

# Location-based mobile tourist services - first user experiences

Barbara Schmidt-Belz<sup>a</sup>,  
Alexander Zipf<sup>b</sup>, and  
Heimo Laamanen<sup>c</sup>  
Stefan Poslad<sup>d</sup>

<sup>a</sup> Fraunhofer FIT, Sankt Augustin, Germany  
Barbara.Schmidt-Belz@fit.fraunhofer.de

<sup>b</sup> European Media Lab, Heidelberg, Germany  
Alexander.Zipf@eml.villa-bosch.de

<sup>c</sup> Sonera, Helsinki, Finland  
heimo.laamanen@sonera.com

<sup>d</sup> Queen Mary University of London, UK  
stefan.poslad@elec.qmul.ac.uk

## Abstract

The vision of nomadic users having seamless, worldwide access to a range of tourist services seems within reach, within only a few years from now. While much of the underlying technology is already available, there are challenges with respect to usability that need intelligent solutions. CRUMPET has realized a personalized, location-aware tourism service, implemented as a multi-agent system with a concept of service mediation and interaction facilitation. The system has been validated in terms of technical and user-perceived qualities at four European trial sites. This paper reports the findings of the user validation and draws conclusions concerning mobile tourism services.

**Keywords:** Mobile Tourism Service; Location-Based Services; User Validation; Software Agents.

## 1 Introduction

Emerging new technologies such as handheld mobile devices with wireless connections to the Internet open up new prospects for eCommerce and eTourism. The vision of a broad range of services for tourists being available, from everywhere and at every time, becomes realistic for the near future. Location-based and personalized services are considered key features of such services. A promising technical approach

is software agent technology, which has additional advantages with respect to scalability, service mediation, and the management of seamless mobility. The provision of content and services, adaptable to, and tailored for mobile users, may soon become another important channel of destination marketing for cities and regions.

But what do users think about such a mobile tourism service? Do they feel, the service has added benefits, compared to traditional media and Web-based services? What would be the crucial applications and qualities that “make the big difference”? A range of usability issues concerning mobile services is being discussed in the science community; are there already viable, good solutions? And, last but not least, would there be a future market for such systems?

Once prototypical realisations are available, users can validate the implemented approaches and assess concepts and realization details from their point of view. Such first user experiences are a valuable guidance for further improvements, design decisions and market strategies for the new technology.

This paper is structured as follows: Section 2 gives an overview over the CRUMPET system, the features of the prototypes and how the trials have been performed. In Section 3 we report the outcome of the user validation, focussing on location-based and personalized services. Section 4 contains the more general results of our survey when looking for the added value of mobile tourism service. Finally, in Section 5, we draw our major conclusions and outline future work.

## **2 CRUMPET system and Trials**

The goal of the European IST project CRUMPET has been the "Creation of User-friendly Mobile Services Personalised for Tourism". CRUMPET has had two main objectives:

- To implement and trial tourism-related value-added services for nomadic users across mobile and fixed networks
- To evaluate agent technology in terms of user-acceptability, performance and best-practice as a suitable approach for fast creation of robust, scalable, seamlessly accessible nomadic services

Figure 1 illustrates the functional architecture of the CRUMPET system. It has in essence a three-tiers structure, with the mobile clients on the one hand, the local

services on the other hand, and a multi-agent system between both, which implements the value-added integrated services. For more details and a discussion of the design rationale of this system architecture we refer to (Poslad et al. 2001) and (Schmidt-Belz et al. 2002). In this paper here we rather focus on the user's point of view on this system.

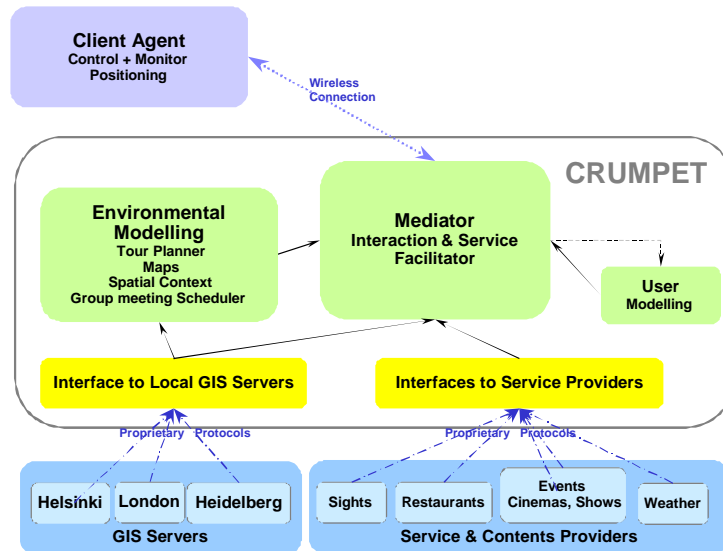


Figure 1: Functional architecture of the CRUMPET multi-agent system

The system offers a simple user interface and handling of services. The main functionality is:

