library's programming relating to the theme of food and nutrition.

The aim for the library is to link the knowledge it offers with that of the community and its local businesses and associations. The resources are offered thematically and localised to a neighbourhood, thus offering a new form of multifaceted and multisource recommendation. The application does not necessarily belong to the library but can still be fed by the library opening its data.



#14

AN AUGMENTED STROLL

Informations.

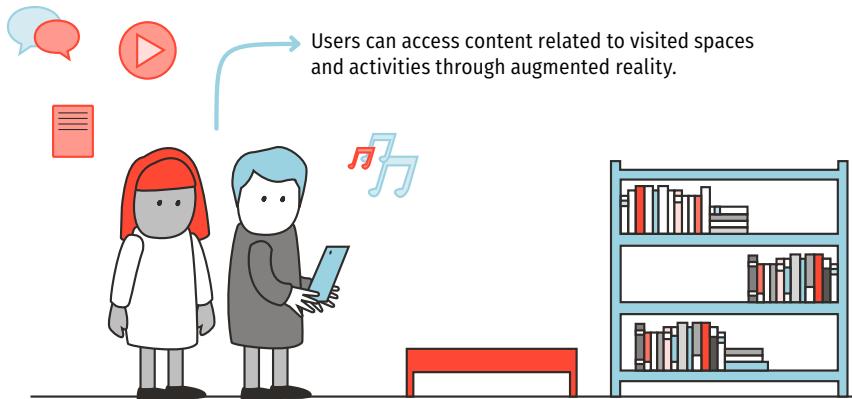
Location	The whole library
Usage	Individual
Equipment	Tablet, smartphone
Timeframe	Before, during and after the event

Development context :

National meeting of music librarians (RNBM), Lyon-Villeurbanne, April 2019.

Designers :

Music librarians, members of the PLACED team



The library has organized an augmented digital universe for each of its spaces. Thanks to their smartphones, users can walk in this parallel universe and thus access digital resources linked to the crossed physical spaces. Depending on the events organized at the library, this parallel universe is updated with the appropriate resources.

For the library, the challenge is to make digital resources visible on the basis of principles: first, in relation to the space in which the user wanders, and then in relation to the time of the cultural programming of the library. Thus, librarians can highlight resources which are not very visible and whose complementary interest with physical resources and with events is underexploited.

#15

STEP BY STEP

Informations.

Location	The whole library
Usage	Collective
Equipment	Signage
Timeframe	Before and during the event

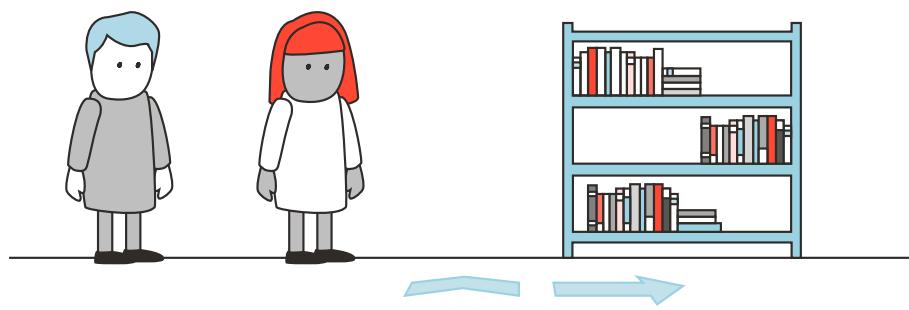
Development context :

National meeting of music librarians (RNBM), Lyon-Villeurbanne, April 2019.

Designers :

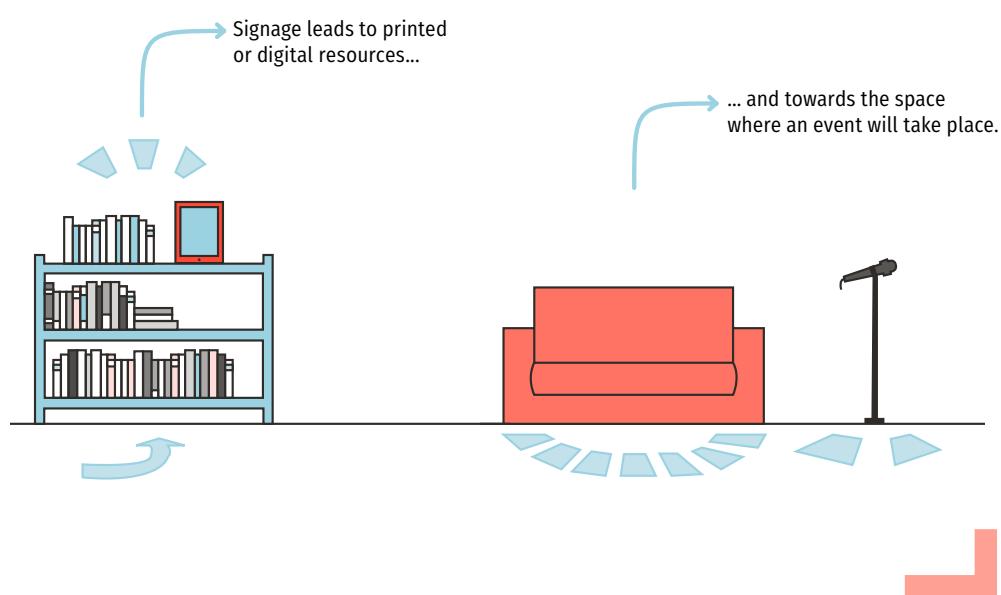
Music librarians, members of the PLACED team.

Users locate signage on the ground.



Upon entering the library, users locate signage on the ground. This relates to an event recalled by the visuals. The users who follow it will be invited on a journey through the library and its collections, with stops at various presentation tables, and terminating at the place where the event is organised. A variant of this step by step consists of offering signage accompanied by a QR code that leads to various digital resources.

The aim of this installation is first of all to make the event a global event, which combines the experience of the user brought to follow a new path in the library, the promotion of the collections, and the discovery of the event. The second aim is to show users how events have a strong relationship with the resources offered by the library. The third aim is to attract users to the site of the event itself and invite those who did not plan to participate.



A.2 SITUATED SKETCHING STUDY PARTICIPANT LEAFLET

Etude Ébauche Automne 2018

Présentation de l'étude

Durée : 1h30

Déroulé :

00:00	5 min	- Start timer - Introductive speech
00:05	10 min	- Consent Form - Background questionnaire - Attach the microphones
00:15	10 min	- Training task with Paper - Training task with Ebauche
00:30	5 min	- 1st Activity leaflet presentation - Let the participants read the text
00:35	15 min	- 1st Activity
00:50	10 min	- Enactment & Video (advice)
01:00	5 min	- Pause
01:05	5 min	- 2nd Activity leaflet presentation - Let the participants read the text
01:10	15 min	- 2nd Activity
01:25	10 min	- Enactment & Video (advice)
01:35	10 min	- Conclusion questionnaire - Ask the participants to present their videos - Interview

Présentation du contexte de l'étude

À lire de la même manière idéalement sans variation pour tous les participants.

Encore merci de vous prêter à cette étude, avant que l'on commence, je vais vous présenter brièvement sa raison et son but.

Nous cherchons à comprendre les processus de design liés aux affichages publics. Nous cherchons en particulier à comprendre comment concevoir, quelles méthodes et quels outils peuvent être utiles à la conception ou au contraire être des freins.

Pendant l'heure qui va suivre, vous allez mener 2 activités de conception pour des affichages publics. Ces activités seront sur des thèmes différents, et dans des situations différentes.

La première situation vous demandera de réaliser un système de collaboration à distance dans une salle de travail de l'ENSSIB, permettant à des étudiants d'avancer sur des projets de groupe avec des camarades à distance.

La deuxième situation vous placera dans la bibliothèque de l'ENSSIB où le but sera d'imaginer un moyen innovant de communiquer sur les événements organisés au sein de l'école.

Chaque activité commencera par une présentation du contexte ainsi que des ressources disponibles. Vous aurez ensuite 15 minutes pour imaginer un concept et dessiner les écrans nécessaires. Enfin vous aurez 10 minutes pour mettre en situation votre idée pendant laquelle vous enregistrerez une vidéo de vous en train de jouer votre scénario, ce sera le résultat final de l'exercice.

