“Just-in-Place” information for mobile device interfaces

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Abstract

Designing mobile device interfaces impose a series of challenges on human-computer interaction: displays are small, means of input are limited and use-contexts are very dynamic. This paper addresses the potentials of *context sensitivity* for making mobile device interfaces less complex and easier to interact with, thus easing the use of information technology while being mobile. Based on a semiotic approach to information representation, it is argued that the design of mobile device interfaces can benefit from spatial and temporal *indexicality,* reducing the information complexity and the interaction space of the device while focusing on the information and functionality relevant *here and now.* Illustrating this approach, a series of design sketches are presented showing two possible 3G mobile versions of an existing web and wap-based information service: with and without the use of spatial and temporal indexicality.

Introduction

With the launch of wap (wireless application protocol) and browsers like AvantGo for PDAs, Internet has been brought to mobile devices and wireless information services targeted at mobile users are now beginning to emerge. Wireless applications and mobile technology in the shape of wap-phones and PDAs are, however, still very much in their infancy regarding usability, network speed, display capabilities and computing performance. While the next generation of wireless devices (3G) promises a platform matching the performance of desktop computers, this does not in it self provide higher *usability* of mobile devices and applications. Designing usable interfaces for today as well as tomorrow’s mobile devices is not trivial but involves a series of challenges on human-computer interaction. Displays on mobile devices are small, means of input are limited and use-contexts are very dynamic. Regardless of performance offered by the technology, the usability of mobile information services consequently suffers from interfaces being very compact and cluttered with information and use thus demanding the user’s full attention. In mobile use-contexts (e.g. finding one’s way through a building, driving a car or just walking down the street), requiring this change of focus from activities in the real world towards operating technology can be problematic. If mobile devices are to have higher usability while actually being mobile, the user interface must remain relatively simple and the required interaction with the technology must remain minimal. These requirements call for new well-designed user interfaces.
An example of a “minimal attention interface” is the use of audio output instead of graphical displays for GPS devices presented in Holland et al. (2001). Another example is the use of head-up displays in automobiles or augmented reality for mobile devices in general, allowing the users to stay focused on their physical surroundings. While these approaches focus on new means of *output* (sound, and transparent displays), new sources of *input* may contribute to minimal attention interfaces by supplying means for simplifying the user interface and reducing the demand for user interaction.

“Just-in-Place” information

One of the features of the next generation of wireless devices is the ability to access information about the user’s *physical location,* whether through GPS or through wireless network cells, and combine this information with time. Besides facilitating applications supporting spatial navigation, this feature more importantly enables the design of a new range of mobile information services pushing information based on the continuously *changing* context of a mobile IT-user (see e.g. Cheverst et al. 2001). Instead of viewing the dynamic use context of mobile devices exclusively as a *problem* for mobile user-interaction, context changes can be viewed as important means of *input* to mobile information

services. Physical space becomes part of the interface of providing the user with information and functionality adapted to a specific location in space and time: "just-in-place" information.
It is, however, too simple to state that context sensitivity will facilitate higher usability when this information becomes available for developers in future 3G mobile devices. A number of questions have to be addressed. What are the potentials of context sensitivity in relation to HCI? How does the spatial and temporal context influence on information representation and how can general insight into this relation transform into specific interface design for mobile devices?

Representing "Just-in-Place" information

The study of semiotics is focused on the meaning and use of signs and symbols. A semiotic approach to the design of "just-in-place" information for mobile devices can contribute to a theoretically based understanding of information representation and the role of spatial and temporal context, and contribute to focusing the task of designing minimal attention user interfaces by taking into account their contextual surroundings.
From a semiotic perspective, information is viewed as representations (representamen) of something else (their object). Faced with an interpreter (the user), these representations cause a reaction or interpretation (the interpretant).

