

SPATIAL NARRATIVES FROM MOBILE GIS - the case of H.C.Andersen in Copenhagen

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Abstract. Principles of a mobile gps-enabled gis acting as a tourist information system are discussed and exemplified with special focus on the narrative aspects of tourist guidance. Flexible adaptation to user movements is accomplished by providing information about objects that the user passes as well as site-specific 'narrative links' to new locations that the user may choose to visit. The strategy is expected to enable an enhanced travel experience for someone heading for a specific destination while still provide the basis for 'explorative detours'. The principles are illustrated through a case-study of H.C. Andersen's residences in Copenhagen

1 Introduction

This paper examines the potentials of a gps-enabled gis acting as a mobile tourist information system with special focus on the narrative (or story-telling) aspects of tourist guidance. The rapidly expanding use of palmtop computers and portable dedicated systems for in-car mobile navigation raises the issue of further utilization of their gis-core for providing information about the area surrounding the travel path. A gps-enabled mobile gis could present stored attribute information about nearby objects, according to specified user preferences and interests, be it for architecture, historic landmarks or birth places of famous writers. The attribute information in question could range from simple building age attributes from a gis building layer to actual tourist informations systems based on sets of objects selected to suit tourist segments with specific preferences or backgrounds.

The actual means of communicating the information would need to reflect the situation of the traveller; Car drivers may prefer sound messages, while a person on bicycle or walking has better opportunities for stopping and reading any text og images displayed by the system.

A central issue in this context is whether the system should guide the user along specific pre-defined routes that enables a desirable sequence of visits to selected land marks. This is similar to the traditional tour suggestion maps in guide books. Or whether the user should 'guide' the system by making route decisions independent of the information system. This will require a system that presents relevant information about any object that the user happens to pass. The underlying assumption behind the

work described in this paper is the belief that mobile information systems should most of all be flexible and respond cleverly to any travel path taken by the user who may be traveling through an area for some other specific purpose.

The results presented in the paper focus specifically on how a system may respond in a flexible way to the de-facto travel path taken by the traveller while still - through the use of so-called narrative links - being able to provide suggestions for new locations to visit as a relevant continuation of the information obtained at the current location, (see fig. 1). This can be seen as a hybrid of the two extremes mentioned above that would enable an enhanced travel experience for someone heading for a specific destination while still provide the basis for 'explorative detours' if the user so desires.

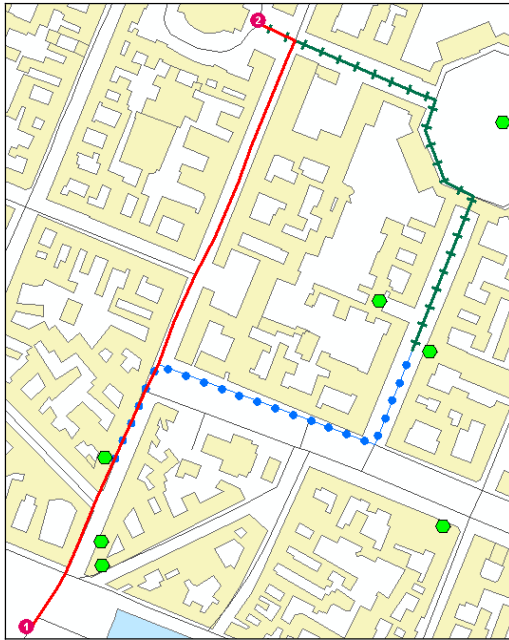


Fig. 1. Solid path from (1) to (2) indicates a planned travel route, path with circle symbol indicates a narrative link received when passing an object and path with hash symbol indicates subsequent route towards destination (possibly provided by the standard navigation functionality)

