

# bibox: A Tangible Approach to Motivating Participation in Public Libraries

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## Abstract

Within the Library 2.0 model, visitors of public libraries are enabled to actively shape the services of their library. Unlike previous trends, principles of participation and collaboration should be assimilated into the physical space of public libraries instead of being added as an extra layer on top of existing services. We present a set of eight design principles for motivating participatory systems in the Library 2.0 context. Based on these principles, we introduce bibox, a tangible book rating- and recommendation system for public libraries. In an in-the-wild study, we evaluate how our system motivates active participation. We show that the proposed design principles can contribute to higher levels of engagement from the users of the system within the Library 2.0 context.

## 1 Introduction

With the introduction of Web 2.0, typical web users changed from consumers to contributors by continuously creating and profiting from new content within the collective intelligence of all web users (O'Reilly, 2005). The proliferation of the Web 2.0 concept led public libraries to rethink their role when it came to delivering information, entertainment and services to their visitors. The idea of Library 2.0 was born. This concept aims to involve visitors in actively shaping library services (Casey & Savastinuk, 2007). However, present approaches tend to add Web 2.0 technologies, such as blogs and wikis, on top of existing services without truly integrating the participation layer within the library space itself (Anttiroiko & Savolainen, 2011). Research has been undertaken on installing interactive technology in the physical spaces of public libraries in the form of large screens, floor projections or children's interactive exhibitions (Kanis, et al., 2012; Krogh, et al., 2004; Lykke-Olsen & Nielsen, 2007). However, these systems faced difficulties with engaging library visitors and with reusing the systems in the future. To build a system that enables participation within a public

library and motivates engagement among visitors, we conducted extensive research on existing theories and approaches to derive a set of design principles in the semi-public context of libraries. Based on a contextual analysis of a public library, as well as existing motivational theories and design concepts, we deduced eight general design principles. From these principles, we developed bibox, a tangible book rating- and recommendation system. bibox takes a first step towards enabling library visitors to contribute within the physical space of their public library. By rating books and profiting from recommendations on-site, visitors can actively participate in a locally-oriented community. Furthermore, this paper presents an in-the-wild study in the public library of Cologne, Germany, to assess how our system supports real user engagement and if it succeeds at encouraging visitors to participate in and shape their library services.

## 2 Related Work

Various research projects for enhancing public library services and visitor involvement have been conducted in recent years. These systems range from placing interactive displays in the foyer of public libraries (Kanis, et al., 2012) to installing an entire transformation lab with alternating interactive exhibitions (Krogh, et al., 2004). iFloor was an interactive floor projection onto which visitors could send questions and answers via SMS (Krogh, et al., 2004). It intended to motivate the exchange between visitors and librarians. Collaboration was encouraged, as visitors had to physically participate using gestures to move the cursor over the floor and reveal the available text messages. On Biebbeep (Kanis, et al., 2012) locally relevant and library-related information, such as news, Twitter feeds or Flickr photos, were shown on a screen in the foyer of a public library. In addition to consuming the information, visitors could contribute by sending information to the screen via their personal social media account.

While both systems received positive feedback in terms of enhancing public library services, observations showed a decreasing participation rate over time, and a low percentage of library visitors who interacted with the system (Kanis, et al., 2012). Concerning iFloor, the way of interacting with the installation was not obvious enough, which led many visitors to only look at it in passing without interacting (Krogh, et al., 2004). Both systems were situated near the entrance of a public library; however, a formal integration into the workflow of a regular library visitor was missing. An additional step and a particular interest in the installation would have been necessary for interaction. Furthermore, both systems contained a barrier to entry, since either mobile phones or social media accounts were required to participate.

bibPhone (Lykke-Olsen & Nielsen, 2007) and VoiceYourView (Whittle, et al., 2010) were two playful installations that aimed at gathering opinions on books or library services by providing a physical phone. Hereby, the installations addressed the well-known way of speaking into and listening from an earpiece. However, interviews revealed that users felt uncomfortable when voicing their opinion aloud, given that they were aware of their physical presence in the public space of the library. This prevented user participation in the long term.

