HOW TO FIND THE WAY: TEXT_BASED OR MAP_BASED SEARCH? AN EXPLORATIVE STUDY ON THE USE OF THE JOURNEY

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1. Introduction

With new technologies of information and communication, it is now possible to reach increasingly large masses of information on increasingly varied supports and modes of interaction. During a typical workday, a user employs several times his computer, PDA or cell phone to seek or receive diverse information. The technological developments also enable the personalization of information in order to better meet the user's needs.

A user often makes use of a web site to extract information appropriate to his needs. As all the users do not have the same level of technological experiment, the design of web sites should enable the users to use a site with a minimal effort. Especially, the web sites, which include essential information for great numbers of people, must be conceived to guarantee the usability.

The web sites of the systems for public transport can be considered as one of the most important examples. It is now possible for a user to give the parameters necessary to see the possible routes for its displacement. Although the system seems really promising, an unusable interface can transform this experiment into a nightmare for the user.

In this context this study aims to examine the uses of online journey planners, taking those of London (Transport for London – TfL), New York (Metropolitan Transport Authority – MTA) and İstanbul (İstanbul Elektrik Tramvay ve Tünel İşletmeleri – İETT) as examples and conduct a usability test on the journey planner of İETT. This particular journey planner is different than the other two with its use of a map. TfL's journey planner is mostly text-based with a high level of detailed search options. The journey planner of MTA is also text-based with less detail compared to that of TfL. On the other hand, while İETT has a text-based planner, it also offers an interactive map to its users.

Our aim in conducting a usability test is to be able to see to what extent the users prefer the map and to see if the map increases usability of the system compared to a text-based system. In the second part, we will examine the use of graphic design to represent geographical realities, define the journey planners and briefly examine the three examples mentioned above. The third part includes the methodology. We will see how the sample was chosen and which instruments were used for data collection. Research questions will also be presented in this section. In the fourth part we will be discussing the results of the usability test focusing mainly on users' preferences and common problems. After identifying key problems or highlights of the web site, a brief comparison will be made with the systems of TfL and MTA.

2. Concepts

Graphical Representation Of Geographic Reality (Maps & Diagrams)

Organization and visual representation of information has been one of the most important issues concerning graphic design even before the age of industrialization or computers. Street signs, emblems, official pronouncements and news would have to be visually organized and represented even in ancient Egypt or in mediaeval Italy (Newark, 2002: 6).

Although cartography exists since 6,200 BC; with the earliest known map considered to be the town map of Çatalhöyük, discovered by James Mellaart in 1963 (Mellaart, 1964: 55); a map is not really a graphic design as it is not possible to talk about a visual reorganization of a geographical reality. The Tabula Peutingeriana (Table de Peutinger) (Fig. 1) on the other hand is thought to be the oldest known road map (dating from the 4th or the early 5th century) and is considered to be more of a plan than a map showing the main roads as red lines with segments each defining a distance of one day's travel and with pictograms of buildings to represent hotels and spas (BBC.co.uk). A better-known and carefully structured modern example of a visual reorganization of a geographic reality is the London Underground Map by Henry C. Beck (Fig. 2).

Not a designer but an engineering draughtsman working for the London Underground, Beck re-designed the London Underground Map in 1933 on an octagonal grid with the lines meeting at right angles or forty-five degrees and the stations placed according to their relationship on the system rather than their actual geographical locations. The inclusion of the Thames in the diagram gives a sense of scale and place while the use of color makes it easier to identify the different lines (Hollis, 2001:18–94). His design idea is still used for the current London Underground Map by Transport for London and is also adopted worldwide for urban bus, rail and metro maps. With the advanced technology, use of maps and diagrams have widely expanded and have an important place on interactive mediums. From interactive plans and maps on web sites to portable GPS (Global Positioning System) devices, which can be found even on recent cell phone models, the options of way-finding have multiplied immensely.

Journey Planner

An inter-modal journey planner is a transport information system that helps users to plan journeys and provides them with information and support on trip (Mentzdv, 2008). Journey planners are first developed for and used by the travel industry since 1970s.