Les enregistrements et vidéos qui seront prises lors de l'étude ne seront bien sûr pas diffusées et serviront à analyser le déroulé de l'atelier.

Background questionnaire

- Id
- Age
- Genre
- Education background (computer science, graphic design, interaction design, ergonomics, etc.)
- Education level (bac, bachelor, master)
- Years of professional practice ()
- Have you ever designed internet of things devices, for screens distributed in the environment?
- Have you experience in designing for libraries
- Have you experience in designing for educational institution (schools or universities)
- On a scale of 1 to 5 how much experience do you have sketching on paper
 - 1=no xp - 5=a lot of experience
- On a scale of 1 to 5 how much experience do you have sketching on tablets
 - 1=no xp - 5=a lot of experience
- Have you ever practiced bodystorming activities

[https://docs.google.com/forms/d/1EZ_2PVBWLH18PKqviVhP0q8W7iIF33meKui9uIZ9rX0/edit
?usp=sharing](https://docs.google.com/forms/d/1EZ_2PVBWLH18PKqviVhP0q8W7iIF33meKui9uIZ9rX0/edit?usp=sharing)

<https://goo.gl/JaGMfN>

Material

Mesures

1 Action camera
1 Glasses spycam
1 microphone

Common

1 Smartphone to film the video prototype

Paper

Drawing pens :

- blue
- red
- green
- black

Correcting white

Pencil & Gum

Paper sheets A3 & A4

Scotch

Digital

3 dual sockets
2 rallonges
2 Ébauche tablets
2 target 27" touchscreens
2 Intel compute stick
3 target tablets
2 protection covers

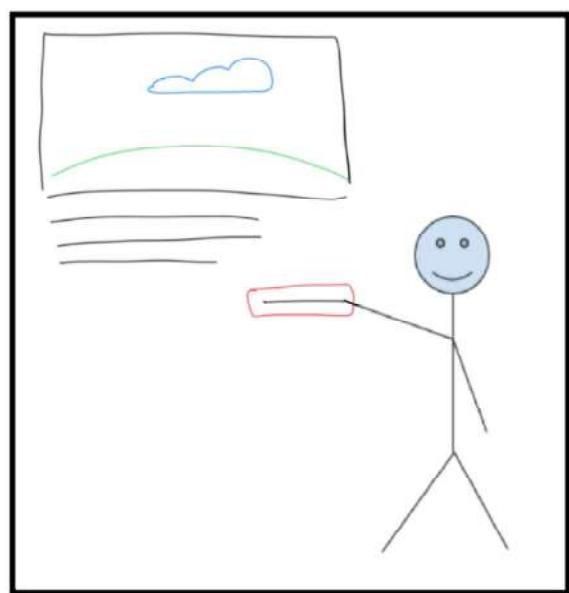
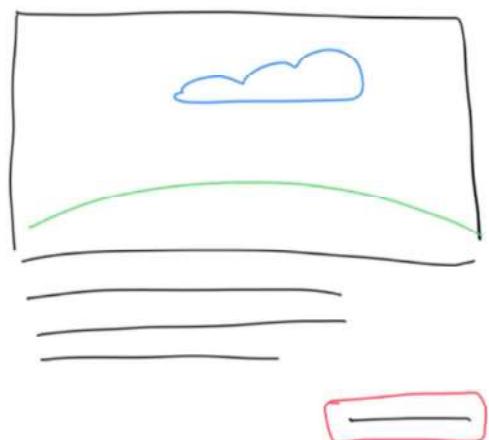
Planning de l'étude

Durée : 1h30

00:00	20 min	Introduction
00:20	30 min	1ère activité
00:50	5 min	Pause
00:55	30 min	2ème activité
01:25	10 min	Conclusion

Echauffement - papier

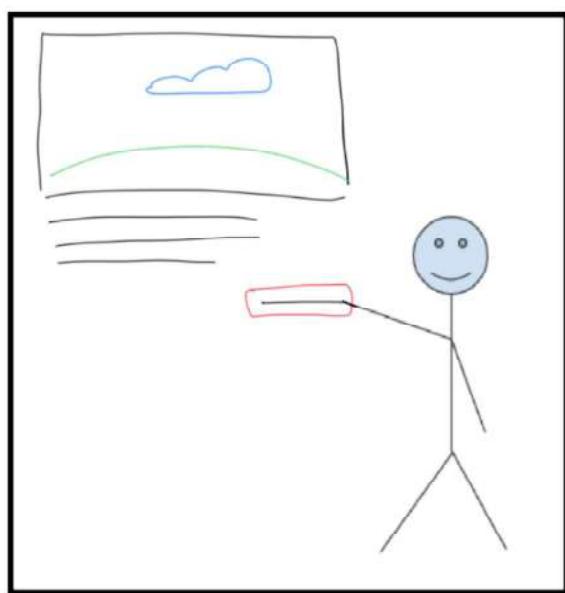
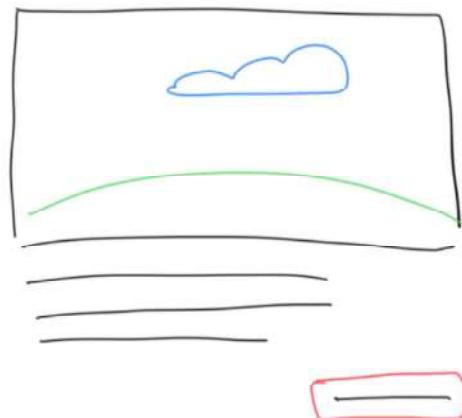
Voici un dessin d'interface, reproduisez-le et collez le sur un mur. Une fois ceci fait, prenez vous en photo en train d'appuyer sur le bouton rouge de l'interface.



Echauffement - tablette

Voici un dessin d'interface, reproduisez-le et envoyez-le vers une tablette. Une fois ceci fait, prenez vous en photo en train d'appuyer sur le bouton rouge de l'interface.

Vous pouvez dessiner avec le stylet et effacer avec le doigt. Si vous envoyez plusieurs dessins vers une tablette, vous pouvez les faire défiler sur celle-ci en touchant l'écran.



Communiquer sur des événements de la bibliothèque

Contexte

Vous êtes une équipe ayant en charge la conception d'un nouveau système interactif installé dans la bibliothèque permettant de découvrir les événements passés, présents et à venir organisés par celles-ci.

Jusqu'à maintenant les activités de la bibliothèque ne sont consultables uniquement via le site web ainsi que via les posters dans le hall d'entrée. Même les usagers réguliers de la bibliothèque ont du mal à se renseigner sur les activités qui pourraient les intéresser.

Vous pouvez imaginer les dispositifs numériques que vous souhaitez pour votre système (écrans, imprimantes, haut-parleurs, etc.) et vous avez accès à une base de donnée complète des activités, dont un extrait est disponible en annexe : titre, description, biographie des invités, documents sur le même thème, etc.

Buts

Vous pouvez choisir un ou plusieurs des éléments listés ci-dessous pour inspirer votre conception, voire proposer de nouveaux buts :

- Proposer un nouveau média de communication pour les activités de la bibliothèque
- Facile d'utilisation par tous
- Accessible aux personnes en situation de handicap
- Système respectant les habitudes des usagers de la bibliothèque
- Visualisation du nombre d'événements ayant lieu dans la bibliothèque
- Communication autour d'événements en lien avec les collections environnantes
- Un usager intéressé peut ajouter une activité à son calendrier
- L'usager peut, via le système, naviguer dans des informations connexes de l'activité : vidéos, pages web, présentations des invités, etc.
-
-

Scénario utilisateur possible

Vous pouvez utiliser et modifier ce scénario afin d'inspirer votre prototype

Steven est un étudiant bibliothécaire à l'ENSSIB. Pour son projet de fin de semestre en communication numérique il a pour but de concevoir un site web pour une collection temporaire autour du Musée des Beaux-Arts de Lyon. Pour cela il s'intéresse tout autant aux aspects graphiques que techniques nécessaires à la réalisation de son projet.