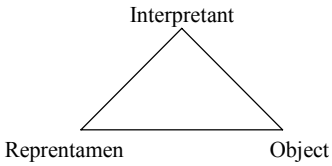
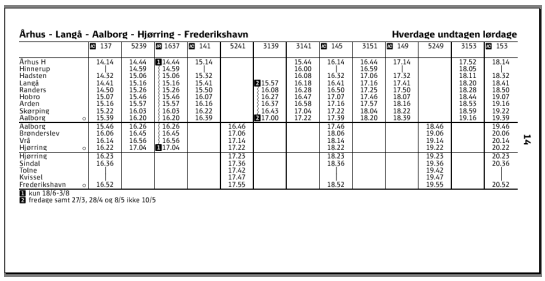


Figure 1. Semiotics: relations between object, representation and interpretant.

The semiotics operates with three types of relationships between objects and representations: *symbolic* (conventional) relationships between representations and the represented, *iconic* relationships (based on similarity) and *indexical* (material/causal) relationships. Symbols and icons are ways of representing information *independent* of its location in space and/or time like e.g. written text in books and the use of icons on web pages. Indexes, on the other hand, are ways of representing information with use of *strong relation* to spatial and/or temporal location exploiting information already present in the context. Indexical representations are e.g. used on signposts and information boards.
From his work on pervasive computing, Peter Bøgh Andersen (2001) describes the relationship between spatial and temporal context and information representation by stating: "symbolic and iconic representations of information can be converted into temporal and spatial indexical representation of the same information by location in time and space". This principle is illustrated in figure 2 and 3, showing two ways of representing information about train departures.



Århus - Langå - Aalborg - Hjørring - Frederikshavn — **Hverdage undtagen lørdage**

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Hinnerup	|	14.59	1 16.59	|			16.00	|	16.59	|		18.05	|
Hadsten	14.32	15.06	| 15.06	15.32			16.08	16.32	17.06	17.32		18.11	18.32
Langå	14.41	15.16	| 15.16	15.41		2 15.57	16.18	16.41	17.16	17.41		18.20	18.41
Randers	14.50	15.26	| 15.26	15.50		| 16.08	16.28	16.50	17.25	17.50		18.28	18.50
Hobro	15.07	15.46	| 15.46	16.07		| 16.27	16.47	17.07	17.46	18.07		18.44	19.07
Arden	15.16	15.57	| 15.57	16.16		| 16.37	16.58	17.16	17.57	18.16		18.53	19.16
Skørping	15.22	16.03	| 16.03	16.22		| 16.43	17.04	17.22	18.04	18.22		18.59	19.22
Aalborg ○	15.39	16.20	| 16.20	16.39		2 17.00	17.22	17.39	18.20	18.39		19.16	19.39
Aalborg	15.46	16.26	| 16.26		16.46			17.46			18.46		19.46
Brønderslev	16.06	16.45	| 16.45		17.06			18.06			19.06		20.06
Vrå	16.14	16.56	| 16.56		17.14			18.14			19.14		20.14
Hjørring ○	16.22	17.04	1 17.04		17.22			18.22			19.22		20.22
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Tolne	|				17.42			|			19.42		|
Kvissel	|				17.47			|			19.47		|
Frederikshavn ○	16.52				17.55			18.52			19.55		20.52

1 kun 18/6-3/8
2 fredage samt 27/3, 28/4 og 8/5 ikke 10/5

14

Figure 2. A traditional timetable:
symbolic representation with no indexicality.

Figure 3. An electronic timetable:
spatial and temporal indexicality.

The traditional timetable shown in figure 2 is an example of symbolic and iconic information representation with no indexicality thus being valid independent of the user's location in space and time. The electronic timetable shown in figure 3 is an example of symbolic and indexical information representation being valid (and relevant) only at a specific spatial location at a specific time. Increasing the indexicality of the representation from the traditional timetable to the

electronic timetable results in a significant reduction of information and interaction. Instead of having to look up departures from a specific location at a specific time (figure 2), the user is presented with simple information adjusted to his physical location at the present time (figure 3). Examples of reducing information and interaction by increasing indexicality are numerous, but further examples are prohibited here due to limited space.