With the Internet, self-service online journey planner became available. Today most public transport companies provide their users with a journey planner. A contemporary journey planner allows the user to type in his/her point of departure and point of arrival and provides the user with the information about the itinerary, necessary transfers etc. Additional parameters can also be specified such as number of transfers or type of transport so that the information meets the user's specific needs.

The Journey Planner systems chosen as examples are those of New York, London and İstanbul. As stated in the introduction part, a usability test will be realized on the journey planner of İstanbul and the other cities will provide additional information to compare. The choices of New York and London are due to key similarities like demographic statistics and the multitude of transportation mode choices (Table 1) (US Census Bureau, 2008; The MTA 2006: 6; Transport for London Annual Report and Statement

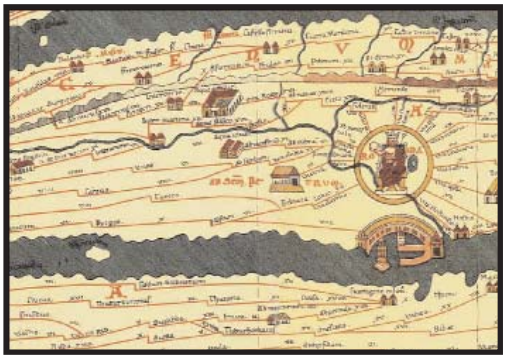

Fig.1. The Tabula Peutingeriana

Fig.2. London Underground

of Accounts 2006/07: 13; TÜİK, 2007; İETT 2006 Yılı İdare Faaliyet Raporu: 77; İstanbul Ulaşım Faaliyet Raporu '06: 17; İDO Faaliyet Raporu '06: 39; T.C.D.D. İstatistik Yıllığı 2002-2006: 58).

London's Journey Planner provides the user with various input options. The system is text-based. User can type in the departure point and the arrival point as a station, stop, post code, address or a place of interest and also the date and time of his/her desired journey (Figure 3).

New York's Trip Planner works in a similar way to London's Journey Planner. It is also text-based. Its search page is simpler offering less detailed options. User also types in the point of departure and arrival, the desired time of travel, maximum walking distance and the transport modes that he/she wants to use (Figure 4). Advanced options for the disabled also exist. The system works only in English.

Contrary to the other two systems, İETT's journey planning system (Yolculuk Planlama Sistemi) has a more graphical interface, offering the user an interactive map of İstanbul on its homepage. This page can be separately examined in four different fields (Figure 5).

These fields offer different modes of interaction to the user and can be used separately or in combinations. In Field no. 1 user can select a bus, rail or sea line from a drop down menu or search for a line with a keyword. The user can see the timetable and route for the selected line as well as seeing the line on the map. The timetable and the itinerary appear below the map. In Field no. 2, the user can search for a stop or station. Field no. 3 offers a search of itinerary similar to those of London and New York. Contrary to these other systems, the system does not accept an address, a postcode or a street name. User has to type in the name of the stop or station. After three characters are typed, the system starts to offer names with an auto-complete function. The results of

	Population	Number of Total Passengers of Public Transport in 2006
New York City	8,214,426	2,237,980,467
London	7,460,000	3,054,300,000
İstanbul	12,573,836	827,067,566