En cherchant des documents pouvant l'aider dans sa tâche, il découvre [à vous de spécifier comment] qu'un atelier initiant à la conception de site web est organisé par la bibliothèque en partenariat avec le club info de l'ENSSIB.

Il ajoute l'activité à son agenda en prévoyant d'y participer et emprunte un des ouvrages conseillés : "Sites Web avec Wordpress : 100% pratique !"

Maintenant que vous avez pris connaissance du contexte, il est l'heure de se lever de table et d'aller prototyper vos idées dans la bibliothèque !

Ressources

Événements de la bibliothèque

Titre	Date	Lieu	Durée	Description
Bibliotouch, de nouvelle collections numériques	12/11/2018 14:00	Auditorium 1	1:30	Bibliotouch est une nouvelle interface numérique interactive permettant de visualiser et naviguer dans les collection numériques et physiques de la bibliothèque
L'atelier du code - Web	14/11/2018 13:00	Salle info 207	2:00	Comment démarrer avec les langages du Web pour créer son site, débutants bienvenus.
Semaine de l'innovation	19/11/2018 10:00	Bibliothèque de l'ENSSIB	5:00	Démos et tests : la bibliothèque de l'ENSSIB comme vous ne l'avez jamais vue !
Que voir ?	19/11/2018 13:00	Bibliothèque de l'ENSSIB	1:00	3 films présentés par 3 étudiants, parfait pour occuper son weekend !
Café débat - Politique à la bib'	22/11/2018 14:00	Bibliothèque de l'ENSSIB	1:30	Présentation par R. Bats suivi d'un débat autour de la place du politique dans les bibliothèques publiques.

Travail de groupe avec des participants à distance

Contexte

Pendant les périodes de stage, les étudiants ont souvent du mal à se retrouver pour travailler ensemble sur un même lieu pour leurs projets de groupe : beaucoup d'étudiants trouvent un stage à Lyon, mais d'autres partent dans d'autres villes. Vous êtes une équipe ayant en charge la conception d'un nouveau système collaboratif pour des salles de travail d'école ou d'université répondant à cette problématique.

En utilisant votre système les étudiants peuvent initier des échanges audio et vidéo avec leurs camarades à distance, et même plus: partager et collaborer sur des documents, structurer et planifier leur travail, préparer et s'entraîner à donner des présentations.

Vous pouvez utiliser les dispositifs numériques que vous souhaitez pour votre système (tablettes, écrans, projecteurs, imprimantes, haut-parleurs, etc.), et tous les problèmes techniques liés à la collaboration et les communications ont été résolus.

Buts

Vous pouvez choisir un ou plusieurs des éléments listés ci-dessous pour inspirer votre conception, voire proposer de nouveaux buts :

- Proposer un système interactif de collaboration
- Facile d'utilisation par tous
- Accessible aux personnes en situation de handicap
- Qui donne un sentiment de présence des personnes à distance
- Qui facilite la collaboration à distance avec des documents papier ou des post-its
- Qui offre un accès facile aux documents de la bibliothèque ou à d'autre ressources numériques
-
-

Scénario utilisateur possible

You can use and modify this scenario to inspire your prototype

Anne est étudiante en Master 1 à l'ENSSIB. En parallèle de son stage à la bibliothèque du 3ème arrondissement, elle prépare avec son groupe de travail un projet de fin d'année sur l'innovation numérique en bibliothèque. Au programme de la réunion, un brainstorming afin de définir la direction du projet ainsi que la réalisation d'une présentation de leur idée.

Deux des cinq membres du groupe ne font pas leur stage à Lyon et doivent participer à distance, Anne et son groupe décident donc d'utiliser la salle d'innovation pédagogique pour faciliter le travail. Une fois dans les lieux, elle peut initier la visioconférence avec les participants à distance et le groupe peut travailler sur leur activité de brainstorming.

Après avoir générée et trié leurs idées, ils décident de créer une présentation présentant leur concept et se répartissent les parties de la présentation.

Maintenant que vous avez pris connaissance du contexte, il est l'heure de se lever de table et d'aller prototyper vos idées dans la salle !

Interview questions

Demander d'expliquer le design concept

Pourquoi avoir utilisé ces espaces spécifiques ?

Pourquoi avoir utilisé plusieurs espaces ? Pourquoi n'en avoir utilisé qu'un ?

Comment envisagent-ils le trajet d'un utilisateur dans le lieu ?

Quelles éléments de l'environnement avez-vous pris en compte pendant la conception

1. Dans la situation 1 ?
2. Dans la situation 2 ?

Est ce que que vous pouvez revenir sur une idée pour chaque situation, et décrire comment elle a émergé ? [creuser l'aspect situé, voir comment cela s'est traduit dans le prototype]

- Aspects spatiaux et contraintes liées (accès aux prise, espace disponible, voie de passage, etc.)
- Aspects contextuels (gens, documents, lumière, signalétique, etc.)

Quels éléments de contexte avez vous ignoré délibérément parce que c'était trop compliqué ? (Bruit, pollution visuelle ou sonore, afflux massif de gens...)

Avez vous proposé des idées malgré une complexité de réalisation probable ? Lesquelles ?

Dans quelle situation avez ressenti qu'il était plus facile de collaborer ?

Dans chaque situation y a t'il eu un moment particulièrement fluide/efficace ? Qu'était ce?

Dans chaque situation y a t'il eu un ou plusieurs moments de blocage ? Qu'était ce ?

Dans quelle situation avez vous exploré le plus d'idées ?

BIBLIOGRAPHY

- [1] Noorhidawati Abdullah, Samuel Chu, Sandhya Rajagopal, Abigail Tung, and Yeung Kwong-Man. "Exploring libraries' efforts in inclusion and outreach activities using social media". In: *Libri* 65.1 (2015), pp. 34–47. URL: <https://doi.org/10.1515/libri-2014-0055>.
- [2] Kheir Al-Kodmany. "Using visualization techniques for enhancing public participation in planning and design: process, implementation, and evaluation". In: *Landscape and Urban Planning* 45.1 (Sept. 1999), pp. 37–45. ISSN: 0169-2046. DOI: [10.1016/S0169-2046\(99\)00024-9](https://doi.org/10.1016/S0169-2046(99)00024-9). (Visited on 12/20/2017).
- [3] Hamed S. Alavi, Elizabeth F. Churchill, Mikael Wiberg, Denis Lalanne, Peter Dalsgaard, Ava Fatah gen Schieck, and Yvonne Rogers. "Introduction to Human-Building Interaction (HBI): Interfacing HCI with Architecture and Urban Design". In: *ACM Trans. Comput.-Hum. Interact.* 26.2 (Mar. 2019). ISSN: 1073-0516. DOI: [10.1145/3309714](https://doi.org/10.1145/3309714). URL: <https://doi.org/10.1145/3309714>.
- [4] Sherry R. Arnstein. "A Ladder Of Citizen Participation". In: *Journal of the American Institute of Planners* 35.4 (July 1969), pp. 216–224. ISSN: 0002-8991. DOI: [10.1080/01944366908977225](https://doi.org/10.1080/01944366908977225). URL: <https://doi.org/10.1080/01944366908977225> (visited on 12/20/2017).
- [5] Raphaëlle Bats. "De la participation à la mobilisation collective : la bibliothèque à la recherche de sa vocation démocratique". Thèse de doctorat dirigée par Merklen, Denis et Tassin, Étienne Sociologie, démographie. Sociologie Université de Paris (2019-....) 2019. PhD thesis. 2019. URL: <http://www.theses.fr/2019UNIP7009>.
- [6] Michel Beaudouin-Lafon and Wendy Mackay. "Prototyping Tools and Techniques". In: *The Human-Computer Interaction Handbook: Fundamentals, Evolving Technologies and Emerging Applications*. USA: L. Erlbaum Associates Inc., 2002, 1006–1031. ISBN: 0805838384.
- [7] Inna Belinky, Joel Lanir, and Tsvi Kuflik. "Using Handheld Devices and Situated Displays for Collaborative Planning of a Museum Visit". In: *Proceedings of the 2012 International Symposium on Pervasive Displays*. PerDis '12. Porto, Portugal: ACM, 2012, 19:1–19:6. ISBN: 978-1-4503-1414-5. DOI: [10.1145/2307798.2307817](https://doi.acm.org/docelec.insa-lyon.fr/10.1145/2307798.2307817). URL: [http://doi.acm.org/docelec.insa-lyon.fr/10.1145/2307798.2307817](https://doi.acm.org/docelec.insa-lyon.fr/10.1145/2307798.2307817).

