Behavioural Impacts of Mobile Tour Guides

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Abstract

Electronic tour guides have been developed to personalise guided tours. Also, in contrast to traditional tours, electronic tour guides allow their users to abandon or modify tours at any time. Research as to whether users take advantage of these added capabilities is currently not available. A field trial was conducted comparing the behaviour of tourists as they were using a Planner providing a personalized guided tour and an Explorer displaying the current location in a map and supplying information about sights on request. The results indicate that users differ significantly in the way and extent to which they take advantage of both mobile applications. It seems that the Planner satisfies the demand for guided tours additionally leaving much needed room for spontaneous deviations. Surprisingly, tour duration, walking distances and number of sights visited using these different mobile applications were similar to traditional guided tours.

Keywords: Personalized tour, mobile tour guide, user perceptions, tour adaptation, tour modification, field trial.

1 Introduction

Intelligent mobile devices featuring dynamic tours promise tourists the opportunity to enhance the experience of a destination by providing relevant and personalized information anytime and anyplace. However, the term "tour" typically relates to a paradigm of tourists following a fixed schedule and visiting the most popular attractions at a destination. One can expect that these perceptions can carry over to a tool which includes "tour" in its name. Thus, a mobile tour guide might be expected to provide a traditional tour guided by an electronic device rather than a human being, but otherwise following the same structure. If this is the case, users who feel comfortable with guided tours and like to adhere to the guidance of a tour guide will be more likely to execute suggestions received from a mobile tour guide. On the other hand, users who would like to freely explore the destination might not realize that a mobile tour guide can also support this kind of tourist behaviour, especially when it has the capabilities to dynamically adapt to users signalling less or increased interest.

The Dynamic Tour Guide (DTG) is a mobile application which, in its "Planner mode", is able to create personalised tours based on tourists' generic preferences and

context based constraints such as tour duration, starting time and location. A previous field trial (Kramer, Modsching, Gretzel, & ten Hagen, 2006) showed its ability to elicit generic interests in the mobile context, to select attractions and to combine them into an appropriate tour. The DTG also offers an "Explorer mode" that computes no tour plan but provides context-based information whenever requested. Tourists can follow their own position on a map and see a list of available attractions in their close vicinity. Either manually selecting or staying at a certain sight will trigger context-driven interpretation. The two modes represent very different paradigms of a mobile information system and raise the question whether they lead to differences in user acceptance of the tool, use of its features, and, ultimately, impacts on tourist behaviour.

2 Related work

Developing tools which can provide personalized tours is a complex task and has become a central issue in current research. The main projects regarding mobile tour guides are C yberguide (Abowd, 1997), GUIDE (Cheverst, 2000), the Deep Map (Malaka, 2001) and Crumpet (Schmidt-Belz, 2003). Unfortunately, evaluations of mobile recommenders by the intended user groups are rare and typically conducted using very small samples. Also, a review of previous studies clearly shows the methodological shortcomings of existing evaluation approaches. For instance, GUIDE is a mobile tour guide that computes a route based on selections of concrete sights by the tourist him/herself. Reaching a sight, context-sensitive information is provided. In a field trial over 4 weeks 60 tourists were asked to use a mobile device with the GUIDE prototype. Time stamped interaction logs, audio recording protocols and personal interviews delivered data for later evaluation with the objective to validate system requirements. Although audio recordings provide insights into user problems, they are not tied to a specific location and their analysis is time-intense. Another example is the Crumpet project, which developed a personalized, location-aware multi-agent system. It recommends and informs about tourist attractions, and provides interactive maps displaying the user's position as well as points of interest (Pols). A usability evaluation at four different trial sites served to find out if the system was useful and provided benefits compared to currently available media. Users had to perform typical tourist tasks while being observed, and later completed a questionnaire. However, observing subjects is not only extremely intrusive and might cause changes in behaviour but is also very personnel- and time-consuming. GPS-based log approaches can help overcome some of these problems. Ashbrook and Straner (2003) collected data of 5 subjects over 7 months using this methodology. Such GPS-based approaches are not only important for system evaluations but also provide general insights into travel behaviour. According to Brown and Chalmers (2003), previous studies on tourist behaviour lack detailed observations of tourists in practice. Most are questionnaire-based like the study of Freytag (2003) and thus are static and dependent on tourists' memory and perceptions.

March and Woodside (2005) argue that planned and realized tourist behaviour differ substantially and consumer decisions can be greatly influenced by product information at the destination. Similarly, Pearce (2005) outlines the often substantial effect of interpretation on on-site experiences and behaviours. By providing

recommendations and interpretation of sights, mobile tour guides are expected to have great influence on tourist behaviour. Consequently, a methodology is needed which can capture tourist behaviour in a spatial context and at the same time minimizes the influence of the research methodology on the behaviour studied.