Table.1. Statistics of public transport in New York, Londres et İstanbul

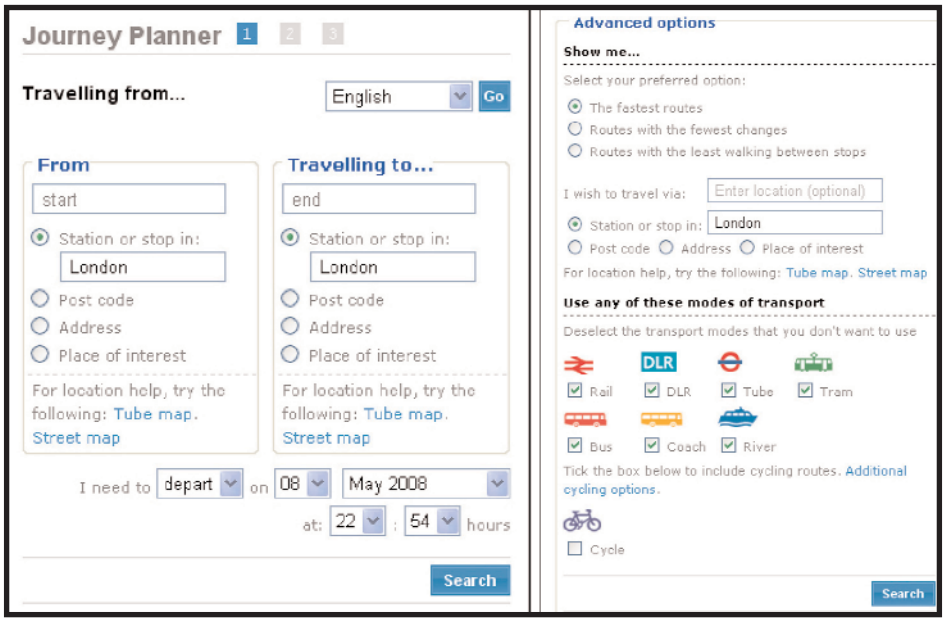

Fig.3. Screenshots from London's Journey Planner interface

the search and proposed options appear above the map. Field no. 4 is the map. Using the icons below the map, the user can zoom in or out on the map as well as sliding it. When the “Durak bul (Find stops)” tool is selected, a user clicks on a point on the map and see a list of stops close to that point. Any one of these stops can be defined as a departure or arrival point on Field no. 3.

Search options are less detailed compared to London and New York’s systems. User is not able to select a desired time of travel, or search with an address or street name. There are no advanced search options and the system works only in Turkish.

When an itinerary is searched via Field no. 3, the results are displayed above the map. The provided information includes the lines, transfer points and number of stops in between (Figure 6). The user can also see the lines’ timetables or routes. Total travel time or the price is not provided and there is no additional information.

3.Usability Test of IETT’s Journey Planner
Methodology

As stated in the previous section, İETT’s journey planner offers a map of İstanbul along with a text-based search engine on its main screen while TfL’s and MTA’s systems offer only a text-based search engine. This difference has been the starting point of this study. A usability test has been carried out for this study mainly to see to what extent the map was preferred by the users to plan their journeys and if the map was able to answer to the usability goals which are discussed also in the previous section. The usability of the system in general was also questioned but to a smaller extent. The research question of this study is as follows: “Do users prefer to search for their itineraries on a graphical interface like an interactive map rather than a text-based search engine?”

A multi-modal approach was chosen for this test. First, the user was asked to fill out a background related questionnaire, which includes questions about the participant’s habits of computer, Internet and public transportation usage. Although the participants were selected with similar computer and Internet experiences, the questions asked in this part offers a detailed overview of the sample.

The second part consists of the test itself where the participant is first asked to look at the homepage of İETT’s journey planner and identify the objects on screen. Secondly, the participant was asked to perform a task using the system. The task is to plan a journey between Ortaköy and Anadolu Kavağı. The participant was set free to use whichever tool he/she wishes on the system. The task was directly observed and recorded on a structured observation sheet. The task observation also included a recorded think-aloud protocol where the participants were asked to talk simultaneously about the actions they carried out and the reasons of their motivation. Observations of participants, in combination with think-aloud protocol, allow researchers to see where misunderstanding or other usage problems occur.

After the test, a debriefing interview took place. This interview included open-ended questions about the participant’s recent experience with the system. The participants were asked about what they liked or did not like about the system, as well as their actions towards the map. Those who did not use the map were asked why they preferred other methods to carry out their task. Those who did use the map were asked if they had any problems while using the map.