2 Background

The work presented here builds upon a prototype gps/gis-based software system described by Møller-Jensen [9]. This paper addresses the problems of scope of information relevance as well as how the presentation of information is constrained by the speed and direction of the user. Being able to match the timing of the information with the spatial scope of the information relevance while moving is seen as an important aspect of such systems. Relatively few papers have described efforts to further

utilize the potential ability of the mobile GIS to provide elaborate attribute information about any object that a user interacts with while moving around. Jiang & Yao [5] provide an overview of definitions, concepts and applications prospects related to location-based services within a GIS-context. Frank et. al. [3] describes a transformation of the traditional GIS into a Location Based Service by providing mobility, distributiveness and egocentric awareness. The general problem of selecting the physical object for which to receive information in a given spatial context (equal to the human action of pointing) has been examined by Egenhofer [1]. IST [4] describes how GPS-enabled city guides are already used in the travel industry and argues that especially the “culture and history travel market” will be able to benefit from a strategy towards location-sensitive presentation of object information. Liu & Karimi [8] present algorithms for predicting the expected future travel path of a user from the current location based on long-term and short-term historical trajectory datasets.

Møller-Jensen & Hansen [10] addresses the issue of visible versus invisible physical objects surrounding the travel path and argues that the gps-supported information systems may be specifically well suited to provide the traveller with historical information related to objects that are presently either removed or do not visually indicate that it is of any interest. It is worth comparing the concept of visibly interesting objects for tourist information with the concept of salience of features applied by f.ex. Klippel & Winter [6] and Nothegger et al. [11] within the context of automatic identification of landmarks for providing navigation support. One difference is the need for the navigation support algorithm to find objects on-the-fly that – for some reason - “stand out” relative to their close surroundings, while the objects represented in the tourist information system would be a priori classified as of absolute interest within a specific domain.

The technical implementation of the current prototype is not designed to take advantage of the high suitability for transportation that characterises the palmtop-computers. The prototype is based on ArcMap from ESRI and runs on a standard laptop computer equipped with a gps. Implementation on a PDA-pocket-PC platform should not present any major technical problems. Future consideration may also involve data handling - whether data should be pre-stored on the device or could be transferred real-time based on the GPRS technology or future wide area wireless ADSL, as discussed by Kwan & Shi [7].

Traditional guided tours or excursions have certain distinct properties: The travel course is normally pre-determined to optimize the contact with interesting sites. This can be in terms of 'sites per hour', 'order or presentation' etc. Moreover, the information passed on to the participants is optimized to fit the actual time frame available. Information may be presented several minutes prior to the actual physical contact in order to introduce the object, build up expectations and in some cases compensate for the fact that the time window for actual contact may - for practical reasons - be much smaller than what is required to provide adequate information.

On the other hand, the user may not be prepared to submit to the time and distance constraints set by a pre-defined tourist route. The user may travel for other purposes than sight-seeing, maybe following a 'quickest route' set out by the routing functionality of the gps unit. He or she is interested in attribute information about the surroundings to enhance the travel experience while moving towards the destination. A system that adapts completely to any user movements may, however, be incapable of provid-

ing adequate information about an area simply because the path of the user may - unrealized by the user - not pass by the sites that are of most interest.

3 The concept of narrative links

Narrative links are suggested here as a compromise between the two strategies. These are simple location pointers stored in the attribute table of an object layer that indicate other locations that are within the same information domain and could optionally be visited by the user subsequently. They can be seen as a kind of spatial hyperlinks.

A set of narrative links are presented to the user when he or she passes one of the objects represented in the system, either by chance or by being directed there by a previous narrative link.

The idea is that fragments of a spatial narrative - or in other words a story related to the surroundings - could be created by following these links if the user decides so. The advantages are that this pursuit of further information by altering the route should be optional to the traveller. The narrative links are selectable according to user preferences. Alternatively, the system will continue to provide information related to the original route.

The experimental system described in this paper implements several types of spatial references or pointers that can be used as narrative links. The key parameters are themes, distance (nearness) and chronology. A pointer is based on either nearness or chronology within the context of a specific theme. The themes are the result of a classification of spatial objects into categories that reflect specific interests of the traveller or an otherwise desirable grouping of objects with common properties. Any object may fall into several themes; a building f.ex. may be both architecturally interesting and the birth place of a historic person.