Designing indexical interfaces for mobile devices

Though the platform for context sensitive mobile information services does not yet exist, prototypes *can* be developed resembling technological features to come by adding wireless LAN and GPS extensions to PDAs. Developing prototypes that actually works and can be tested in a mobile use context is of huge relevance to mobile HCI research. Preparing for 3G-interface design does, however, not always require actual implementation and test. Exemplifying the potentials of indexical interfaces or "just-in-place" information on mobile devices, using a series of simple design sketches and use scenarios, I have redesigned an existing information service currently implemented on web and wap for future 3G wireless mobile devices. The design is not indented for actual implementation. Its primary role is to illustrate how the semiotic perspective on the relation between context and information representation described above can be converted into specific interface design for mobile devices.

The existing information service

As subject for redesign I choose an information service for local cinemas because this service 1) requires the user to browse movies in relation to time and place and 2) as a supplement to the website supports mobile access via wap-enabled mobile phones. Using the website (figure 4a), the user specifies day of week (temporal context) and is then presented with a list of all movies on the specified day (even if in the past) at all theatres affiliated with the service. Accessing the service from a wap phone (figure 4b, 4c), the user specifies cinema of interest (spatial context) and is then presented with list of movies. Selecting a title reveals playing times. While the website is straightforward to use, the wapsite requires a lot of clicking due to the division of information into a large number of sub-pages (wap cards).

a) Web: "Movies playing on Saturday 20th Oct" b) Wap: "Choose Cinema" c) Wap: "Choose movie"

Figure 4. An existing cinema information system for web (a) and wap (b and c)

Two possible 3G mobile device interfaces

Information services like this are very likely to be accessible through 3G devices in the future, providing better user interfaces than currently possible with wap. Figure 5 and 6 illustrates different interface designs for such services on a 3G platform, without and with the use of spatial and temporal indexicality.

The first user interface (figure 5) is *not indexical.* It illustrates a design resembling the information and functionality of the existing website by squeezing it into the display of a PDA. Like the website, this design requires the user to specify day and cinema of interest, following which he is presented with a list of *all* movies playing at the selected cinemas at *all* times. At the bottom of the screen, the user can access opening hours, a map of the cinema's locations and a form for ticket reservations. Using this interface, the user is required to make a series of selections among a series of possible choices. The interface quickly becomes cluttered with information.

Figure 5. No indexicality

The second user interface (figure 6a) illustrates a *spatial and temporal indexical representation* of information designed to be available only when entering a specific cinema, providing information about movies playing *here, tonight.* Accentuating movies playing within a limited window of time relatively further increases temporal indexicality. Adding information about how to get to the specific halls from the user's present location increases spatial indexicality.
The indexical interface is far less cluttered with information compared to the non-indexical interface. Using this interface, the user is only required be present at the cinema and select a movie from a limited list of choices.

a) Entering the cinema: Selecting a movie…

b) On the way to Hall A: Finding the right way…

c) Outside Hall A: Buying tickets…

d) Inside Hall A: Silencing mobile devices…

Figure 6. A series of spatially and temporally indexical "just-in-place" interfaces for cinema information system.

One of the fundamental ideas of "just-in-place" information is that the content of the device changes when the context changes. A context sensitive mobile information service would thus typically consist of a *series* of indexical interfaces available at just the right places. The mobile cinema information service could involve the following use scenario and indexical interfaces: Having selected a movie, the device displays direction instructions. The representation of time changes from absolute to relative, increasing temporal indexicality (figure 6b). Outside Hall A, the user selects seats and buys tickets (figure 6c). When the movie begins, the user's mobile devices are silenced (figure 6d). Figure 6 illustrates how "just-in-place" consequently faces the user with very simple interfaces and limited interaction space minimizing the required attention and interaction compared to a non-indexical approach.

Conclusions and further work

Interface design for mobile devices can be simplified by increasing their spatial and temporal indexicality. Increased indexicality reduces complexity of the interface by allowing information to be removed from the interface when present in the context. Simplifying the user interface and pushing information to the device on the basis of context reduces the demands for user interaction and thus contributes to minimal attention interfaces. For further insight into the potentials of indexical interfaces, the design sketches above should be implemented as a working prototype and tested in the actual use context.
Finally, it should be noted that *context* is much more than just space and time. Contextual information about the user's tasks and activity etc. may contribute to further simplification of mobile user interfaces and required user interaction.

References

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