Sample

The test was done with five male and five female participants. According to Jacob Nielsen’s researches, five users are enough to find 85% of usability problems on a web site (Nielsen, 2000). In this research, the user was set free to use whichever tools he/she found necessary to complete his/her task. In that case the number of participants was chosen to be higher than five to increase the probability of a participant using the map. The sample was selected from university students aged between 20-25 (Average age: 22,5) all with an average computer and Internet experience. These criteria enabled controlling individual differences to some extent. The reason of working with students in this research is due to user statistics of İETT. According

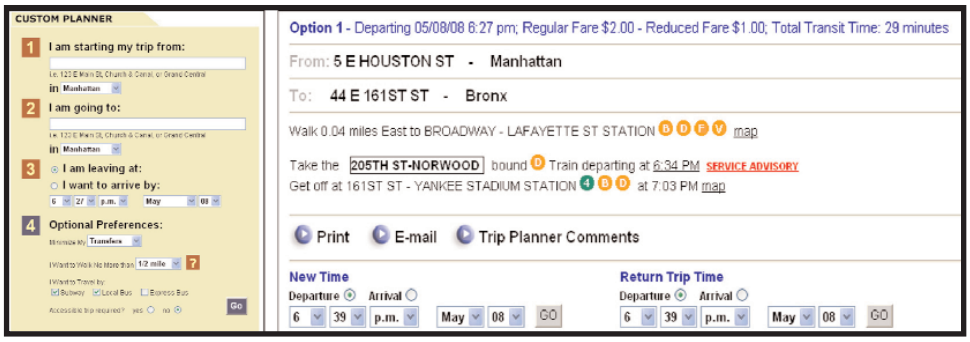

Fig.4. Screenshots from New York's Trip Planner interface

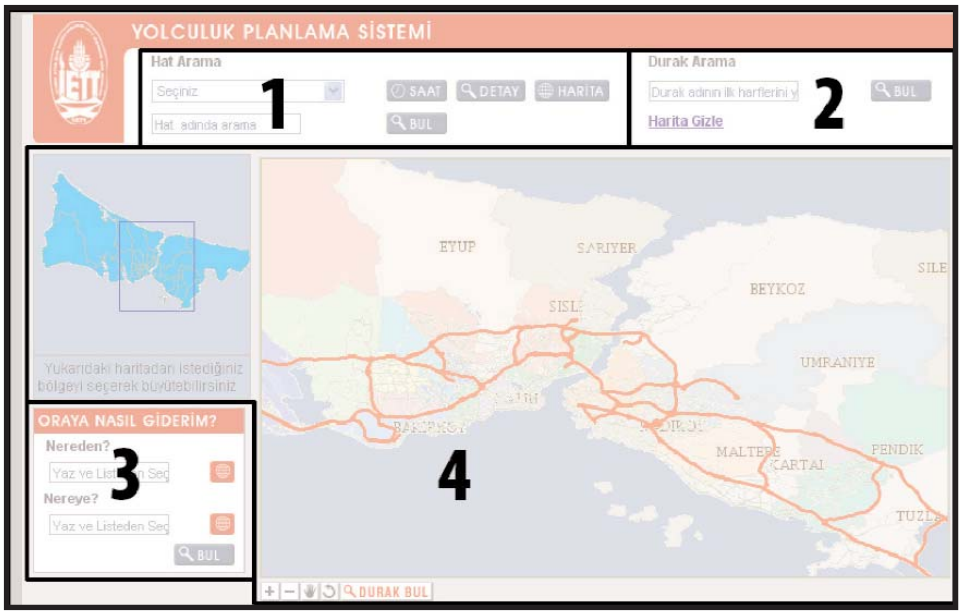

Fig.5. Screenshot from the home page of İETT's journey planning system

Fig.6. Screenshot from the results page of İETT's journey planning system

to 2006 statistics, 25.3% of passengers were reduced card owners and 76.5% of reduced card owners are students (İETT, 2006: 50-77).