Let us assume that the user is passing by an object that is represented with attribute information in the system. The following strategies for suggesting the next object to head for are applied by the system: The first step is to establish the relevant theme or set of themes to follow and the basis for this is the themes associated with the object at the current location. The user may a priori narrow the set of interesting themes down to a few or alternatively decide on the spot which theme to follow (if more than one is registered) - given that the user wants to take an explorative de-tour. Having selected a specific theme, the suggestions of the system may be based on chronology (if the necessary sequencing data exists) or on nearness. In the first case, the suggestion could be either next or previous in the chronological sequence or it could be the first objects in the sequence. In the latter case, the suggestion would be the nearest object that is a member of the theme in question and that has not previously been visited.

This general description is exemplified below by a case related to the writer H.C.Andersens life in Copenhagen. Stated in more informal terms, this linking process could express some of the following daily life guiding sentences (assuming that the user has just passed a former house of residence):

- *if you want to see where he also lived, there is another house of residence just around the corner (theme/nearness).*
- *if you want to see where he lived when he arrived in Copenhagen, take this route to ... (theme/chronology/start)*
- *if you want to see where he lived just before/after this place, take this route to ... (theme/chronology/previous or next)*

It is practical that the system does not direct the user towards objects that the user has already visited the same day - also to avoid going into a loop by pointing back and forth from the same two objects. It is therefore necessary for the system to maintain a log of visited objects. Moreover, the system needs access to the least-cost route between all objects and not just the closest which may already have been visited. These routes may be pre-identified and stored, but it seems more reasonable to compute them on the fly, if navigation functionality is also present on the system.

4 The case of H.C. Andersen in Copenhagen 1819-1875

This particular case is appropriate to illustrate the potential behavior of narrative links for several reasons: The number of relevant sites within a relatively small area is high. The sites can be categorized into several themes reflecting different aspects of the writer's life in Copenhagen. Moreover, there is a wealth of detailed sources to the specific history related to each location and - also due to the 200 years birthday in 2005 - several map books suggesting H.C. Andersen tours through Copenhagen. The proposed system is assumed to be used by a visitor with a higher than average interest in the life of H.C. Andersen and possibly with preferences for specific aspects of it.

A reference map has been established that indicates the location of more than 50 sites within central Copenhagen. Each site has been classified into one or more of the following themes or categories:

- Arrival in Copenhagen 1819
- Residences
- Friends and Supporters
- Cultural institutions
- Young H.C. Andersen
- Old H.C. Andersen
- Places of inspiration for fairy tales

Fig. 2 shows the location of the total set of sites, except for a few that are not in central Copenhagen. Two themes have been selected from the total set for further illustration: 1) the places of residence and 2) sites related to the friends and supporters.

As previously discussed, the order of the visits to the residences may reflect either the ease of access (nearness) relative the current location of the visitor or the chronology of H.C. Andersen's occupancy of the locations. The latter strategy may provide an experience of following H.C. Andersen through the phases of his life.

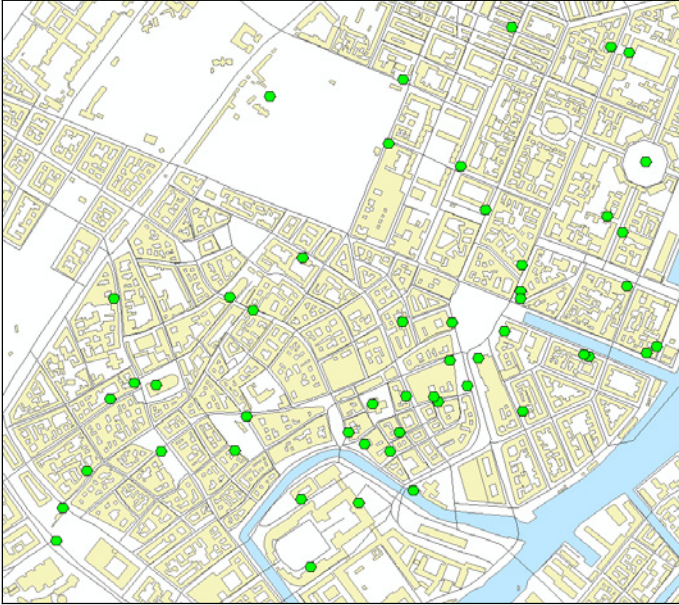


Fig. 2. Map of Central Copenhagen. Points indicate sites that are related to the daily life of H.C. Andersen

The friends and supporters are in many cases famous in a Danish context themselves being co-responsible for the 'golden age' label attached to the first half of the 19. Century. Others are primarily known due to their relation with H.C. Andersen. Getting to know where these persons lived in Copenhagen provides an understanding of the daily trips and whereabouts of H.C. Andersen.