Research shows that the use of tangible objects enhances the understanding of how to interact with a system if the objects draw upon the knowledge from users' everyday lives (Ishii & Ullmer, 1997). Ojala et al. (Ojala, et al., 2012) found that adding a physical object to a public display installation to peak curiosity increased the amount of interaction from the public. In the context of motivating people to participate via interactive technology, using tangible elements that indicate their functionality by referring to familiar concepts adds value to a system. VoxBox, a tangible questionnaire for public events, made use of this idea, motivating participation via physical objects and sliders (Golsteijn, et al., 2015). Their tangible objects did, however, involve physical constraints: once a user ended his interaction, the sliders remained in the same state. Users therefore lacked privacy when giving their opinions, and risked influencing the opinions of the following users. Furthermore, VoxBox was designed for one-time use. The challenge of Library 2.0 installations is to engage visitors in long-term use.

### 3 Design Principles for Library 2.0

So far, no set of design principles can be found in the literature to develop interactive systems for Library 2.0. The main goal, adopted from Web 2.0, is to seamlessly integrate participation, collaboration and interaction in the physical space of public libraries to enable visitors to contribute on-site and hence shape the services of their library (Casey & Savastinuk, 2007). Such a system should be designed to engage visitors to contribute over the long-term and profit from the contributions of others. Based on a contextual analysis of public libraries, we conducted extensive research on motivational theories and on how participation in online communities can be influenced (Tedjamulia, et al., 2005). Furthermore, we analyzed how elements of Gameful and Persuasive Design can trigger participation (Malone, 1982; Fogg, 2009) and which design principles are relevant for public installations (Michelis, 2009). Based on these findings, we derived a set of eight design principles for the design for Library 2.0.

In the following, we will give a brief overview of the main aspects of the eight design principles. A detailed discussion can be found in (Hofmann, 2015).

**Low Barrier to Entry.** To account for the diverse backgrounds of library visitors, the system must not solely enable interaction via specific preconditions, such as personal devices or social media accounts.

**Integration into the Context.** Interaction with the system must blend into the workflow of library visitors. The sociocultural context and embodiment of the user in public space should be considered.

**Usability and User Experience.** For systems beyond desktop, simplicity and interaction affordance is crucial. The system must reduce the cost of participation in time and physical effort and provide as much automation as possible.

**Community Aspect.** The library as a local community with common interests and goals among visitors needs to be emphasized and supported in a participatory system.

**Metaphors and Analogies.** Well-known metaphors and analogies from everyday life need to facilitate the understanding of the system and the interaction process. Analogies which refer to the library content support the integration into the context.

**Interaction Modes.** Providing different interaction modes with varying complexity lets users choose their preferred contribution method and raises the intrinsic motivation to participate.

**Feedback and Incentives.** Systems should highlight how others can benefit from the contribution made. Feedback in the form of social recognition and informative incentives within the context of the library can help motivate contributions.

**Personalization.** The system needs to promote trust and personal responsibility within the community by identifying its members. Personal reference, as well as personalized information for the visitors, enhance their motivation to participate with the system.

## 4 bibox: Design and Concept

The derived design principles were used to develop a motivating participatory system within the Library 2.0 concept. To narrow down the possibilities of such a system, interviews (n=21) on the information and service need of visitors were conducted in two public libraries (Hofmann, 2015). Based on the findings, as well as the design principles for Library 2.0, we developed bibox: A tangible book rating- and recommendation system (Figure 1, left). To track user interaction, we used three Phidget Interface Kits combined with touch-, rotary- and IR reflective sensors. Illumination is implemented through a Phidget LED board and two Phidget relay boards to control the electroluminescence panels.

In the following, we will introduce the system and then show how the derived principles informed the design rationales.

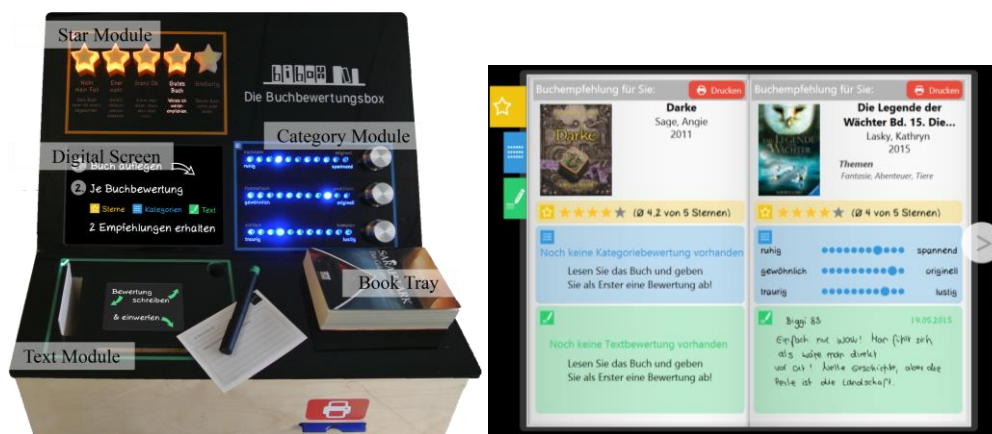


Figure 1: bibox, tangible concept (left), digital screen with book metaphor (right)