4. Findings, Discussions and Results

Background questionnaire

The findings of the questionnaire seemed to overlap with the expectations mentioned about the sample above. Briefly, all the participants had an average computer and Internet experience. Nine participants use a PC and Internet every day. Eight participants have been using a PC for more than 5 years. All of them used public transportation on a regular basis. 6 of them used public transportation daily, two of them used public transportation 3-4 days a week and two of them used public transportation 1-2 days a week.

Task Observation and Debriefing Interview

As described in the second chapter, participants were asked to fulfill a task using the journey planner of İETT. The task was to plan a journey between Ortaköy and Anadolu Kavağı. Participants were free to use whichever tools they wished to use on the system. The task is considered complete when the participant identifies two different journey options presented to him/her by the system. While some of the participants stopped after this point, some went on searching for more details. This provided extra data, also presented in this chapter. Guided by the research question, the aim of the observation was to determine (a) if the interactive map on the system was preferred by the participants, (b) if the map was able to answer to participants' needs and (c) to a smaller extent if other parts of the system were satisfying to the participant.

Usage of the map

Nine participants were able to execute their tasks within averagely 1 minute. To execute their tasks, nine participants used the text-based search engine, only one participant tried to plan their journey on the map. Two participants tried to find more details on the map, after using the text-based search engine. Thus, seven participants in total never touched the map. All the participants that did not use the map told that it would be difficult for them to find the stop *(Anadolu Kavağı)* on the map, as they did not know exactly where it is. Also, four participants told that they found the map too slow and four told that the map seemed difficult to use. All the participants who used the text-based search engine completed the task successfully. The participant who tried to plan her journey using the map was not successful in completing the mission.

Usability of the map

As told earlier, only one participant tried to plan a journey on the map. Another participant wanted to see one of her bus lines on the map. Third participant to use the map wanted to find his itinerary on the map. Each of these attempts resulted in a case of user frustration, which can be defined as when the

Fig.7. Screenshot from the navigation of F08

Fig.8. Screenshot from the navigation of M02

computer acts in an unexpected way that annoys the user and keeps the user from reaching their task goals (Preece, et al., 2006: 187-207). There are many possible causes of user frustration. For instance, a software application may crash, an error message might be unclear or an interface might be confusing (Preece et al., 2006: 147-152). We will now see each case of user frustration within our test in detail:

F03 tried to plan her journey not with the text-based search engine but on the map. She wanted to locate the stops on the map. She did not find the tools to zoom in or out so she used the map on a very small scale. First, she tried to locate *Ortaköy* on the map. As this region was a familiar one for her, she was able to find *Galatasaray Üniversitesi* bus stop, which is in proximity of *Ortaköy* by 670 meters. She selected *Galatasaray Üniversitesi* as her point of departure. Then, she started searching for *Anadolu Kavağı* on the map, but as that region was an unfamiliar one for her, she wasn't able to find the stop. Instead, she found another bus stop called *Kabakoz Kışlası*, which is 10 kilometers away from *Anadolu Kavağı*. She selected *Kabakoz Kışlası* as her point of arrival and created an itinerary not for the *Ortaköy-Anadolu Kavağı* route but for the *Galatasaray Üniversitesi-Kabakoz Kışlası* route, thus failing to fulfill the task.

F02 used the text-based search engine to plan her journey. After seeing the two options provided to her by the system, she clicked on "*Seçimi göster* (Show selection)" icon whose function is to show the selected line on the map. After this action the system started loading the map, not showing the line but instead displaying "*1 katman kaldı*… (1 layer remaining)" (Figure 7). The participant waited for the map to load for 2 minutes and 25 seconds before quitting the action. She stated, *"She would have quit long ago".* She clicked the BACK button of the browser and tried once more. This time she waited for 1 minute and 25 seconds before clicking BACK. After this, the home page failed to load entirely and the participant gave up completely.

