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Björneborn, Lennart

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## Behavioural Traces and Indirect User-to-User Mediation in the Participatory Library

Lennart Björneborn

Royal School of Library and Information Science, Copenhagen, Denmark  
lb@iva.dk

**Abstract.** Participatory information spaces including social media platforms provide affordances for users both to leave behavioural traces of their informational activities and to find such traces from other users, a.k.a. *user-to-user mediation* and *social navigation*. Special focus in the paper is on affordances for *indirect user-to-user mediation* by ‘*trace leavers*’ and ‘*trace finders*’ in a participatory library setting, particularly in the physical Library 2.0. The paper presents a holistic approach, viewing human, physical, and digital information resources as supplementary parts of an integrated library platform that functions as an enabling space for creative practices like user participation and user-to-user mediation. Such a library may be seen as a participatory medium that can facilitate and support users to develop necessary participatory competencies in all facets of the presented life cycle of information behaviour. Truly participatory libraries thus provide more affordances for users with regard to both *leaving* behavioural traces (*create, store, share*) and to *following* such traces (*find, learn*). The paper points to both low-tech and hi-tech examples including mobile and ambient technologies with rich potentials for facilitating user-to-user mediation and social navigation.

**Keywords:** user participation, user-to-user mediation, behavioural traces, social navigation, creative practices, Library 2.0, enabling spaces, affordances, interfaces

### Introduction

*“Homo Ludens impinges on his environment: He interrupts, changes, intensifies; he follows paths and in passing, leaves traces of his presence everywhere.”<sup>1</sup>*

When interacting with information spaces like the Web or libraries, users may leave marks or traces of their activities that may guide other users to find and use information resources. Examples of such behavioural traces are worn covers, dog-eared pages and handwritten notes in books; left-behind books on a table; user-generated topical tags and ratings in online catalogues; edits in wikis; web site log files of user visits; and much more [e.g. 7, 16, 28]. As will be elaborated further below, behavioural traces can be physical or digital, intended or unintended by the ‘trace leaver’ being in direct or indirect contact with the ‘trace finder’.

New affordances, i.e. actionable properties [23], for users both to leave behavioural traces and to find and follow behavioural traces from other users, have been key drivers in the development of new participatory information spaces including social media platforms. Tagging, rating, editing, and re-mixing are examples of participatory activities and *user-to-user mediation* [1] leaving behavioural traces that can be found and followed by other users. Such *social navigation* [6, 7] deals with users’ behaviour that is guided by the behaviour of other users; “moving through an information space and exploiting the activities and orientations of others in that space” [7, p. 277].

This paper briefly outlines a framework for discussing affordances for behavioural traces, user-to-user mediation and social navigation in a participatory library setting (‘Library 2.0’). Special focus is on such affordances for *indirect*, asynchronous, user-to-user mediation and social navigation facilitated by behavioural traces ‘left behind’ by users in the physical Library 2.0.

Many Library 2.0 approaches and discussions have focused on web-based solutions like blogs, wikis, tagging, social network sites, etc., for user participation [e.g. 9, 22]. This paper presents a holistic approach, viewing human, physical and digital information resources as supplementary parts of an integrated library platform that functions as an enabling space for creative practices like user participation and user-to-user mediation.

User-to-user mediation already exists in physical libraries, for example, users exchanging opinions of music, books and other materials at the shelves, or in book clubs where users meet and discuss books they have read. User-to-user mediation can also occur in quite simple and ‘ready-at-hand’ ways, though perhaps not always thought of as acts of user-to-user mediation, as, for example, the dog-eared or left-behind books mentioned above. The aim of this paper is to create more awareness about such existing practices as well as to point to new augmented affordances provided by mobile, pervasive, ambient, and location-based technologies that could be used to facilitate user-to-user mediation and social navigation in a physical Library 2.0 setting.