- [8] Alessandro Bendinelli and Fabio Paternò. "Design Criteria for Public Display User Interfaces". In: *Human-Computer Interaction. Theories, Methods, and Tools*. Ed. by Masaaki Kurosu. Cham: Springer International Publishing, 2014, pp. 623–630. ISBN: 978-3-319-07233-3.
- [9] Jon Bird and Yvonne Rogers. "The pulse of tidy street: Measuring and publicly displaying domestic electricity consumption". In: *workshop on energy awareness and conservation through pervasive applications (Pervasive 2010)*.
- [10] Michael Mose Biskjaer, Peter Dalsgaard, and Kim Halskov. "A Constraint-Based Understanding of Design Spaces". In: *Proceedings of the 2014 Conference on Designing Interactive Systems*. DIS '14. Vancouver, BC, Canada: Association for Computing Machinery, 2014, 453–462. ISBN: 9781450329026. DOI: [10.1145/2598510.2598533](https://doi.org/10.1145/2598510.2598533). URL: <https://doi.org/10.1145/2598510.2598533>.
- [11] Renaud Blanch and Éric Lecolinet. "Treemaps Zoomables: Techniques d'interaction Multi-éChelles Pour Les Treemaps". In: *Proceedings of the 19th Conference on l'Interaction Homme-Machine*. IHM '07. Paris, France: Association for Computing Machinery, 2007, 131–138. ISBN: 9781595937919. DOI: [10.1145/1541436.1541462](https://doi.org/10.1145/1541436.1541462). URL: <https://doi.org/10.1145/1541436.1541462>.
- [12] Susanne Bødker, Pelle Ehn, S Romberger, and D Sjögren. "The UTOPIA project: An alternative in text and images (Graffiti 7)". In: *Swedish Center for Working Life, the Royal Institute of Technology, Stockholm, & the University of Aarhus* (1985).
- [13] Daren C. Brabham. "Crowdsourcing the Public Participation Process for Planning Projects". In: *Planning Theory* 8.3 (2009). _eprint: <https://doi.org/10.1177/1473095209104824>, pp. 242–262. DOI: [10.1177/1473095209104824](https://doi.org/10.1177/1473095209104824). URL: <https://doi.org/10.1177/1473095209104824>.
- [14] Virginia Braun and Victoria Clarke. "Using thematic analysis in psychology". In: *Qualitative Research in Psychology* (2006), pp. 77–101. DOI: [10.1191/1478088706qp063oa](https://doi.org/10.1191/1478088706qp063oa).
- [15] Nathalie Bressa, Kendra Wannamaker, Henrik Korsgaard, Wesley Willett, and Jo Vermeulen. "Sketching and Ideation Activities for Situated Visualization Design". In: *Proceedings of the 2019 on Designing Interactive Systems Conference*. DIS '19. San Diego, CA, USA: Association for Computing Machinery, 2019, 173–185. ISBN: 9781450358507. DOI: [10.1145/3322276.3322326](https://doi.org/10.1145/3322276.3322326). URL: <https://doi.org/10.1145/3322276.3322326>.

- [16] Nathalie Bressa, Kendra Wannamaker, Henrik Korsgaard, Wesley Willett, and Jo Vermeulen. "Sketching and Ideation Activities for Situated Visualization Design". In: *Proceedings of the 2019 on Designing Interactive Systems Conference*. DIS '19. San Diego, CA, USA: ACM, 2019, pp. 173–185. ISBN: 978-1-4503-5850-7. DOI: [10.1145/3322276.3322326](https://doi.acm.org/10.1145/3322276.3322326). URL: <http://doi.acm.org/10.1145/3322276.3322326>.
- [17] Bertram C Bruce, Andee Rubin, and Junghyun An. "Situated evaluation of socio-technical systems". In: *Social Computing: Concepts, Methodologies, Tools, and Applications*. IGI Global, 2010, pp. 2211–2225.
- [18] Marion Buchenau and Jane Fulton Suri. "Experience Prototyping". In: *Proceedings of the 3rd Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques*. DIS '00. New York, NY, USA: ACM, 2000, pp. 424–433. ISBN: 978-1-58113-219-9. DOI: [10.1145/347642.347802](https://doi.acm.org/10.1145/347642.347802). URL: <http://doi.acm.org/10.1145/347642.347802> (visited on 01/09/2019).
- [19] Moira Burke, Anthony Hornof, Erik Nilsen, and Nicholas Gorman. "High-Cost Banner Blindness: Ads Increase Perceived Workload, Hinder Visual Search, and Are Forgotten". In: *ACM Trans. Comput.-Hum. Interact.* 12.4 (Dec. 2005), 423–445. ISSN: 1073-0516. DOI: [10.1145/1121112.1121116](https://doi.acm.org/10.1145/1121112.1121116). URL: <https://doi.acm.org/10.1145/1121112.1121116>.
- [20] Colin Burns, Eric Dishman, William Verplank, and Bud Lassiter. "Actors, Hairdos & Videotape—Informance Design". In: *Conference Companion on Human Factors in Computing Systems*. CHI '94. New York, NY, USA: ACM, 1994, pp. 119–120. ISBN: 978-0-89791-651-6. DOI: [10.1145/259963.260102](https://doi.acm.org/10.1145/259963.260102). URL: <http://doi.acm.org/10.1145/259963.260102> (visited on 01/09/2019).
- [21] Bill Buxton. *Sketching User Experiences: Getting the Design Right and the Right Design*. en. Morgan Kaufmann, July 2010. ISBN: 978-0-08-055290-3.
- [22] Selene Colburn and Laura Haines. "Measuring libraries' use of YouTube as a promotional tool: an exploratory study and proposed best practices". In: *Journal of Web Librarianship* 6.1 (2012), pp. 5–31. DOI: [10.1080/19322909.2012.641789](https://doi.org/10.1080/19322909.2012.641789). URL: <https://doi.org/10.1080/19322909.2012.641789>.
- [23] Geoff Cooper, Christine Hine, Janet Rachel, and Steve Woolgar. "Ethnography and human-computer interaction". In: *CAMBRIDGE SERIES ON HUMAN COMPUTER INTERACTION* (1995), pp. 11–36.
- [24] Terry Costantino, Steven LeMay, Linnea Vizard, Heather Moore, Dara Renton, Sandra Gornall, and Ian Strang. "Exploring Participation in the Design of Public Library E-Services". In: *Pro-*

