Visual Highlighting of Information for Public Transport Information Systems

Romina Kühn
TU Dresden, Junior Professorship in Software Engineering of Ubiquitous Systems
Dresden, 01062 Germany
Romina.Kuehn@tu-dresden.de

Beatrice Moltkau
TU Dresden, Junior Professorship in Software Engineering of Ubiquitous Systems
Dresden, 01062 Germany
Beatrice.Moltkau@mail.inf.tu-dresden.de

Thomas Schlegel
TU Dresden, Junior Professorship in Software Engineering of Ubiquitous Systems
Dresden, 01062 Germany
Thomas.Schlegel@tu-dresden.de

Abstract
In urban space, public displays are primarily used to present information concerning public transport: tram or bus lines, timetables or departure times. They are mostly located at stops to provide information to people who are waiting for their bus or passing pedestrians. Highlighting relevant information on public displays seems to be a suitable approach to find specific information more quickly. In this paper, we present a general set of visual highlighting methods, which can be used to support users in finding relevant information. The presented highlights form the basis to select the most appropriate approach for visualizing passenger information in the public transport domain more easily.

Author Keywords
Visualization; highlighting; public transport.

ACM Classification Keywords
H.5.2. Information interfaces and presentation (e.g., HCI): User Interfaces. Graphical user interfaces (GUI).

Public Transport Information Systems
The number of public displays in public transportation rises because of decreasing manufacturing costs, which is accompanied by new application possibilities. Finding relevant information can sometimes be difficult due to
the size of a display and the wealth of information. Especially in case of homogenous types of media or information, for example, a lot of text or numbers it can take a while to find the required information. Fisher et al. [3] already investigated blocked highlighting and its usefulness to the test participants in order to find relevant information faster and more easily. Wickens et al. [9] describe how information on maps on small size displays (16”) can be highlighted. As one result, they stated that a combination of high- and lowlighting helps viewers to find relevant information more quickly. Ostkamp et al. [6] did research on visual highlighting for public displays. The authors involve additional technologies such as mobile devices to select information and visualize them. In contrast to their work, we set our focus on general visualizations, which can be used in the application area of public transportation to highlight information on public displays. The results of the aforementioned authors [3], [6], [9] serve as a basis for our further investigations.

In public transport, the most important and common kinds of information for passengers include timetables with dependencies between number and text, a list of departures, network maps, tickets and fares, changes and the passenger’s location [4] as presented in Figure 1. Especially for tourists or business travelers in unfamiliar environments, it is necessary to support them in finding helpful and relevant information. Highlighting these kinds of information seems to be an appropriate solution to support passengers.

**Visual Highlighting of Information**

We identified different visualizations and distinguish two types of highlighting: single and combined highlighting. This differentiation is necessary when considering different levels of complexity of information as well as different users at the same time.

**Single highlighting methods**

We identified some single highlighting methods (see Table 1), which can be used to point out the relevant information in public transport. The highlighting methods can be applied not only to location, start or end points, but also to a specific line on a network map.

**Combined highlighting methods**

Combining different single highlighting methods represents further visualization options. Different combinations of two or three single highlighting methods are presented in Table 2. They can be used to highlight more complex information, e.g. start and end points combined with information about departure or arrival time or a specific line.