A higher degree of involving users’ activities and skills in the mediation of information resources may create more engaging, inspiring, playful, and stimulating library spaces that can circulate more information resources among the users – and not least: this may also create more engaged users feeling more ownership of the library.

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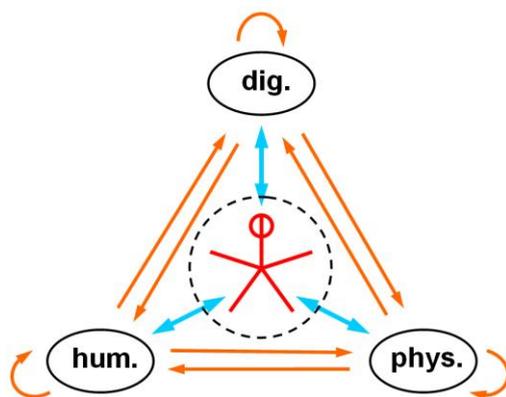
<sup>1</sup> Constant Nieuwenhuis cited in [12]

## Library 2.0 across social, physical, and digital affordances

As defined by Holmberg et al. [17, p. 677], “Library 2.0 is a change in interaction between users and libraries in a new culture of participation catalysed by social web technologies“. The creator of the term ‘Library 2.0’, Michael Casey, recognized that physical libraries are important when developing new affordances for user participation: “The heart of Library 2.0 is user-centered change. It is a model for library service that encourages constant and purposeful change, inviting user participation in the creation of both the physical and the virtual services they want, supported by consistently evaluating services” [3]. In a similar vein Lankes [21] sees the library users as important players in the development of “a truly ‘participatory’ library”.

In the holistic approach to user participation and user-to-user mediation outlined in this paper, the model in Fig. 1 is essential [1, 2]. The model shows how the multimodality of different human, physical, and digital parts of the library may be looked upon as an *integrated whole*; as supplementary and supportive parts for one another. This *integrative interface* of a library comprises the totality of all contact surfaces, access points and mediation flows between users and human, physical, and digital information resources. Human information resources comprise users, staff, and other human players in the library. Physical library resources include printed books, journals, flyers, etc., on display devices like shelves, tables, etc. Digital library resources include digital text, audio and video available through online files, databases, web pages, etc. Examples of mediation flows (single arrows in Fig. 1) between information resources could be users talking to each other (‘human → human’) or flyers in the physical library pointing to library web pages (‘physical → digital’). Mediation flows can be combined into longer chains and loops across all modalities in the model. See more examples in [1].

On this background, the outlined integrative interface comprises all affordances for how the user in the center of the model can take active part and interact across social, physical, and digital information spaces in the library – important in a participatory library setting. In other words, the presented approach suggests thinking affordances, design, usability, user participation, and behavioural traces across *all* contact surfaces between users and information resources – and not only such features in digital interfaces.



**Fig. 1.** Integrative multimodal interface model [1, 2]. User in center within ‘socio-cognitive-embodied’ context (broken line circle) interacts (double arrows) with human (hum.), physical (phys.) and digital (dig.) information resources. Between resources are mediation flows (single arrows). See more details and explanations in [1].

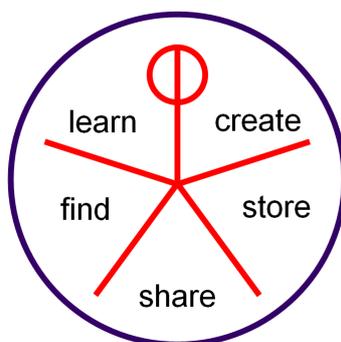
## Affordances for user-to-user mediation in the whole information behaviour ‘life cycle’

In the participatory library outlined above, different affordances for user-to-user mediation are essential: How well does library interfaces allow users to leave behavioural traces by creating, storing and sharing informational content, and how easy is it for users to find and learn from such content in all parts of the library’s integrative interface as modelled in Fig. 1?