- ceedings of the 13th Participatory Design Conference: Short Papers, Industry Cases, Workshop Descriptions, Doctoral Consortium Papers, and Keynote Abstracts - Volume 2.* PDC '14. Windhoek, Namibia: Association for Computing Machinery, 2014, 17–20. ISBN: 9781450332149. DOI: [10.1145/2662155.2662174](https://doi.org/10.1145/2662155.2662174). URL: <https://doi.org/10.1145/2662155.2662174>.
- [25] Peter Dalsgaard, Kim Halskov, and Rune Nielsen. “Towards a Design Space Explorer for Media Facades”. In: *Proceedings of the 20th Australasian Conference on Computer-Human Interaction: Designing for Habitus and Habitat*. OZCHI '08. Cairns, Australia: Association for Computing Machinery, 2008, 219–226. ISBN: 0980306345. DOI: [10.1145/1517744.1517816](https://doi.org/10.1145/1517744.1517816). URL: <https://doi.org/10.1145/1517744.1517816>.
 - [26] Nicholas S. Dalton, Emily Collins, and Paul Marshall. “Display Blindness? Looking Again at the Visibility of Situated Displays Using Eye-Tracking”. In: *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*. CHI '15. Seoul, Republic of Korea: Association for Computing Machinery, 2015, 3889–3898. ISBN: 9781450331456. DOI: [10.1145/2702123.2702150](https://doi.org/10.1145/2702123.2702150). URL: <https://doi.org/10.1145/2702123.2702150>.
 - [27] Sheep N. Dalton, Paul Marshall, and Ruth Conroy Dalton. “Measuring Environments for Public Displays: A Space Syntax Approach”. In: *CHI '10 Extended Abstracts on Human Factors in Computing Systems*. CHI EA '10. Atlanta, Georgia, USA: Association for Computing Machinery, 2010, 3841–3846. ISBN: 9781605589305. DOI: [10.1145/1753846.1754066](https://doi.org/10.1145/1753846.1754066). URL: <https://doi.org/10.1145/1753846.1754066>.
 - [28] Oya Demirbilek and Halime Demirkhan. “Universal product design involving elderly users: a participatory design model”. In: *Applied Ergonomics* 35.4 (July 2004), pp. 361–370. ISSN: 0003-6870. (Visited on 12/20/2017).
 - [29] Karen Detken, Carlos Martinez, and Andreas Schrader. “The Search Wall: Tangible Information Searching for Children in Public Libraries”. In: *Proceedings of the 3rd International Conference on Tangible and Embedded Interaction*. TEI '09. Cambridge, United Kingdom: Association for Computing Machinery, 2009, 289–296. ISBN: 9781605584935. DOI: [10.1145/1517664.1517724](https://doi.org/10.1145/1517664.1517724). URL: <https://doi.org/10.1145/1517664.1517724>.
 - [30] Kees Dorst and Nigel Cross. “Creativity in the design process: co-evolution of problem–solution”. In: *Design Studies* 22.5 (Sept. 2001), pp. 425–437. DOI: [10.1016/s0142-694x\(01\)00009-6](https://doi.org/10.1016/s0142-694x(01)00009-6). URL: [https://doi.org/10.1016/s0142-694x\(01\)00009-6](https://doi.org/10.1016/s0142-694x(01)00009-6).

- [31] Paul Dourish. "What We Talk About when We Talk About Context". In: *Personal Ubiquitous Comput.* 8.1 (Feb. 2004), pp. 19–30. ISSN: 1617-4909. DOI: [10.1007/s00779-003-0253-8](https://doi.org/10.1007/s00779-003-0253-8). URL: <https://doi.org/10.1007/s00779-003-0253-8>.
- [32] Alix Ducros, Clemens N. Klokmose, and Aurélien Tabard. "Situated Sketching and Enactment for Pervasive Displays". In: *Proceedings of the 2019 ACM International Conference on Interactive Surfaces and Spaces*. ISS '19. Daejeon, Republic of Korea: Association for Computing Machinery, 2019, 217–228. ISBN: 9781450368919. DOI: [10.1145/3343055.3359702](https://doi.org/10.1145/3343055.3359702). URL: <https://doi.org/10.1145/3343055.3359702>.
- [33] James K Elmborg. "Libraries as the spaces between us: Recognizing and valuing the third space". In: *Reference & User Services Quarterly* (2011), pp. 338–350.
- [34] Eva Eriksson and Andreas Lykke-Olesen. "StorySurfer: A Playful Book Browsing Installation for Children's Libraries". In: *Proceedings of the 6th International Conference on Interaction Design and Children*. IDC '07. Aalborg, Denmark: Association for Computing Machinery, 2007, 57–64. ISBN: 9781595937476. DOI: [10.1145/1297277.1297289](https://doi.org/10.1145/1297277.1297289). URL: <https://doi.org/10.1145/1297277.1297289>.
- [35] Helen Evans and Heiko Hansen. *PollStream*. 2003. URL: <http://hehe.org.free.fr/hehe/pollstream/index.html>.
- [36] Jérémie Garcia, Theophanis Tsandilas, Carlos Agon, and Wendy Mackay. "Inksplorer: Exploring musical ideas on paper and computer". In: *New Interfaces for Musical Expression (NIME 2011)*. 2011.
- [37] William Gaver. "Making Spaces: How Design Workbooks Work". In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. CHI '11. Vancouver, BC, Canada: Association for Computing Machinery, 2011, 1551–1560. ISBN: 9781450302289. DOI: [10.1145/1978942.1979169](https://doi.org/10.1145/1978942.1979169). URL: <https://doi.org/10.1145/1978942.1979169>.
- [38] Elizabeth Gerber. "Improvisation Principles and Techniques for Design". In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. CHI '07. New York, NY, USA: ACM, 2007, pp. 1069–1072. ISBN: 978-1-59593-593-9. DOI: [10.1145/1240624.1240786](https://doi.org/10.1145/1240624.1240786). URL: [http://doi.acm.org/10.1145/1240624.1240786](https://doi.acm.org/10.1145/1240624.1240786) (visited on 01/09/2019).
- [39] Elizabeth Gerber. "Using Improvisation to Enhance the Effectiveness of Brainstorming". In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. CHI '09. New York, NY, USA: ACM, 2009, pp. 97–104. ISBN: 978-1-60558-246-

7. DOI: [10.1145/1518701.1518718](https://doi.org/10.1145/1518701.1518718). URL: <http://doi.acm.org/10.1145/1518701.1518718> (visited on 01/09/2019).
- [40] Nahid Golafshani. "Understanding reliability and validity in qualitative research". In: *The qualitative report* 8.4 (2003), pp. 597–607.
- [41] Carla Gröschel, Peter Dalsgaard, Clemens N. Klokmose, Henrik Korsgaard, Eva Eriksson, Raphaëlle Bats, Aurélien Tabard, Alix Ducros, and Sofia E. Serholt. "PARTICIPATE: Capturing Knowledge in Public Library Activities". In: *Extended Abstracts of the 2018 CHI Conference on Human Factors in Computing Systems*. CHI EA '18. Montreal QC, Canada: ACM, 2018, LBW06o:1–LBW06o:6. ISBN: 978-1-4503-5621-3. DOI: [10.1145/3170427.3188605](https://doi.org/10.1145/3170427.3188605). URL: <http://doi.acm.org/10.1145/3170427.3188605>.
- [42] Jonathan Haber, Miguel A. Nacenta, and Sheelagh Carpendale. "Paper vs. Tablets: The Effect of Document Media in Co-located Collaborative Work". In: *Proceedings of the 2014 International Working Conference on Advanced Visual Interfaces*. AVI '14. Como, Italy: ACM, 2014, pp. 89–96. ISBN: 978-1-4503-2775-6. DOI: [10.1145/2598153.2598170](https://doi.org/10.1145/2598153.2598170). URL: <http://doi.acm.org/docelec.insa-lyon.fr/10.1145/2598153.2598170>.
- [43] John Halloran, Eva Hornecker, Geraldine Fitzpatrick, Mark Weal, David Millard, Danius Michaelides, Don Cruickshank, and David De Roure. "Unfolding Understandings: Co-designing UbiComp In Situ, over Time". In: *Proceedings of the 6th Conference on Designing Interactive Systems*. DIS '06. University Park, PA, USA: ACM, 2006, pp. 109–118. ISBN: 1-59593-367-0. DOI: [10.1145/1142405.1142423](https://doi.org/10.1145/1142405.1142423). URL: <http://doi.acm.org/docelec.insa-lyon.fr/10.1145/1142405.1142423>.
- [44] Kim Halskov and Aron Fischel. "The Design Space of Media Architecture Displays". In: *Interactions* 26.6 (Oct. 2019), 60–63. ISSN: 1072-5520. DOI: [10.1145/3360325](https://doi.org/10.1145/3360325). URL: <https://doi.org/10.1145/3360325>.
- [45] Kim Halskov and Nicolai Brodersen Hansen. "The diversity of participatory design research practice at PDC 2002–2012". In: *International Journal of Human-Computer Studies* 74 (Feb. 2015), pp. 81–92. ISSN: 1071-5819. DOI: [10.1016/j.ijhcs.2014.09.003](https://doi.org/10.1016/j.ijhcs.2014.09.003). URL: <http://www.sciencedirect.com/science/article/pii/S1071581914001220> (visited on 12/17/2020).
- [46] Steve Harrison and Paul Dourish. "Re-place-ing Space: The Roles of Place and Space in Collaborative Systems". In: *Proceedings of the 1996 ACM Conference on Computer Supported Cooperative Work*. CSCW '96. New York, NY, USA: ACM, 1996, pp. 67–76. ISBN: 978-0-89791-765-0. DOI: [10.1145/240080.240193](https://doi.org/10.1145/240080.240193). URL: <http://doi.acm.org/10.1145/240080.240193> (visited on 12/23/2018).