3 Methodology

In August 2006 a field trial was conducted in Görlitz, Germany to examine the behaviour of tourists resulting from the use of the mobile recommender system DTG. The main objective was to study the differences of the Planner and Explorer modes in terms of their impact on tourist behaviours. A total of 20 mobile devices (MDA III or VPA III) connected to a Bluetooth GPS receiver and equipped with the mobile DTG application were utilized. Respectively 10 devices configured as operating in the Planner or in the Explorer mode were handed to the tourists each day in the morning and received back in the afternoon. The devices were dispersed at several places throughout the city and could either be brought back to a central collection station or deposited at any restaurant or hotel in the city. The tourists were also asked to fill out a questionnaire and received a DVD of the city Görlitz as an incentive for participating.

Instead of observing the users directly which inevitably runs the risk of taking influence on their decisions, the software was equipped with an instrumentation mechanism in the background. Also, rather than defining tasks for the field trial which would constrain actual tourist behaviour, tourists were asked to use the mobile devices to support their exploration of the destination. Letting the tourist use the mobile device unobserved provided them with the choice to abandon the use at any time if the effort necessary to interact with it exceeded the perceived value.

Different types of data were used to evaluate different research targets:

- XML files containing all user interactions (inputs, clicks) and application events (automatic information presentation, tour adaptation) and results (computed tour)
  → Specified interests and tour constraints for tour computation
  → Planned duration, distance and specific attractions
  → Manual modifications (add or remove attractions) of the tour plan
  → Interactions during the tour and conditional on the tour progress
- GPS log file containing NMEA values delivered by the GPS receiver
  → Actually covered distance based on coordinates
  → Actual tour duration based on timestamps
  → Actually visited locations by comparison to their coordinate referenced areas
  → Actual visit durations based on hardly varying coordinates for longer time spans
- Supplementary questionnaire asking for demographic data (age, gender) and tour relevant facts (information sources, difficulties)

Despite its advantages over methodologies used in previous studies, this methodology is limited for the following reasons: The evaluation relies on automated data that reveal user decisions but give no insight regarding their intentions or reasons. In addition, all behavioural decisions are assumed to be triggered by the tourists or their

mobile device without taking into account external influences like companions, traffic, weather or else. Furthermore tourists are assumed to have recognised certain attractions based on predefined staying times though they may not have seen the attraction as such. Last but not least, GPS accuracy in towns like Görlitz is limited (ten Hagen, 2005). This affects the anticipated locations on one hand and causes navigation problems on the other. The DTG application integrates the commercial navigation software Navigon (2006). Detailed studies during the beta phase indicated that around half of the navigation instructions were either plainly wrong or at least misleading, e.g. to "turn right" after one has already passed the turning point. The tourists were advised that the directives may be inexact and should not be followed blindly. Indeed, the survey results show that the DTG Planner was only ranked fifth (15%) as the most trustful orientation help. Tourists preferred city maps (22%), road signs (18%), distinctive buildings (16%) and information signs (15%).

4 Results

Throughout August 2006, 274 tourists (132 using the Planner mode and 142 the Explorer mode) took part in the field trial. The majority (56%) of the participants had never been in Görlitz before. The mean age was 47 years and 68% of the participants were male. Only 13% of the tourists were travelling alone, the average size of a travel group was 3 persons. The majority of the participants felt comfortable handling the application, though 85% rated their capabilities with such mobile devices as very low or low, 79% stated zero years of usage and 81% stated zero hours of usage per week. Nevertheless, less than one fourth complained about difficulties regarding the handling of the device.

Use and Influences of the DTG Planner Mode

Only few tourists who used the Planner mode of the DTG engaged in detailed interest specification; most weighted a small number of main interest categories. After all constraints were specified the DTG Planner computed a tour. The median planned tour had a duration of 2.4 hours and included 12 attractions. Tourists can manually add or remove attractions which results in a recalculation to optimise the tour with the new constraints; however, 65% of the tourists did not make use of this option and performed the tour as it was proposed. This might indicate that most tourists like to have a tour plan and trust the recommendation. Tourists who modified their tours did it twice per tour. They more often added than removed attractions, suggesting that tourists must be well informed about what is worth seeing in Görlitz. Tourists who removed attractions might have already visited them. Fig. 1 displays the distribution of tour modifications during the tour. A high percentage of modifications occurred during the planning phase but tourists also modified their tour in the second half. By reaching special sights along their way tourists might try to include those to expand the tour. Closer to the end they might feel tired of walking and try to finish the tour earlier by shortening it.