In Library and Information Science (LIS), human information behaviour has been defined as “the totality of human behavior in relation to sources and channels of information, including both active and passive information seeking, and information use” [30]. The framework outlined in this paper unfolds the view on human information behaviour by dividing it into five main facets – key facets in LIS research – dealing with how humans *create, store, share, find* and *learn* when handling different kinds of informational content, cf. Fig. 2.

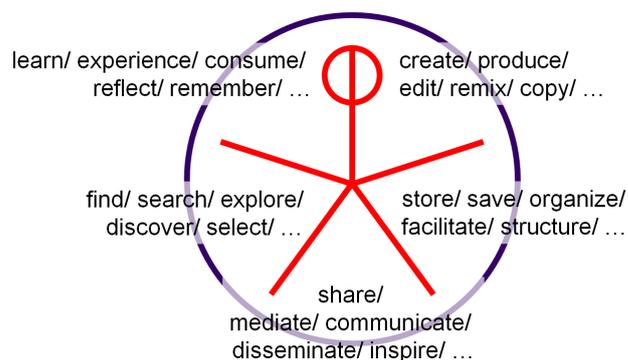
The notion of ‘information use’ in Wilson’s definition above is thus expanded into more facets in order to comprise augmented affordances for users’ information behaviour in a participatory library setting.

The resulting ‘stick man’ in Fig. 2 represents the user in Fig. 1; a user who can handle information in different ways in different situations. The order of the five facets should not be understood strictly linearly, as different types of information behaviour can occur in different order in different informational processes.



**Fig. 2.** Simplified 'life cycle' model of human information behaviour.

In Fig. 3 below, more verbs related to human information behaviour have been added to the five facets. The dots indicate that even more verbs of course are possible. Some verbs may also overlap different facets in the model.



**Fig. 3.** Extended 'life cycle' model of human information behaviour.  
Participatory libraries provide affordances for users to participate actively in all five facets.

Traditionally, libraries have mainly provided affordances for users to participate actively in the two facets *find* and *learn* in the information behaviour life cycle model. In a truly participatory library, there are 'affordances 2.0' for users to participate actively in *all* five main behavioural facets in the model. That is, besides the traditional facets *find* and *learn*, users should also be able to *create*, *store* and *share* informational content as part of the integrative library interface, e.g. in online catalogues, wikis, blogs, or in the library's physical settings.

In other words, participatory approaches like Library 2.0 provide more affordances for user-to-user mediation with regard both to *leaving* behavioural traces (*create*, *store*, *share*) and to *following* such traces (*find*, *learn*).

## Direct and indirect user-to-user mediation and social navigation

As already indicated in the introduction, user-to-user mediation and social navigation are closely connected; user-to-user mediation thus provides communicative cues including behavioural traces that may guide social navigation. As noted in the introduction, social navigation deals with "moving through an information space and exploiting the activities and orientations of others in that space" [7, p. 277]. In other words, social navigation deals with activities of users being guided by other users' activities that have been mediated in some way between users in a given space. Human, physical and digital parts of libraries (Fig. 1) function as important means for such user-to-user mediation that may guide social navigation as will be elaborated in more details in this section.

Table 1 below is based on a differentiation between *direct* and *indirect* social navigation [6]. As shown in Table 1, *direct* user-to-user mediation and social navigation deal with users in direct, synchronous, contact with other users, whereas *indirect* user-to-user mediation and social navigation deal with users in indirect, asynchronous, and often anonymous contact, with left-behind behavioural traces as mediating means between the users.

In Table 1, two extra differentiating layers have been added;

- (1) whether the user-to-user mediation and social navigation take place in physical or digital spaces, and
- (2) whether the 'trace-leaving' activity is intended or unintended by the 'trace leaver'.