- [47] Chris Heape. "The Design Space: the design process as the construction, exploration and expansion of a conceptual space". English. PhD thesis. 2007. ISBN 978-87-991686-6-8.
- [48] Uta Hinrichs, Simon Butscher, Jens Müller, and Harald Reitterer. "Diving in at the Deep End: The Value of Alternative In-Situ Approaches for Systematic Library Search". In: *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*. CHI '16. San Jose, California, USA: Association for Computing Machinery, 2016, 4634–4646. ISBN: 9781450333627. DOI: [10.1145/2858036.2858549](https://doi.org/10.1145/2858036.2858549). URL: <https://doi.org/10.1145/2858036.2858549>.
- [49] Steven Houben and Christian Weichel. "Overcoming Interaction Blindness through Curiosity Objects". In: *CHI '13 Extended Abstracts on Human Factors in Computing Systems*. CHI EA '13. Paris, France: Association for Computing Machinery, 2013, 1539–1544. ISBN: 9781450319522. DOI: [10.1145/2468356.2468631](https://doi.org/10.1145/2468356.2468631). URL: <https://doi.org/10.1145/2468356.2468631>.
- [50] Hilary Hutchinson et al. "Technology Probes: Inspiring Design for and with Families". In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. CHI '03. New York, NY, USA: ACM, 2003, pp. 17–24. ISBN: 978-1-58113-630-2. DOI: [10.1145/642611.642616](https://doi.org/10.1145/642611.642616). URL: <http://doi.acm.org/10.1145/642611.642616> (visited on 12/22/2018).
- [51] Mads Møller Jensen, Roman Rädle, Clemens N. Klokmose, and Susanne Bodker. "Remediating a Design Tool: Implications of Digitizing Sticky Notes". In: *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems*. CHI '18. Montreal QC, Canada: ACM, 2018, 224:1–224:12. ISBN: 978-1-4503-5620-6. DOI: [10.1145/3173574.3173798](https://doi.org/10.1145/3173574.3173798). URL: <http://doi.acm.org/docelec.insa-lyon.fr/10.1145/3173574.3173798>.
- [52] Henrik Jochumsen, Dorte Skot-Hansen, and Casper Hvenggaard. "The Role of Public Libraries in Urban Development and Culture-led Regeneration". In: *European public libraries today and in an historical context* (2010).
- [53] Marije Kanis, Wouter Meys, Mettina Veenstra, Maarten Groen, and Wout Slakhorst. "BiebBeep: An Interactive Screen for Supporting Public Library 2.0 Information and Social Services". In: *CHI '11 Extended Abstracts on Human Factors in Computing Systems*. CHI EA '11. Vancouver, BC, Canada: Association for Computing Machinery, 2011, p. 515. ISBN: 9781450302685. DOI: [10.1145/1979742.1979550](https://doi.org/10.1145/1979742.1979550). URL: <https://doi.org/10.1145/1979742.1979550>.

- [54] Clemens N. Klokmose, James R. Eagan, Siemen Baader, Wendy Mackay, and Michel Beaudouin-Lafon. "Webstrates: Shareable Dynamic Media". In: *Proceedings of the 28th Annual ACM Symposium on User Interface Software & Technology*. UIST '15. Charlotte, NC, USA: ACM, 2015, pp. 280–290. ISBN: 978-1-4503-3779-3. DOI: [10.1145/2807442.2807446](https://doi.acm.org/10.1145/2807442.2807446). URL: <http://doi.acm.org/10.1145/2807442.2807446>.
- [55] Henrik Korsgaard. "Toward Place-Centric Computing: Making Place With Technology Together". PhD thesis. Aarhus Universitetsforlag, 2016.
- [56] Hannu Kukka, Tommi Heikkinen, Henri Kytökangas, Taru Tanska, and Timo Ojala. "UbiLibrary: Situated Large Public Display as Interactive Interface to Library Services". In: *Proceedings of the 22nd International Academic Mindtrek Conference*. Mindtrek '18. Tampere, Finland: Association for Computing Machinery, 2018, 192–201. ISBN: 9781450365895. DOI: [10.1145/3275116.3275143](https://doi.org/10.1145/3275116.3275143). URL: <https://doi.org/10.1145/3275116.3275143>.
- [57] Germán Leiva and Michel Beaudouin-Lafon. "Montage: A Video Prototyping System to Reduce Re-Shooting and Increase Re-Usability". In: *Proceedings of the 31st Annual ACM Symposium on User Interface Software and Technology*. UIST '18. New York, NY, USA: ACM, 2018, pp. 675–682. ISBN: 978-1-4503-5948-1. DOI: [10.1145/3242587.3242613](https://doi.acm.org/10.1145/3242587.3242613). URL: <http://doi.acm.org/10.1145/3242587.3242613> (visited on 12/23/2018).
- [58] James Lin, Mark W. Newman, Jason I. Hong, and James A. Landay. "DENIM: An Informal Tool for Early Stage Web Site Design". In: *CHI EA '01*. New York, NY, USA: ACM, 2001, pp. 205–206. ISBN: 978-1-58113-340-0. (Visited on 12/20/2017).
- [59] Allan MacLean, Richard M. Young, Victoria M. E. Bellotti, and Thomas P. Moran. "Questions, Options, and Criteria: Elements of Design Space Analysis". In: *Hum.-Comput. Interact.* 6.3 (Sept. 1991), 201–250. ISSN: 0737-0024. DOI: [10.1207/s15327051hci0603%264_2](https://doi.org/10.1207/s15327051hci0603%264_2). URL: https://doi.org/10.1207/s15327051hci0603%264_2.
- [60] Wendy E. Mackay and Anne-Laure Fayard. "HCI, Natural Science and Design: A Framework for Triangulation across Disciplines". In: *Proceedings of the 2nd Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques*. DIS '97. Amsterdam, The Netherlands: Association for Computing Machinery, 1997, 223–234. ISBN: 0897918630. DOI: [10.1145/263552.263612](https://doi.org/10.1145/263552.263612). URL: <https://doi.org/10.1145/263552.263612>.
- [61] Malcolm McCullough. "Digital Ground: Architecture, Pervasive Computing, and Environmental Knowing". In: (2004).

- [62] Delphine Merrien. "An Information Sciences Library at your Fingertips. Explore Bibliotouch and Discover the Unexpected!" In: *BOBCATSSS 2019* (2019).
- [63] Jörn Messeter. "Place-specific computing: A place-centric perspective for digital designs". In: *International Journal of Design* 3.1 (2009), pp. 29–41.
- [64] Jörn Messeter. "Place-specific computing: A place-centric perspective for digital designs". In: *International Journal of Design* 3.1 (2009).
- [65] Daniel Michelis and Jörg Müller. "The Audience Funnel: Observations of Gesture Based Interaction With Multiple Large Displays in a City Center". In: *International Journal of Human–Computer Interaction* 27.6 (2011), pp. 562–579. DOI: [10.1080/10447318.2011.555299](https://doi.org/10.1080/10447318.2011.555299). eprint: <https://doi.org/10.1080/10447318.2011.555299>. URL: <https://doi.org/10.1080/10447318.2011.555299>.
- [66] David R. Millen. "Rapid Ethnography: Time Deepening Strategies for HCI Field Research". In: *Proceedings of the 3rd Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques*. DIS '00. New York City, New York, USA: Association for Computing Machinery, 2000, 280–286. ISBN: 1581132190. DOI: [10.1145/347642.347763](https://doi.org/10.1145/347642.347763). URL: <https://doi.org/10.1145/347642.347763>.
- [67] Andrew Vande Moere and Dan Hill. "Designing for the situated and public visualization of urban data". In: *Journal of Urban Technology* 19.2 (2012), pp. 25–46.
- [68] Andrew Vande Moere and Niels Wouters. "The Role of Context in Media Architecture". In: *Proceedings of the 2012 International Symposium on Pervasive Displays*. PerDis '12. Porto, Portugal: Association for Computing Machinery, 2012. ISBN: 9781450314145. DOI: [10.1145/2307798.2307810](https://doi.org/10.1145/2307798.2307810). URL: <https://doi.org/10.1145/2307798.2307810>.
- [69] Jörg Müller, Florian Alt, Daniel Michelis, and Albrecht Schmidt. "Requirements and Design Space for Interactive Public Displays". In: *Proceedings of the 18th ACM International Conference on Multimedia*. MM '10. Firenze, Italy: Association for Computing Machinery, 2010, 1285–1294. ISBN: 9781605589336. DOI: [10.1145/1873951.1874203](https://doi.org/10.1145/1873951.1874203). URL: <https://doi.org/10.1145/1873951.1874203>.
- [70] Jörg Müller, Dennis Wilmsmann, Juliane Exeler, Markus Buzeck, Albrecht Schmidt, Tim Jay, and Antonio Krüger. "Display blindness: The effect of expectations on attention towards digital signage". In: *International Conference on Pervasive Computing*. Springer. 2009, pp. 1–8.