## 4.1 System concept

bibox provides library visitors with a tangible experience to rate books while at the same time allowing them to benefit directly from their own contribution in the form of book recommendations. The tangible concept consists of three rating modules (star, category, text) and a digital screen linked to them that displays book recommendations (Figure 1, right). The user begins the interaction by placing a book on the book tray. The system's interaction mode activates and the *star module* lights up. The digital screen displays an invitation for the user to give a star rating for his book. The user can rate their book from 1 to 5 via the illuminated touch stars (Figure 2, a). A textual description explains the meaning of the stars. As soon as the rating is given, the digital screen shows two recommendations based on the visitor's book (Figure 1, right). Each book recommendation provides basic information as well as an aggregated rating of all previous ratings for this book in the library. If the user is interested in one of the books, they can print its signature via an integrated printer whereby they can directly navigate to the new book in the shelf. To continue rating the book, the user can either switch to the next module via the digital book metaphor, by using the bookmarks or flipping the pages, or just by using the desired tangible module. When the user activates the *category module*, three LED scales, representing opposing adjectives in form of semantic differentials, become active and can be controlled through three rotary knobs (Figure 2, b). Depending on whether the book is fiction or non-fiction, different categories are illuminated and can be rated. After the user has rated the book on all three scales, the digital screen displays two more book recommendations. By turning the page on the digital screen or by using the desired module, the user activates the next rating module, the *text module*. Here users can freely express their thoughts using pen and paper (Figure 2, c). An Anoto ADP-301 pen is used to immediately digitalize the text, which is displayed on the screen in the module as soon as the user puts the paper in the corresponding slot. The system provides two additional recommendations that the user can examine on the digital screen. To finish the interaction, the user removes their book from the system.

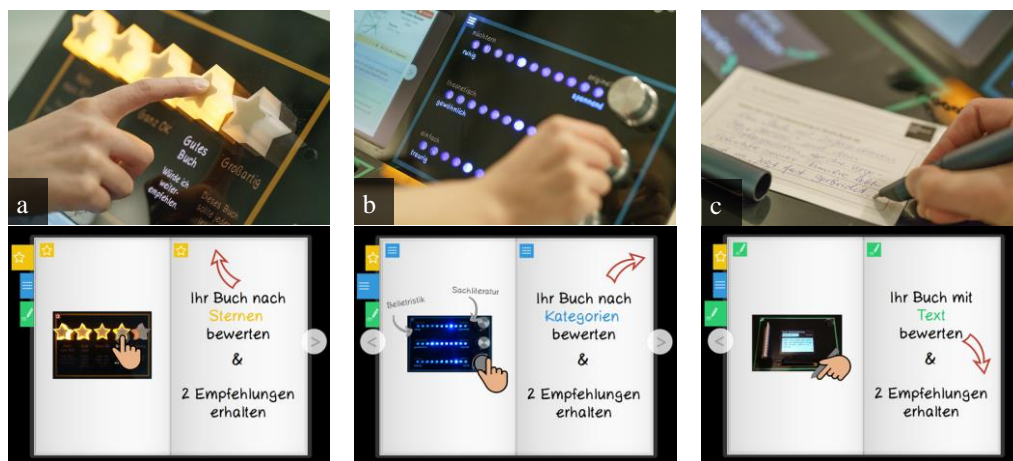


Figure 2: Tangible modules with corresponding digital screens for (a) star rating (b) category rating (c) text rating