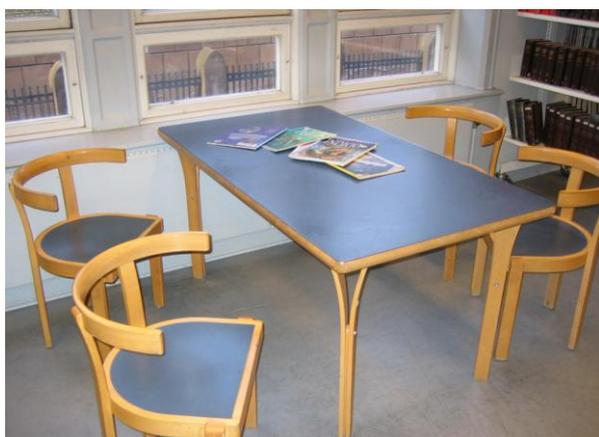
For example, a user may discover behavioural traces in the shape of books left behind after use on a table by other users in a physical library (cf. Fig. 4a). This indirect user-to-user mediation may not be intended by the 'trace leavers' but is perceived by the 'trace finder' in his or her indirect social navigation.

<ul style="list-style-type: none"> <li>• <b>direct</b>, synchronous, user-to-user mediation and social navigation <ul style="list-style-type: none"> <li>○ in <b>physical</b> spaces <ul style="list-style-type: none"> <li>▪ intended; e.g. face-to-face conversation</li> <li>▪ unintended; e.g. conversation overheard by others</li> </ul> </li> <li>○ in <b>digital</b> spaces <ul style="list-style-type: none"> <li>▪ intended; e.g. chat</li> <li>▪ unintended; e.g. chat overheard in virtual worlds (e.g. Second Life)</li> </ul> </li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• <b>indirect</b>, asynchronous, user-to-user mediation and social navigation <ul style="list-style-type: none"> <li>○ in <b>physical</b> spaces <ul style="list-style-type: none"> <li>▪ intended; e.g. messages on notice boards, physical tags</li> <li>▪ unintended; e.g. dog-eared pages, left-behind books</li> </ul> </li> <li>○ in <b>digital</b> spaces <ul style="list-style-type: none"> <li>▪ intended; e.g. links, tags, ratings, comments</li> <li>▪ unintended; e.g. recommender systems</li> </ul> </li> </ul> </li> </ul>

**Table 1.** Typology for direct and indirect user-to-user mediation and social navigation.

Whereas affordances for links, tags, rating, comments, etc. in indirect user-to-user mediation and social navigation are well-described in research on *digital* Library 2.0 approaches [e.g. 9, 22], affordances for indirect user-to-user mediation and social navigation in the *physical* Library 2.0 have been less investigated.

In a study [1] of users' information behaviour in two Danish public libraries, observed users looked through shelves and trolleys containing newly returned materials (Fig. 4b). In this indirect user-to-user mediation and social navigation, users explored and exploited other users' behavioural traces, here in the shape of newly returned books. Such activity may lead to serendipitous findings of information resources not known or not planned in advance [1, 2]. One of the libraries in the study had shelves with user-to-user-recommended books (Fig. 4c). The same library also provided tabs with smileys and ratings ('Giggle', 'Sob', 'Shock', 'Yawn', etc.) for users to attach to books they liked or disliked (Fig. 4d). This is an example of an affordance for indirect and intended user-to-user mediation and social navigation in the physical library with obvious parallels to tagging and rating in library online catalogues [e.g. 3, 9, 18] or on social web sites like *LibraryThing.com*.



**Fig. 4a.** Indirect, *unintended* user-to-user mediation in physical library: left-behind materials



**Fig. 4b.** Indirect, *unintended* user-to-user mediation in physical library: newly returned books



**Fig. 4c.** Indirect, *intended* user-to-user mediation in physical library: reader-to-reader-recommended books



**Fig. 4d.** Indirect, *intended* user-to-user mediation in physical library: 'opinion' tabs attached by users to books

## Augmented affordances for user-to-user mediation in the participatory library

Mobile, pervasive, ambient, and location-based technologies connect physical and digital information spaces. For example, by mobile phones able of displaying information from physical objects enriched with RFID chips, 2D barcodes, etc. [e.g. 4, 15, 25, 29]. These technologies provide new affordances for indirect user-to-user mediation and social navigation by leaving and finding *digital* behavioural traces in *physical* spaces.