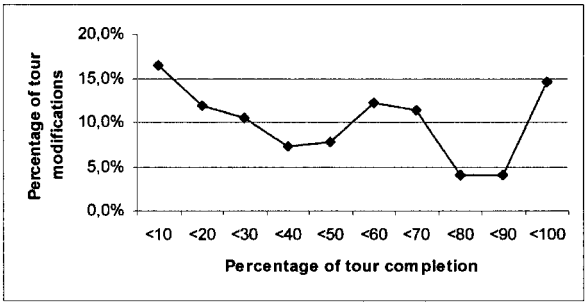

Fig. 1. Distribution of modifications during tours

Table 1 compares the actual tour with the original tour plan. On average the tourists visited 50% (6 out of 12) of the attractions proposed by the DTG Planner (the distribution of the tour completions according to the tour plan is displayed in Fig. 2). Thus, the actual duration and length of the tours are smaller than planned. Fig. 3 visualizes the amount of sights of the original plan that are being visited or skipped during the tour execution. Most tour building blocks (TBBs) that were skipped were scheduled at the end of the tour. This is a strong indication that tourists often finish their tours earlier and abandon the last part maybe due to tiredness. However, the last TBB is almost always visited as it is the desired endpoint of the tour.

Table 1. Comparison of planned and actual tours (median values)

	Planned	***Actual***
Tour duration [min.]	142	76
Number of sights in tour	12	11
→ actual visits of those originally planned		6
Percentage of planned visits	100%	55%
Percentage of unplanned visits	0%	45%

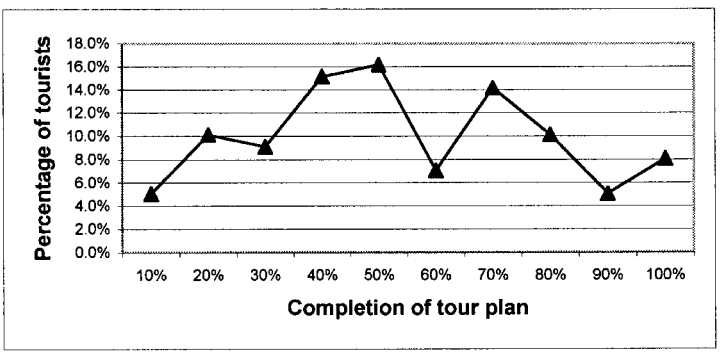

Fig. 2. Percentage of tour completion according to plan

The results also indicate that tourists visit a lot of unplanned attractions, likely for two reasons: they stop at additional attractions when passing by along their normal route or they explicitly deviate from the given itinerary to visit a certain attraction they saw from afar. The median duration of an actual tour is 1.3 hours which approximately equals the duration of common guided tours. That might mean tourists are not willing or simply not used to perform longer tours. And it underlines the fact that tourists only used the DTG Planner for one activity, a tour, and, thus, for just a small segment of their stay in Görlitz.

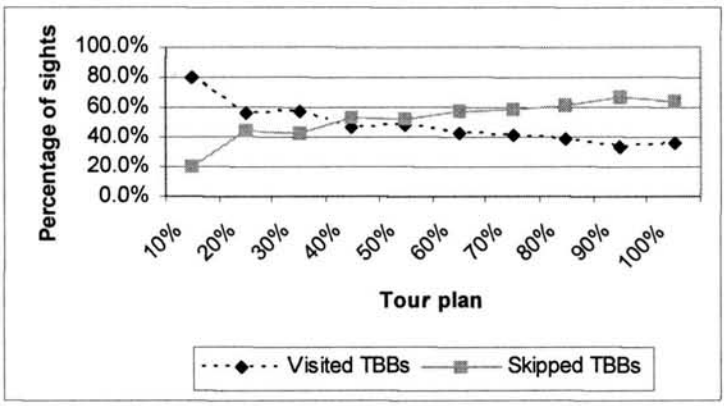

Fig. 3. Percentage of visited and skipped sights according to tour plan

Fig. 4 shows the distribution of actual and planned tour duration. It seems tourists were a bit too optimistic when planning their tour as their actual walking time is much shorter. This diagram again underlines the findings of Table 1.