## 4.2 Design rationales

To meet the design principle of a *low barrier to entry*, we did not involve personal devices or social media accounts. Interaction takes place without any preconditions for users other than having a library book in hand to rate. As a future, second-level approach, additional interaction can be added via an optional smartphone app, catering to users who prefer to participate on their own devices without excluding visitors who do not meet this requirement. The *integration into the context* is met via two different approaches. The system is intended to be set up next to the loan desk. When returning a book, the visitor can use the installation to give their opinion about the book. In this way, no additional step or break in the usual library workflow is necessary. Secondly, bibox integrates itself into the library by addressing library-relevant content like book ratings and recommendations. Its focus on one main task, as well as the playful way of interacting with the tangible objects, enhances the *usability and user experience* of bibox. The system uses visual and textual clues to lead the user to the next action and provides feedback after users' input. The print function enables users to directly find their book recommendations on the shelves. bibox supports the *community aspect* of the public library given that it is only accessible to local visitors who are often from the same neighborhood. Limitation on the local media inventory creates a common base for ratings. The integration of *metaphors and analogies* is met by the digital book metaphor, which brings with it the affordance on how to navigate through the system by turning pages and via bookmarks. All tangible elements in the modules promote physical interaction by referring to well-known everyday interaction concepts like selecting a star to rate, turning volume knobs, or writing with a pen. By implementing a combination of digital and physical user interfaces, linked by content and navigation, the user can choose their preferred *interaction mode* to interact with the system. Furthermore, all three modules are independent, meaning they can be accessed in arbitrary order or not at all. The inherent workflow leads from the least to the highest detail of rating, however, the user can choose the order and the mode they want to interact with. We provide indirect *feedback* on how to contribute and how others benefit by displaying previous ratings within the new book recommendations. Social comparison was not implemented, since we decided against a user login; therefore, there is no tracking of prior participation. *Personalization* is only partially implemented in the system. To keep the low barrier of entry without a time consuming registration, the system does not provide a personalized section for individual users. However, the system overcomes anonymity by providing personal features like names and handwriting of the text ratings, which increase the sense of personal responsibility within the library.

## 5 Evaluation in the Wild

To be successful bibox should engage people so they are motivated to use it frequently. Engagement can be split into three aspects: *attractors*, which call attention from passers-by; *sustainers*, through which the motivation to participate is maintained; and *relaters*, which support the creation of a relationship with the system to get the user to return to interact with it in the future (Edmons, et al., 2006).

To evaluate whether the design according to our set of design principles succeeds at getting people engaged with the installation, we conducted a one-week in-the-wild study in the public library of Cologne, Germany. We observed 18 visitors using the system without explicitly providing a scenario. We augmented these observations with a semi-structured interview and an assessment of the user experience. The study participants were composed of 10 female and 8 male library visitors, aged 12 to 70. They either approached bibox by themselves or were asked by the moderator to try out the new system. In addition, over a two-month installation period, all interactions were logged to investigate the long-term usage of the system.

The following sections present the most important findings and discuss the success of the application of our derived design set.

## 5.1 Results

The initial reaction on the installation was overall positive. The majority of participants approached bibox themselves, interested by the eye-catching new system. Some participants stated that they were attracted by the shining LEDs and the striking design of the box. Parallels were drawn to jukeboxes and gaming machines and many visitors highlighted the playful approach that drew their attention. Two thirds of participants stated that the system made them curious so they got interested in trying it out. The installation site turned out to be very important because visitors were able to spot the system at the entrance of the library. Almost all passing library visitors showed signs of interest by stopping their walk and examining the system. Reasons for not interacting with the system were in most cases a lack of time or not having a book worth rating.

We used the User Experience Questionnaire (Laugwitz, et al., 2008) to assess the overall interaction experience. The questionnaire provides 26 items, which range from -3 to +3 in six dimensions. The dimensions addressing hedonistic aspects were rated from above-average to excellent (novelty=1.5, attractiveness=1.2, stimulation=1.1). 14 participants praised the tangible interaction, as it raised the fun factor and made it implicitly clear how to interact with the system. The remaining three dimensions, which call upon the traditional usability aspects, were rated near neutral mean values (efficiency=0.8, dependability=0.3, perspicuity=0.1). One main issue that users struggled with was the interaction process. To give maximum flexibility to the user, no forced workflow is implemented in bibox. Even though the visual elements, which serve to group the information and emphasize navigation through the interface, were perceived as clear and supportive, some users reported that they missed a step-wise process through the system. However, every participant successfully rated their book using at least two ratings. The digital book metaphor was perceived as supportive and a good indication of how to navigate through the interface. The book recommendations were met with enthusiasm and considered as a useful addition to existing library services. The automatic digitalization of the handwriting led to amazement among the participants who pointed out that this gives “a personal touch” to the rating system.