---

**Figure 1:** Public transport related information presented on a public display without highlighting.
<table>
<thead>
<tr>
<th>Highlighting</th>
<th>Effect</th>
<th>Visual example</th>
<th>Usage in public transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color/ Saturation</td>
<td>Objects with high saturation and/or color attract more attention than without. [5]</td>
<td><img src="image" alt="Color/Saturation Example" /></td>
<td>To highlight single points, e.g. start or end points on a map, locations, information in a set of homogenous information.</td>
</tr>
<tr>
<td>Blurring</td>
<td>Blurred elements take a back seat; defined elements come to the fore. [8]</td>
<td><img src="image" alt="Blurring Example" /></td>
<td>To focus on a specific information in a set of homogenous or heterogenous information, e.g. a departure.</td>
</tr>
<tr>
<td>Size/Line width</td>
<td>Bigger objects are in the focus of interest, e.g. the biggest of several similar objects will be focused. [8]</td>
<td><img src="image" alt="Size/Line Width Example" /></td>
<td>For single points or lines on a map.</td>
</tr>
<tr>
<td>Movement/ Flashing</td>
<td>Moving or flashing elements attract attention.</td>
<td><img src="image" alt="Movement/ Flashing Example" /></td>
<td>To visualize the route from the start to the end point on a map.</td>
</tr>
<tr>
<td>Addition</td>
<td>Adding different shapes to an object to differentiate more easily between objects. [8]</td>
<td><img src="image" alt="Addition Example" /></td>
<td>E.g. to differentiate more easily between a list of ticket rates or departures.</td>
</tr>
<tr>
<td>Symbols</td>
<td>Symbols give meaning to an element, e.g. a special label. Independent from language. [2], [7]</td>
<td><img src="image" alt="Symbols Example" /></td>
<td>To describe a single point better, e.g. marking a current location or an end point with a flag.</td>
</tr>
<tr>
<td>Text</td>
<td>Offer additional information to an object or symbol; differentiation of similar objects, e.g. Points of Interest. [5]</td>
<td><img src="image" alt="Text Example" /></td>
<td>To describe a specific point, e.g. the name of a current location.</td>
</tr>
</tbody>
</table>

Table 1: Single highlighting methods
<table>
<thead>
<tr>
<th>Highlighting &amp; Effect</th>
<th>Visual example</th>
<th>Usage in public transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blurring &amp; Flashing</td>
<td><img src="image1.png" alt="Visual example" /></td>
<td>To highlight information on a map or in a list, e.g. specific departure or a starting point.</td>
</tr>
<tr>
<td>Color &amp; Blurring</td>
<td><img src="image2.png" alt="Visual example" /></td>
<td>Focus on a specific information, e.g. a single point on a map.</td>
</tr>
<tr>
<td>Size &amp; Color</td>
<td><img src="image3.png" alt="Visual example" /></td>
<td>To highlight, e.g. one specific line on a map.</td>
</tr>
<tr>
<td>Movement &amp; Color</td>
<td><img src="image4.png" alt="Visual example" /></td>
<td>To highlight a route on a map from a starting point to the passenger’s destination.</td>
</tr>
<tr>
<td>Symbol &amp; Flashing</td>
<td><img src="image5.png" alt="Visual example" /></td>
<td>To highlight a given route including the start and end point.</td>
</tr>
<tr>
<td>Addition &amp; Movement / Flashing</td>
<td><img src="image6.png" alt="Visual example" /></td>
<td>To focus on a specific point, e.g. starting point on map with other surrounding points.</td>
</tr>
</tbody>
</table>
Flashing & Symbol & Movement: Movements or a flashing element attract attention, an additional symbol specifies the element. [2], [5], [1]

Text & Symbol & Flashing: A short text describes symbols more detailed; flashing attracts attention.

To focus on a specific information with the help of flashing and moving elements, to describe the information more detailed by a symbol.

Clearly describes a single point, language-independent, e.g. end point of a route.

Table 2: Combined highlighting methods

<table>
<thead>
<tr>
<th>Additions</th>
<th>Blurring &amp; Color: The relevant ticket and fare is highlighted by a striking color and by blurring of all other options.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finish</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2: Public transport related information with highlighted content
The usage of different kinds of highlighting, e.g. blurring & color, addition, color & size, symbol & text as well as movement is illustrated in Figure 2.

Conclusion and Future Work
This paper presented a set of visual highlighting methods on public displays in the field of public transport and will be integrated in our future work. We plan to evaluate the different kinds of highlighting in a real-world setting. For this, the test users will have to perform different tasks in a given time including the correctness of the solved tasks. As a result of this evaluation, we expect to find the most efficient visualization for representing highlighted information in public transport. Furthermore, we want to establish a basis to give recommendations to (local) public transportation services, which type of highlighting of specific information suits best for passengers in public transport.

Acknowledgements
This research has been funded within the SESAM project under the grant number 100098186 by the European Social Fund (ESF) and the German Federal State of Saxony.

References