- Recommendation of services, e.g. tourist attractions (based on personal interests and the vicinity to the current location)
- Interactive maps (overview maps of the area, highlighting the current position of the user; maps highlighting sites of interest and tours; maps can be panned and zoomed)
- Information about tourist attractions, both short text, more detailed information, maps, directions and pictures.
- Proactive tips, giving an unobtrusive tip when the user gets near a site that might interest him or her.

The client device is a handheld computer (e.g. iPAQ), the user location is determined by GPS sensor data. Modern handhelds offer a screen size and resolution that is adequate to display maps and simple HTML pages. The system has not been realized for extremely limited displays such as WAP enabled mobile phones.

The project has developed a functional prototype, available with local content at four trial sites: Heidelberg/G, Helsinki/Fi, London/UK, and Aveiro/Pt. The trials allow validating the system and the approach, both with respect to technical achievements and user assessment. The trial sites each have a special focus, which allowed comparing variants, such as differences in local contents available.

The method chosen for this user validation is a field experiment, where users have to perform some typical tourist tasks, while using the services offered by the CRUMPET system. The test persons answered a questionnaire that has been developed to clarify the above-mentioned questions. The questionnaire ensures comparable validation results throughout



all trial sites. We have also applied the standardized questionnaire SUMI (Kirakowski 2002) to measure usability. We also observed the test users during the experiment, which gave us deeper insight in user experiences. This combination of quantitative and qualitative methods is appropriate especially when validating a highly innovative technology.

The selection of test persons was oriented at the prospective market of such a system. Basically, every tourist should be able to use CRUMPET. On the other hand, we assume that the CRUMPET user owns and uses a PDA for everyday tasks (such as personal planner, taking notes, dictionary) as well as when travelling. In this respect CRUMPET differs from a kiosk solution or a museum

guide. The future CRUMPET user is more likely to be a mobile knowledge worker at a higher level of computer literacy.

Sample	gender		Grand Total
	female	male	
age			
20-39	30%	42%	72%
40-60	8%	17%	25%
> 60	0%	3%	3%
Grand Total	38%	63%	100%

So far, more than 80 persons have taken part in the CRUMPET trials. The familiarity with some crucial computer usage has been documented for each test person but not made a criterion in selecting test persons.

Frequency of use	Computer	WWW	WAP	PDA
not used so far	2%	0%	67%	58%
sometimes	14%	11%	25%	25%
frequently	84%	89%	8%	17%

### 3 Location-Based Personalized Services

In general, location-based services are considered crucial for the success of mobile applications (Oertel et al. 2002). It is also widely assumed that the mobile services should be personalized, see for instance (Short 2000). By location-based services (LBS) a broad scope of value-added features is understood that are based on the systems awareness of the user's current location. The user acceptance of location-based services has recently been investigated in more detail (Kölmel and Wirsing 2002). In CRUMPET, the user location is used to facilitate user request of services and to add functionality to maps (Zipf 2002). Personalization adds consideration of the user's personal interest in the available service types; these interest can be automatically learned. The pro-active mode of service is another option to use positioning and personalization for a value-added tourism service. Our findings confirm the importance of personalized LBS services, see also next section.

The central role of maps in a tourist guide has been corroborated by our experiences. Maps can meanwhile be rendered in a good quality on a modern PDA. Navigation support on very small screens (such as WAP phones) is often given by maps that show only a schematic picture of a route. In our experiments, however, we observed that users, i.e. pedestrian tourists, asked for many details they wanted to find in a map. Depending on the task at hand, they looked for a match between aspects of their



physical environment and the map representation on the screen. There is certainly a trade-off between avoiding cognitive overload, giving task-specific information, and adapting to personal preferences, that needs further and more detailed investigation.

We also found evidence that a few people would need text for a tour description, as they were unable to interpret a map. If textual directions are provided, in addition to maps, this could also be used for an audio guide, which is more adequate in some situations when the user cannot look at a screen.