- [71] Michael J. Muller and Sarah Kuhn. "Participatory Design". In: *Commun. ACM* 36.6 (June 1993), 24–28. ISSN: 0001-0782. DOI: [10.1145/153571.255960](https://doi.org/10.1145/153571.255960). URL: <https://doi.org/10.1145/153571.255960>.
- [72] Elena Márquez Segura, Laia Turmo Vidal, Asreen Rostami, and Annika Waern. "Embodied Sketching". en. In: *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems - CHI '16*. Santa Clara, California, USA: ACM Press, 2016, pp. 6014–6027. ISBN: 978-1-4503-3362-7. DOI: [10.1145/2858036.2858486](https://doi.org/10.1145/2858036.2858486). URL: <http://dl.acm.org/citation.cfm?doid=2858036.2858486> (visited on 01/09/2019).
- [73] A. F. Newell, A. Carmichael, M. Morgan, and A. Dickinson. "The Use of Theatre in Requirements Gathering and Usability Studies". In: *Interact. Comput.* 18.5 (Sept. 2006), pp. 996–1011. ISSN: 0953-5438. DOI: [10.1016/j.intcom.2006.05.003](https://doi.org/10.1016/j.intcom.2006.05.003). URL: <https://doi.org/10.1016/j.intcom.2006.05.003> (visited on 01/09/2019).
- [74] Donald A. Norman. "Human-Centered Design Considered Harmful". In: *Interactions* 12.4 (July 2005), 14–19. ISSN: 1072-5520. DOI: [10.1145/1070960.1070976](https://doi.org/10.1145/1070960.1070976). URL: <https://doi.org/10.1145/1070960.1070976>.
- [75] William Odom, John Zimmerman, Scott Davidoff, Jodi Forlizzi, Anind K. Dey, and Min Kyung Lee. "A Fieldwork of the Future with User Enactments". In: *Proceedings of the Designing Interactive Systems Conference*. DIS '12. New York, NY, USA: ACM, 2012, pp. 338–347. ISBN: 978-1-4503-1210-3. DOI: [10.1145/2317956.2318008](https://doi.org/10.1145/2317956.2318008). URL: <http://doi.acm.org/10.1145/2317956.2318008> (visited on 06/21/2018).
- [76] R Oldenburg. *The Great Good Place: Cafes, Coffee Shops, Bookstores, Bars, HairSalons and Other Hangouts at the Heart of Community*. New York, USA: Marlowe and Company, 1989.
- [77] Ramon Oldenburg and Dennis Brissett. "The third place". In: *Qualitative Sociology* 5.4 (Dec. 1982), pp. 265–284. ISSN: 1573-7837. DOI: [10.1007/BF00986754](https://doi.org/10.1007/BF00986754). URL: <https://doi.org/10.1007/BF00986754>.
- [78] Antti Oulasvirta, Esko Kurvinen, and Tomi Kankainen. "Understanding Contexts by Being There: Case Studies in Bodystorming". In: *Personal Ubiquitous Comput.* 7.2 (July 2003), pp. 125–134. ISSN: 1617-4909. DOI: [10.1007/s00779-003-0238-7](https://doi.org/10.1007/s00779-003-0238-7). URL: <http://dx.doi.org/10.1007/s00779-003-0238-7> (visited on 12/23/2018).

- [79] T.C. Pape and K. Thoresen. "Development of common systems by prototyping". In: *Computers and Democracy: A Scandinavian Challenge*. Ed. by Gro Bjerknes, Pelle Ehn, and Morten Kyng. Gower Pub Co, 1987. ISBN: 0566054760.
- [80] Roman Rädle, Midas Nouwens, Kristian Antonsen, James R. Eagan, and Clemens N. Klokmose. "Codestrates: Literate Computing with Webstrates". In: *Proceedings of the 30th Annual ACM Symposium on User Interface Software and Technology*. UIST '17. Québec City, QC, Canada: ACM, 2017, pp. 715–725. ISBN: 978-1-4503-4981-9. DOI: [10.1145/3126594.3126642](https://doi.acm.org/10.1145/3126594.3126642). URL: [http://doi.acm.org/10.1145/3126594.3126642](https://doi.acm.org/10.1145/3126594.3126642).
- [81] Ramesh Raskar, Paul Beardsley, Jeroen van Baar, Yao Wang, Paul Dietz, Johnny Lee, Darren Leigh, and Thomas Willwacher. "RFIG lamps: interacting with a self-describing world via photosensing wireless tags and projectors". In: *ACM SIGGRAPH 2004 Papers*. 2004, pp. 406–415.
- [82] A. Rohde, B. Sundararajah, S. Bech-Petersen, and K. Gronbaek. "InfoGallery: informative art services for physical library spaces". In: *Proceedings of the 6th ACM/IEEE-CS Joint Conference on Digital Libraries (JCDL '06)*. 2006, pp. 21–30.
- [83] Ugo Braga Sangiorgi, François Beuvens, and Jean Vanderdonckt. "User Interface Design by Collaborative Sketching". In: *Proceedings of the Designing Interactive Systems Conference*. DIS '12. Newcastle Upon Tyne, United Kingdom: ACM, 2012, pp. 378–387. ISBN: 978-1-4503-1210-3. DOI: [10.1145/2317956.2318013](https://doi.acm.org/10.1145/2317956.2318013). URL: [http://doi.acm.org/10.1145/2317956.2318013](https://doi.acm.org/10.1145/2317956.2318013).
- [84] Henry Sanoff. "Multiple views of participatory design". In: *focus* 8.1 (2011), p. 7.
- [85] Gianluca Schiavo, Eleonora Mencarini, Kevin B.A. Vovard, and Massimo Zancanaro. "Sensing and Reacting to Users' Interest: An Adaptive Public Display". In: *CHI '13 Extended Abstracts on Human Factors in Computing Systems*. CHI EA '13. New York, NY, USA: ACM, 2013, pp. 1545–1550. ISBN: 978-1-4503-1952-2. DOI: [10.1145/2468356.2468632](https://doi.acm.org/10.1145/2468356.2468632). URL: [http://doi.acm.org/10.1145/2468356.2468632](https://doi.acm.org/10.1145/2468356.2468632) (visited on 06/20/2018).
- [86] Dennis Schleicher, Peter Jones, and Oksana Kachur. "Bodystorming As Embodied Designing". In: *Interactions* 17.6 (Nov. 2010), pp. 47–51. ISSN: 1072-5520. DOI: [10.1145/1865245.1865256](https://doi.acm.org/10.1145/1865245.1865256). URL: [http://doi.acm.org/10.1145/1865245.1865256](https://doi.acm.org/10.1145/1865245.1865256) (visited on 01/09/2019).
- [87] Donald Schön. "The reflective practitioner". In: *New York* 1083 (1938).