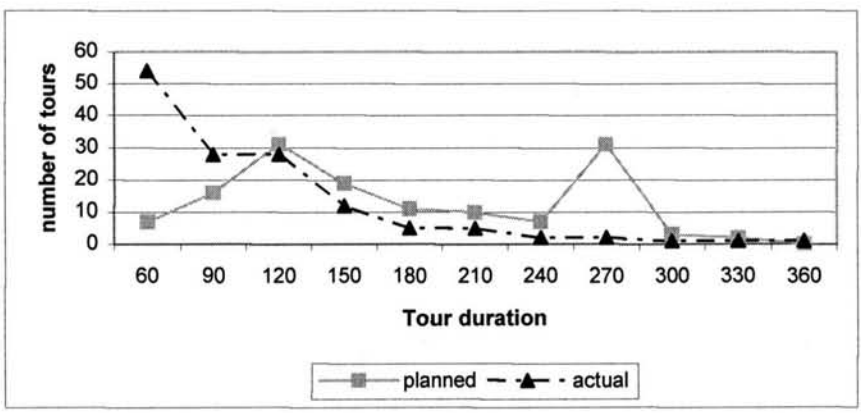

Fig. 4. Distribution of planned and actual tour duration

A total of 55% of the tourists got distracted during their tour at least once. A distraction is defined as three deviations of more than 100 metres from the proposed

itinerary. In 89% of the cases another sight was the reason for leaving the recommended route. In other cases tourists got lost, probably because of misleading directives of the mobile navigator due to bad GPS accuracy within the Old Town of Görlitz. What becomes clear is that tourists really try to execute the plan as it is proposed. Deviations are pretty rare considered the covered distances and always lead the tourists back to the planned route.

The DTG Planner tracks the execution of the tour plan. If the plan and the actual execution deviate by more than ½ hour the DTG suggests adapting the tour to account for the accumulated changes. If the tourist agrees a new plan is computed for the remaining amount of time. The tourist can also choose to continue the tour with the acceptance of later or earlier arrival. The need for adaptation arises since some tourist might walk faster or slower or tourists might stay longer at a sight than anticipated. Furthermore a tourist might simply get distracted by an attraction or a souvenir shop along the way and ignore the execution of the tour plan. Last but not least a tourist might simply get lost. Of the 132 planned tours only 9% were adapted, though 17% of the tours were recommended to be adapted. This means that almost half of the tourists who were provided with an adaptation suggestion by the DTG Planner did not agree to an adaptation and continued with their tour as it was planned. Anyhow, those few adaptations took place during the last 10% of the tour for 47% of the cases. The reason for adaptation is a time deficit in 78% of the cases, which entails a shortening of the tour, and a time surplus in 22% of the cases, which in contrast entails an expansion of the tour. These results show that in practice for such short tours around 1.5 hours the predefined deviation time of ½ hour might be too long and needs to be reduced.

The DTG Planner also allows for integrating restaurant stops into the plan. The mean time spent at restaurants was 27 minutes, with most tourists choosing a café. But in 69% of the cases the tourists who had planned a restaurant decided not to visit them. Reasons for that, according to the questionnaire data, are that 62% decided not to visit a restaurant at all and 27% spontaneously visited a different restaurant along the way, sometimes just a bakery. Other reasons trace back to the short duration of the tours and the mind set associated with a "Guided Tour", which generally does not have a restaurant break. The DTG Planner data suggests that tourists first finish the tour, return the mobile device and start another activity like having lunch or coffee. The planner mode provides a Guided Tour, which is a well-known model. Tour adaptation and the inclusion of a restaurant visit are abilities of a "Day Planner", which is an entirely new mental model lacking a traditional analogue.

Comparison of Planner and Explorer Mode

The results of the previous section show that the tour plan is helpful as half of it was performed in the recommended manner. Nevertheless tourists took the opportunity to enrich the tour plan by attractions along the way. This suggests that even the DTG Planner provides a level of independence guided tours performed within a group can not offer. In contrast to the still very structured tours resulting from interactions with the Planner version, use of the Explorer mode is not based on a tour plan but entirely driven by spontaneous user decisions.

Table 2. Clicks and time for different actions with the Planner (median values)

	Clicks	*Time [min.]*
Interest specification	25	2.3
Tour specification	6	2.3
Navigation mode	37	29
Total interaction	**93**	**85**

Table 2 shows the interaction data for the DTG Planner. In a preceding field trial (Kramer, 2006) the elicitation of interests took about 2 minutes and less than 20 clicks. This year the values are slightly higher as the tourists had the opportunity to perform the tour afterwards and seemed to invest more effort into planning. No interest specification is necessary for the Explorer mode. Fig. 5 shows the amount of interactions with both applications during the duration of the tour. The Planner demands much more clicks in the beginning as the tour must be specified. The Explorer shows a more even dispersion of clicks over time as there are only two interaction schemes: orientation by a map and requesting information, which is equal throughout the whole tour. Fewer clicks in the end may mean that tourists request less information as they become tired or return to places they have already been at and heard about. However in both cases the average interaction frequency is 1.1 click/min.