M02 used the text-based search engine to plan his journey. After seeing the two options provided by the system, he started using the map to see if the itinerary was shown on it. As the itinerary was not shown on the map, he tried to find the way on his own. Zooming in to *Üsküdar*, he tried to find the stops between *Üsküdar* and *Beykoz* (Figure 8). He tried for 6 minutes, couldn't find his route, gave up and stated that *"He has lost himself in this map!"*.

All of the participants who used the map complained about its slowness. Two of the participants also stated that the map was not detailed enough. M02: *"There are not a lot of details but still it is too slow"*. Only the names of municipalities and stop names are displayed. There are no other indications like street names or places of interest. M02 and M04 compared this map to Google Earth, stating that the latter is faster and much easier to use. F03 and M02 stated that they found the buttons on the map (eg. zoom in/out) difficult to select and use.

Usability of the system in general

Regarding the other parts and tools of the system, the text-based search engine where the user can type in the points of arrival and departure has been the most popular tool during the tests. In the debriefing interviews, five participants' answer to "What did you like on this page?" was the *"Oraya nasıl giderim? (How can I go there?)"* search box.

Six participants complained that there weren't enough detailed information about their itineraries and lines. Four participants tried to find out about the time of their travel but were not able to find such information. M04 made calculations about travel time, based on his own knowledge. Three participants thought that the system in general was slow.

Two participants stated that they knew better ways to travel from *Ortaköy* to *Anadolu Kavağı* than the ways suggested by the system. F01 said that she would take the Bosphorus line from *Beşiktaş* without further transfers. M05 said that, he would prefer going to *Sarıyer* from *Ortaköy* and then take a boat to *Anadolu Kavağı*, which would be quicker with less transfers.

Though not a statistic, it was observed that the auto-complete function of the search engine had positive reactions as the participants felt it to be somewhat reassuring; affirming that what the user is doing is right and will possibly generate appropriate search results. M03 actually stated that he liked the auto-complete function: *"It is nice that the name of the stop appears after a few characters. I don't like to type long things"*.

5. Conclusion

The goal of this study was to determine if graphical interfaces like an interactive map was preferred by the average user on a public transportation web site. Supported by diverse data collection protocols, a task observation method was employed for this study.

In our usability test on İETT's journey planner, nine participants used the text-based search engine, instead of searching their itineraries on the map. We may conclude to two explanations for this.

The sample had an average experience with computers and Internet, but their actions in choosing the text-based search engine shows a rather expert behavior. This can be explained with the fact that the definition of the average web user is changing as the average user is now considered to be more experienced than before. Compared to the past, almost all users are now better at physical operations, such as mouse movements and scrolling and -*more importantly for our study*- almost all users know the basics of using search and use it more often than the past (Nielsen, 2008).

On the other hand, users' preferences of the search function rather than the map, combined with the observation from the users' experiences with the map, points out to another finding. It clearly shows that the interactive map on İETT's web site offers poor usability. Although the map itself did not contain a lot of details, the controls for the map were found confusing and hard to use.

We have seen that other popular examples of journey planners -such as the Journey Planner of TfL and the Trip Planner of MTA- offer text-based searches rather than a graphical solution. The results are displayed on a map if the user demands it. An approach like this one could also be adopted by İETT's system. As most of the participants tend to use the search function, it would definitely improve the usability if the search function was offered to be the main choice of interaction with more details compared to its present situation. The map would have a secondary function to display the results if demanded.

If we try to see the findings of this study on a wider scale, we could try to place it in the evolution of graphical representation of geographic realities, which we have briefly seen, in the second section. It is possible to say that the advanced technology and improved user skills now offer a lot more functions than a regular map or diagram.

The personalization of information in these journey planning systems takes us to a point where the users' individual perceptions seem to be more important than the geographic reality itself. In these systems, the geographical positions of points A and B, now bear less importance than the time of travel, the modes of transport and the number of transfers between points A and B. The latter information is considered enough to execute such a travel.

At this point, we can say that a journey planner should be able to provide detailed and accurate information via a text-based search engine and preferably supported by an interactive map. Further tests should be carried out to better determine the needs of users and increase usability in these systems.

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