- [88] Rachel Scott. "The Role of Public Libraries in Community Building". In: *Public Library Quarterly* 30.3 (July 2011). Publisher: Routledge _eprint: <https://doi.org/10.1080/01616846.2011.599283>, pp. 191–227. ISSN: 0161-6846. DOI: [10.1080/01616846.2011.599283](https://doi.org/10.1080/01616846.2011.599283). URL: <https://doi.org/10.1080/01616846.2011.599283> (visited on 12/16/2020).
- [89] Sofia Serholt, Eva Eriksson, Peter Dalsgaard, Raphaëlle Bats, and Alix Ducros. "Opportunities and Challenges for Technology Development and Adoption in Public Libraries". In: *Proceedings of the 10th Nordic Conference on Human-Computer Interaction*. NordiCHI '18. Oslo, Norway: ACM, 2018, pp. 311–322. ISBN: 978-1-4503-6437-9. DOI: [10.1145/3240167.3240198](https://doi.acm.org/10.1145/3240167.3240198). URL: [http://doi.acm.org/10.1145/3240167.3240198](https://doi.acm.org/10.1145/3240167.3240198).
- [90] Mathilde Servet. "Les bibliothèques, des troisièmes lieux culturels à forte valeur humaine ajoutée". FR. In: *L'Observatoire* 52.2 (2018). Place: Grenoble Publisher: Observatoire des politiques culturelles, pp. 71–74. DOI: [10.3917/lobs.052.0071](https://doi.org/10.3917/lobs.052.0071). URL: <https://www.cairn.info/revue-l-observatoire-2018-2-page-71.htm>.
- [91] David Sirkin and Wendy Ju. "Using Embodied Design Improvisation As A Design Research Tool". en. In: *Proceedings of the international conference on Human Behavior in Design*. Ascona, Switzerland, 2014, p. 7.
- [92] Clay Spinuzzi. "The Methodology of Participatory Design". In: *Technical Communication* 52 (May 2005), pp. 163–174.
- [93] Susan Leigh Star and James R. Griesemer. "Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907–39". In: *Social Studies of Science* 19.3 (Aug. 1989), pp. 387–420. DOI: [10.1177/030631289019003001](https://doi.org/10.1177/030631289019003001). URL: <https://doi.org/10.1177/030631289019003001>.
- [94] Lucy Suchman. "Located accountabilities in technology production". In: *Scandinavian journal of information systems* 14.2 (2002), p. 7.
- [95] Alice Thudt, Uta Hinrichs, and Sheelagh Carpendale. "The Bohemian Bookshelf: Supporting Serendipitous Book Discoveries through Information Visualization". In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*. CHI '12. Austin, Texas, USA: Association for Computing Machinery, 2012, 1461–1470. ISBN: 9781450310154. DOI: [10.1145/2207676.2208607](https://doi.org/10.1145/2207676.2208607). URL: <https://doi.org/10.1145/2207676.2208607>.
- [96] Himanshu Verma, Hamed S. Alavi, and Denis Lalanne. "Studying Space Use: Bringing HCI Tools to Architectural Projects". In: *Proceedings of the 2017 CHI Conference on Human Factors in*

- Computing Systems.* CHI '17. Denver, Colorado, USA: Association for Computing Machinery, 2017, 3856–3866. ISBN: 9781450346559. DOI: [10.1145/3025453.3026055](https://doi.org/10.1145/3025453.3026055). URL: <https://doi.org/10.1145/3025453.3026055>.
- [97] John Vines, Tess Denman-Cleaver, Paul Dunphy, Peter Wright, and Patrick Olivier. "Experience Design Theatre: Exploring the Role of Live Theatre in Scaffolding Design Dialogues". In: *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems.* CHI '14. New York, NY, USA: ACM, 2014, pp. 683–692. ISBN: 978-1-4503-2473-1. DOI: [10.1145/2556288.2556960](https://doi.acm.org/10.1145/2556288.2556960). URL: <http://doi.acm.org/10.1145/2556288.2556960> (visited on 01/09/2019).
 - [98] Daniel Vogel and Ravin Balakrishnan. "Interactive public ambient displays: transitioning from implicit to explicit, public to personal, interaction with multiple users". In: *Proceedings of the 17th annual ACM symposium on User interface software and technology.* UIST '04. New York, NY, USA: Association for Computing Machinery, Oct. 2004, pp. 137–146. ISBN: 978-1-58113-957-0. DOI: [10.1145/1029632.1029656](https://doi.org/10.1145/1029632.1029656). URL: <https://doi.org/10.1145/1029632.1029656> (visited on 11/11/2020).
 - [99] Miaosen Wang, Sebastian Boring, and Saul Greenberg. "Proxemic peddler: a public advertising display that captures and preserves the attention of a passerby". In: *Proceedings of the 2012 international symposium on pervasive displays.* 2012, pp. 1–6.
 - [100] Mark Weiser. "The Computer for the 21 st Century". In: *Scientific American* 265.3 (1991). Publisher: Scientific American, a division of Nature America, Inc., pp. 94–105. ISSN: 0036-8733. URL: <https://www.jstor.org/stable/24938718> (visited on 12/17/2020).
 - [101] Mark Weiser and John Seely Brown. "The Coming Age of Calm Technology". en. In: *Beyond Calculation: The Next Fifty Years of Computing.* Ed. by Peter J. Denning and Robert M. Metcalfe. New York, NY: Springer, 1997, pp. 75–85. ISBN: 978-1-4612-0685-9. DOI: [10.1007/978-1-4612-0685-9_6](https://doi.org/10.1007/978-1-4612-0685-9_6). URL: https://doi.org/10.1007/978-1-4612-0685-9_6 (visited on 12/17/2020).
 - [102] Wesley Willett, Yvonne Jansen, and Pierre Dragicevic. "Embedded data representations". In: *IEEE transactions on visualization and computer graphics* 23.1 (2016), pp. 461–470.
 - [103] Craig Wisneski, Hiroshi Ishii, Andrew Dahley, Matt Gorbet, Scott Brave, Brygg Ullmer, and Paul Yarin. "Ambient Displays: Turning Architectural Space into an Interface between People and Digital Information". en. In: *Cooperative Buildings: Integrating Information, Organization, and Architecture.* Ed. by Gerhard

- Goos, Juris Hartmanis, Jan van Leeuwen, Norbert A. Streitz, Shin'ichi Konomi, and Heinz-Jürgen Burkhardt. Vol. 1370. Series Title: Lecture Notes in Computer Science. Berlin, Heidelberg: Springer Berlin Heidelberg, 1998, pp. 22–32. ISBN: 978-3-540-64237-4 978-3-540-69706-0. DOI: [10.1007/3-540-69706-3_4](https://doi.org/10.1007/3-540-69706-3_4). URL: http://link.springer.com/10.1007/3-540-69706-3_4 (visited on 11/22/2020).
- [104] Daisy Yoo, Aurélien Tabard, Alix Ducros, Peter Dalsgaard, Clemens Nylandsted Klokmose, Eva Eriksson, and Sofia Serholt. “Computational Alternatives Vignettes for Place- and Activity-Centered Digital Services in Public Libraries”. In: *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. CHI ’20. Honolulu, HI, USA: Association for Computing Machinery, 2020, 1–12. ISBN: 9781450367080. DOI: [10.1145/3313831.3376597](https://doi.org/10.1145/3313831.3376597). URL: <https://doi.org/10.1145/3313831.3376597>.
- [105] Zhenpeng Zhao, Sriram Karthik Badam, Senthil Chandrasegaran, Deok Gun Park, Niklas L.E. Elmquist, Lorraine Kisselburgh, and Karthik Ramani. “skWiki: A Multimedia Sketching System for Collaborative Creativity”. In: *Proceedings of the 32Nd Annual ACM Conference on Human Factors in Computing Systems*. CHI ’14. Toronto, Ontario, Canada: ACM, 2014, pp. 1235–1244. ISBN: 978-1-4503-2473-1. DOI: [10.1145/2556288.2557394](https://doi.org/10.1145/2556288.2557394). URL: <http://doi.acm.org/10.1145/2556288.2557394>.