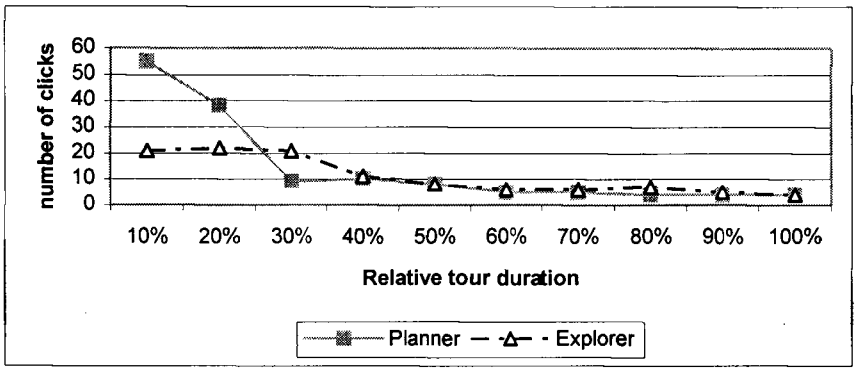

Fig. 5. Distribution of clicks

Table 3 compares both versions considering distance, duration and number of visited sights. The observed behaviours are, first, very similar for the two different modes and, second, pretty close to what one would assume to be the case for traditional tours without the use of a mobile tour guide. Either the "tour paradigm" is so engrained that it determines the behaviour of the tourists or it reflects more fundamental human constants like attention span, distance willing to walk or amount of information that can be processed. These experiences derive the need for a combination of both modes for a practical adoption. As the tourists pass additional sights during their planned tour they may want to receive appropriate information as it is provided by the Explorer mode.

Table 3. Comparison of performed tours (median values)

	Planner	*Explorer*
Tour distance [km]	3.4	4.2
Tour duration [h]	1.3	1.7
Number of visited sights	11	14
Time per sight [min]	7.1	7.1
Sights per distance [1/km]	3.2	3.3

5 Future research

Results of the questionnaire data indicate that only 10% of all tourists are walking by themselves. Most are couples, families or groups. As proposed for online planning systems by Franke (2002) the concept of the DTG needs to be extended to serve groups of tourists jointly discovering a destination. Especially an interest profile for the whole group has to be synthesised from the individual ones as described by Masthoff (2004) who combines multiple preferences for a common television programme. In general, the findings indicate that the methodology employed was appropriate. However, detailed insights into the reasons for behaviour changes could not be derived. A study design with prompts by the system asking the user to indicate why a certain behaviour was triggered should be explored for future studies. It was found that the Planner mode is used for a single activity, a tour, and this tour may only be the first one with others to follow. For these subsequent tours the "tour guide" paradigm needs to be reframed to a mobile information system. Such a mobile information system will remember the sights visited at this destination as part of an earlier guided tour or during self-guided exploration to propose an additional tour that helps the tourist discover the not so obvious beyond the beaten paths. This requires more research on users' conceptual model of mobile tour guides as well as on effective ways to communicate different paradigms to a user so that impacts on behaviour can be realized.

6 Conclusion

The presented results indicate that tourists are accepting the guided tour model. However they seem to enjoy with relish the ability to ignore the plan, since they are just executing 50% of the planned sights, adding sights along the way and dropping sights at the end of the plan. This additional level of independence is a unique differentiation of the mobile tour guide versus traditional guided tours in a larger group. However advanced features like the inclusion of a restaurant or the adaptation of the tour plan were rarely used. These are features of a Day Planner with a planning horizon beyond a single guided tour and –unfortunately- without such a strong traditional analogue. The Explorer as an entirely passive mobile application was used for tours a little bit longer enabling the discovery of proportionally more sights. However the Explorer relies on traditional means, e.g. signs, to guide the tourist. In this field study pretty much all tours were initial tours and hence they covered the highlights in the mediaeval town centre. A planner remembering the sights visited

before can devise a plan that leads to entire different areas of the city that an exclusive user of the Explorer might have trouble finding. Despite the fundamental differences between the Planner and Explorer application the distances, durations and number of sights visited were similar and close to traditional guided tours potentially indicating fundamental constraints about the will of a tourist to walk, focus on one activity and process information about sights.

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