So far, libraries have focused on transferring web services like searching, reservation, reference service, etc., to mobile platforms [e.g. 5, 8]. These approaches have thus mainly been concerned with the two facets *find* and *learn* in the information behaviour life cycle model in Fig. 2. In a physical Library 2.0 setting it would be interesting as well to let users *create*, *store*, and *share* information with mobile phones, for example, by using mobile phones to track and show tags, ratings, reviews, and other behavioural traces, digitally attached by other users to physical information resources in the physical library. Similar affordances for augmenting physical spaces with digital, informational ‘layers’ are already provided as applications for smartphones by companies like *Layar.com*.

Augmenting physical environments with communicative devices can also be in the shape of so-called *ambient* interfaces [e.g. 11, 14, 25, 29]. Using visual cues, sound, and other sensory modes for representing aggregated behavioural patterns by users to other users in a library could be a means to stimulate user-to-user mediation and social navigation. It could be fountains with the height of water representing how many materials have been borrowed so far during a day. It could be dynamic wall maps with light diodes visualizing how many users are in different library sections as tracked by sensors and counters. This would be a case of indirect user-to-user mediation by displaying aggregated and anonymized behavioural traces from many users. Such playful installations could motivate users to fall into conversation with other users, and could stimulate curiosity and guide social navigation: what to do and where to go in the library.

The ideas and examples in this section can only capture a small fraction of how new technologies can stimulate and support user-to-user mediation and social navigation in libraries. In the years to come, it will be interesting to see how new augmented affordances for user-to-user mediation and social navigation in physical libraries can be combined and integrated with already existing ‘ready-at-hand’ and low-tech affordances like the examples illustrated in Fig. 4a-d above. Mixing and bridging such human, physical, and digital modalities may enable new ways of facilitating both ‘trace leavers’ and ‘trace finders’ in a participatory library setting.

## Concluding remarks

This paper has presented a framework for discussing affordances for user-to-user mediation and social navigation, for leaving and following behavioural traces of user activities in a participatory library setting. Special focus has been on affordances for *indirect* user-to-user mediation and social navigation in the physical Library 2.0 where users’ activities may be guided by traces left of other users’ activities. In this context, the paper has pointed to low-tech as well as hi-tech examples across human, physical, and digital modalities with rich potentials for further development and integration that may facilitate both ‘trace leavers’ and ‘trace finders’.

In continuation of the introductory quote, the outlined integrative library interface in Fig. 1 may be seen as a participatory medium and an enabling and engaging space – an ‘open-minded space’ [27] – for *Homo Ludens*, the *Playing Man* [19]. If truly participatory libraries shall emerge – that also provide more playful platforms – a key point in the paper is that *all* interfaces in such libraries should be designed to provide more affordances for users with regard both to *leaving* behavioural traces (*create*, *store*, *share*) and to *following* such traces (*find*, *learn*).

However, allowing users to leave more traces of their activities across human, physical and digital modalities in the whole integrative library interface is a challenge for traditional library thinking. If user-generated access points to information resources shall co-exist together with library-generated access points there will be a need for new ways of sharing quality control and presenting navigational overviews in library interfaces. In this context, it is important to address issues of privacy and information overload when handling behavioural traces. In this process, it is essential that library users are supported to develop creative practices and participatory literacies [e.g. 10, 13, 20, 24, 26] in all facets of the presented life cycle of human information behaviour.

A higher degree of involving users’ activities and skills in the mediation of information resources may revitalize the library as a social platform for knowledge sharing and support the evolution of more engaging, inspiring, and playful library spaces.

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