The interaction with maps in order to pan or zoom, also in order to include and display specific objects, needs to be as simple and straight forward as possible. We observed many users who intuitively tried to directly manipulate the map in order to pan and zoom. We also had the impression, that some would prefer scrolling to panning (i.e. a larger map is transmitted, the user then scrolls to see the area of interest). We found diverging opinions about the orientation of maps: should the map be always oriented to the north or should it be turned to match the user's direction? The latter would require sensor data (e.g. electronic compass) and might confuse some, when they turn occasionally to have a look around while the map orientations remains as it is. This also needs more detailed investigation.

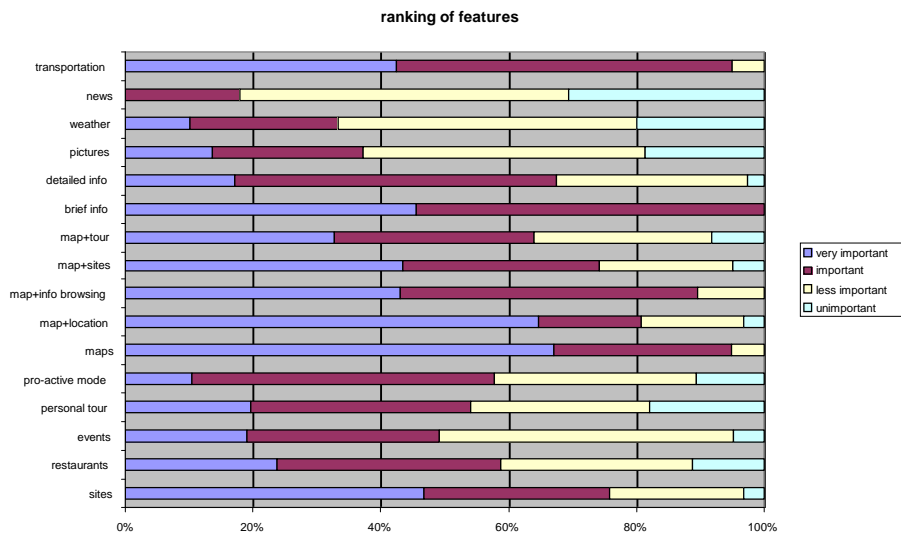
## 4 In search of the crucial application

### 4.1 Tourist information needs

Information needs differ for the planning vs. the travelling situation. For instance, hotels are usually looked up (and booked) before travelling (~ 90%). Sights to visit at a destination are looked up before travelling and also while on tour (> 70%, resp. >60%). The interest in events that might be available at a destination during the intended period of time is also rather high (both >60%) .

The most interesting finding, however, is that transportation ranks very high both when planning a tour and while travelling (~75%, ~60%). Transportation was also considered a very important aspect of a destination (a mean rank of “important”). This does probably not mean that people are interested in transportation but rather that transportation is very often a problem.

The sources from which people get this information are various: most people in our sample (93%) use the WWW for planning. This was to be expected of highly computer-literate people. While on tour, the WWW is currently not very important (~25%), the reason probably being that mobile access to the Web is still limited. We found it remarkable, however, that the same people in addition to using the WWW also buy books (68%) and use maps on paper (~55%). We conclude that for the near future various sources of information for travelling people will continue to co-exist.



## 4.2 Ranking of mobile tourist services

Finally we asked for the importance of several features that would be supplied by a mobile tourism service such as CRUMPET.

Information about transportation again ranges very high, and opinions do not diverge much in this point. From interviews we learned that people hope for transportation information being frequently updated, reliable and personalized. From a content provider’s point of view this is rather a challenge, unfortunately. Maps also range

very high, and even more so when enhanced by highlighting the current position of the user, a tour, or sites of interest.

All in all, location-based services and transportation information would certainly be crucial applications for a mobile tourism support that have the potential to most clearly demonstrate the added value of mobile support compared to existing media.

### **4.3 Overall assessment of CRUMPET**

In the end, we wanted to know whether the users see the added benefits in a CRUMPET system and whether they would be prepared to pay something for this service. The rather high percentage of people who clearly see the added value of a system like CRUMPET is very encouraging. It is also good to see how many of these are in principle willing to pay for the service. Considering that the many services in the WWW are usually for free, this was not a save bet.