Concerning the added value and reuse of the installation, 16 users stated that they are highly interested in such a participatory rating system. Four of them pointed out that they liked the way they could influence and shape the information service of the library themselves. One

participant highlighted that she would use the system even without the recommendations as an incentive. During the study week, one participant visited the library for a second time and was observed to instantly head towards bibox to rate his newly read books.

To assess the long-term usage, we logged interaction data over a two-month period. During the first month over eight sessions per day were launched with bibox. This number declined to four sessions per day during the second month. Logging data showed that more than half of the interactions were launched for children books. Two thirds of the users rated their book with two or three ratings, which gives an indication of users' motivation to interact with the system longer than necessary. Almost 90% of the users rated their book with stars, while the category and text modules were less frequently used (48% and 14%). However, due to the amount of media items in the library, we discovered that, even after two months, users rarely received book recommendations with existing ratings, since too many books had not yet been rated with bibox. This reduced the value of the installation, since visitors could not immediately profit from the contributions of others, which impaired the user experience and therefore the motivation to reuse the system.

## 5.2 Discussion

Results of both in-the-wild evaluation methods show that bibox successfully integrates the Library 2.0 concepts of participation and interaction in the physical space of a public library. We were particularly interested in how the design according to the eight design principles supports engagement consistent with Edmonds et al. (Edmons, et al., 2006).

### **Attractors**

The system's design succeeded in attracting library visitors and peaking curiosity to spark interaction. The salient appearance, tangible objects and luminous elements drew visitors' attention towards the installation. The location directly at the entrance served both as a seamless integration into the workflow and as a spotlight on the system. Given that more than half of all interactions were launched by children, this suggests that the playful design of the system gives the impression of being developed for young people.

### **Sustainers**

During the in-the-wild study, and from the extracted logged data, we observed that over two thirds of the users used the system for more than a single rating, rating their book via two or three rating modules. This observation and the results from the UEQ show that bibox is stimulating and fun to interact with. Statements from the participants indicated appreciation for the clear affordance associated with tangible elements. The applied metaphors and the different ways of interacting with the system were acknowledged and served as a motivation to continue the interaction. A drawback we observed was that attention was divided between the tangible and digital interfaces, causing users to lose track of the process inherent in the installation. This could be solved by not providing recommendations after each partial rating but only after the tangible interaction with all rating modules is finished, thus ensuring that there is no interruption in the rating process.



### Relaters

Even though participants were enthusiastic about using the system in the future for their book ratings, usage logging over two months showed a significant decrease in interaction. However, the estimated percentage of visitors who actively engaged with the system still compares to common participation rates in other communities, e.g. online communities (Tedjamulia, et al., 2005). During the entire study, library visitors stated to highly appreciate the additional service that bibox added to their library and many continued to use the system. The practical difficulty of lacking recommendations due to long cycle times for books to be read, rated and recommended, could be solved by including locally-relevant information or book ratings from online sources, provided there is no rating for a book recommendation available yet.

## 6 Conclusion

We presented both a theoretical and practical approach towards Library 2.0. Based on a literature and related-work research we derived a set of eight design principles to design for participation in public libraries. In addition to factors that facilitate the use of the system, such as a low barrier to entry and the integration into the library context, community supporting aspects also became relevant and include a focus on common interests and responsibility within the group through personalization. To exemplify the practical application of the design principles, we developed bibox, a tangible book rating- and recommendation system. Since engagement with a system is crucial for maintaining active long-term interaction, we aimed to analyze how the design principles form a system that contains elements of all three levels of engagement of library visitors: attractors, sustainers and relaters. We conducted an exploratory one-week in-the-wild study in the public library of Cologne, complemented by a two-month data logging period. The results pointed towards a success in engaging library visitors to interact with the system also over a longer period of time. bibox was perceived as a valuable enhancement of library services and motivated visitors to contribute and influence the information provided within the library. The practical application showed that the principles support design for engagement in a public installation within the context of Library 2.0. In future work, we will extend this approach towards broader contribution tasks and also benefiting from participation of fellow-library visitors. Further research on a broader integration of motivational participatory technology within the physical space of libraries will lead towards a comprehensive realization of the Library 2.0 concept.

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