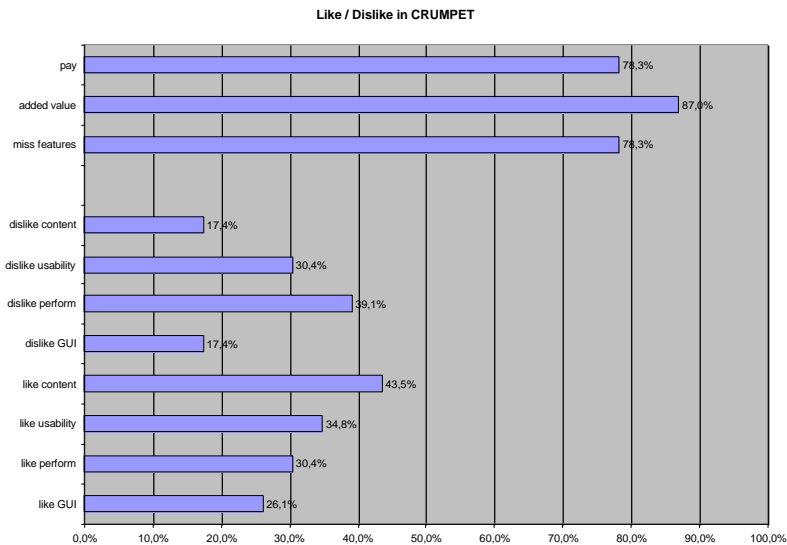
Open questions and a few interviews gave a first idea of which modes of payment would be acceptable for users. We noticed a preference for pre-paid or subscription modes, but this would need further investigation.

The one point about “did you miss features in CRUMPET” might indicate a negative view on the CRUMPET service. Indeed, a mobile tourism service should include more service types than have been realized in CRUMPET. On the other hand, when users ask for more features, the concept is corroborated: users have developed an appetite.

The interpretation of the likes and dislikes is difficult; most dislikes in an aspect are counterbalanced by a higher percentage of users who especially liked this same aspect in the system, but for “performance”, which seems to be a weaker point in the system. Still, opinions are diverging. We will get more clues from the analysis of the SUMI questionnaires, which is not yet completed.

We have also tested all preferences for correlation with demographic data, such as gender, age, or travel frequency. There seems a slight tendency that male users would more easily see the added value of the system; there seems a tendency that people who travel more are more ready to see the added value and also to pay for such a service. Overall, correlations of gender or age with other variables were usually rather low. In other words, within our rather homogeneous sample, these variables played no significant role in determining the other variables.





## 5 Conclusions and Future Work

It is by personal experience only that users get a feeling for innovative technologies and become more explicit and confident in what their needs and requirements are. The CRUMPET system has been acknowledged by users for its simplicity of use and for its focus on location-based services. It was very encouraging that a high percentage of the test users saw the added benefit of the system compared to other available information sources, and that a rather high percentage of users would also be willing to pay for such services. The paying modes acceptable for users need further investigation.

But there is still a way to go before a CRUMPET system could become a marketable product. The most important improvements of CRUMPET in future implementations would be to include more service types, especially such as related to transportation, events and restaurants, a good search function, as well as improved map rendering and interaction.

For mobile tourism service in general the importance of added value by location-awareness has been confirmed, also the importance to provide interactive maps.

Essential applications would be content about local transportation (especially when personalized and reliably updated), background information about local sites (in a choice of granularity) and advanced LBS services.

Several usability issues still need further research, which is already subject to several ongoing research work in HCI, see for instance (Schmidt-Belz and Cheverst 2002). Among them the adequate use of personalisation, the individual preferences in visualization of tours and directions given, and more advanced interaction modes.

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## References

- Kirakowski, J. (2002). "SUMI - Software Usability Measurement Inventory."
- Kölmel, B., and Wirsing, M. (2002). "Nutzererwartungen an Location Based Services - Ergebnisse einer empirischen Analyse." *Geoinformation mobil*, A. Zipf and J. Strobl, eds., Huethig Verlag, Heidelberg.
- Oertel, B., Steinmüller, K., and Kuom, M. "Mobile Multimedia Services for Tourism." *ENTER 2002*, Innsbruck.
- Poslad, S., Laamanen, H., Malaka, R., Nick, A., Buckle, P., and Zipf, A. "CRUMPET: Creation of User-friendly Mobile Services Personalised for Tourism." *3G 2001*, London.
- Schmidt-Belz, B., and Cheverst, K. (2002). "HCI in Mobile Tourism Support." GMD.
- Schmidt-Belz, B., Makelainen, M., Nick, A., and Poslad, S. "Intelligent Brokering of Tourism Services for Mobile Users." *ENTER 2002*, Innsbruck.
- Short, M. (2000). "My generation. Third generation wireless mobile communication." *Electronics and communication engineering Journal*, 12(3), 119-122.
- Zipf, A. "User-Adaptive Maps for Location-Based Services (LBS) for Tourism." *ENTER 2002*, Innsbruck, Austria, 329-338.