Although some of the people in this category are associated with the writer within a specific time frame, the span of years is usually so long that it is of limited relevance to focus on chronology in this case. Some could be assigned to a 'young Andersen' category while others to a 'old Andersen' category, but it is assumed here that sites falling within this theme can be visited in any order without much loss of narrative aspects.

The important process of identifying zones of information relevance is not elaborated in this case study. As described in Møller-Jensen & Hansen [10] these may be based on buffer zones around each object or on a more sophisticated visibility analysis. These zones play an important role in determining the selection and timing of the attribute presentation. For further elaboration of this issue please refer to Møller-Jensen [8].

Fig. 3 illustrates the computation of least-cost routes between all sites falling within one or both of the categories through the use of the network analyst functionality of ArcMap [2]. The length of each route (through the road network) is stored in an origin-destination matrix. This allows the system to suggest the nearest object that has not already been visited for further exploration.

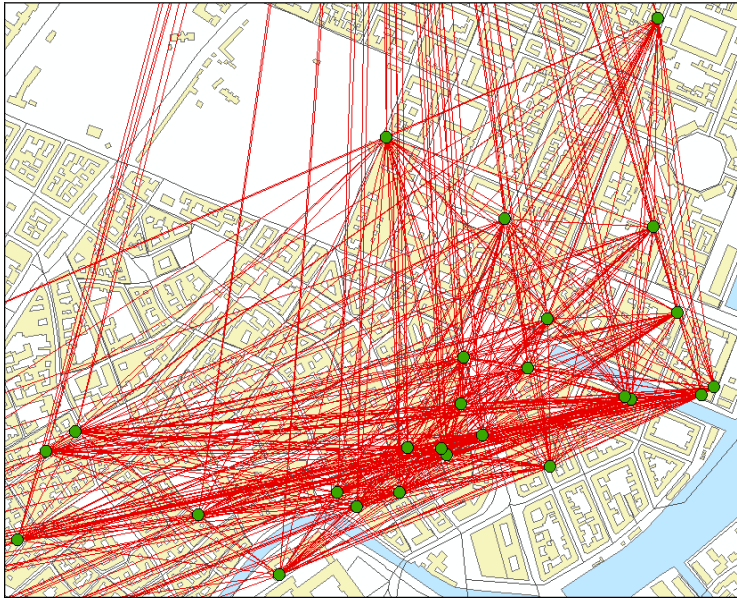


Fig. 3. Network distances between all objects are computed and stored in an OD-matrix

The example presented below shows some preliminary results from on-going experiments with the prototype version and the H.C.Andersen case. Fig. 4 and 5 illustrate the following situation:

Visitor V has initially indicated an interest in the residences of both H.C. Andersen and people associated with him in Copenhagen. By chance, V passes by the former residence of H.C. Andersen in Nyhavn 20. Information is now presented to V as illustrated in fig. 4. The actual place of the information dissemination depends on several parameters including the speed of V. V may subsequently choose to continue towards his initial goal or to examine related sites.

As relevant next visits the system suggests the following, based on the stored narrative links:

- Since H.C. Andersen stayed in Nyhavn 20 many years after his first arrival in Copenhagen, V may choose to examine this thread in-depth, by traveling to the very first residence in Vestergade 18, see fig. 5(a). Using the chronology approach, V may subsequently be directed from the first residence to the second, if this has not already been visited.

- Since Nyhavn 20 is close to other residences in Nyhavn 18 and Nyhavn 67 where H.C. Andersen stayed for more than 15 years, it would only take a few moments for V to see one of these places also, see fig. 5(b).

- Since V is also interested in the Friends and Supporters, V may choose to visit the nearby former residence of his primary supporter and farther figure Jonas Collin, which is within a short distance, see figure 5(c).

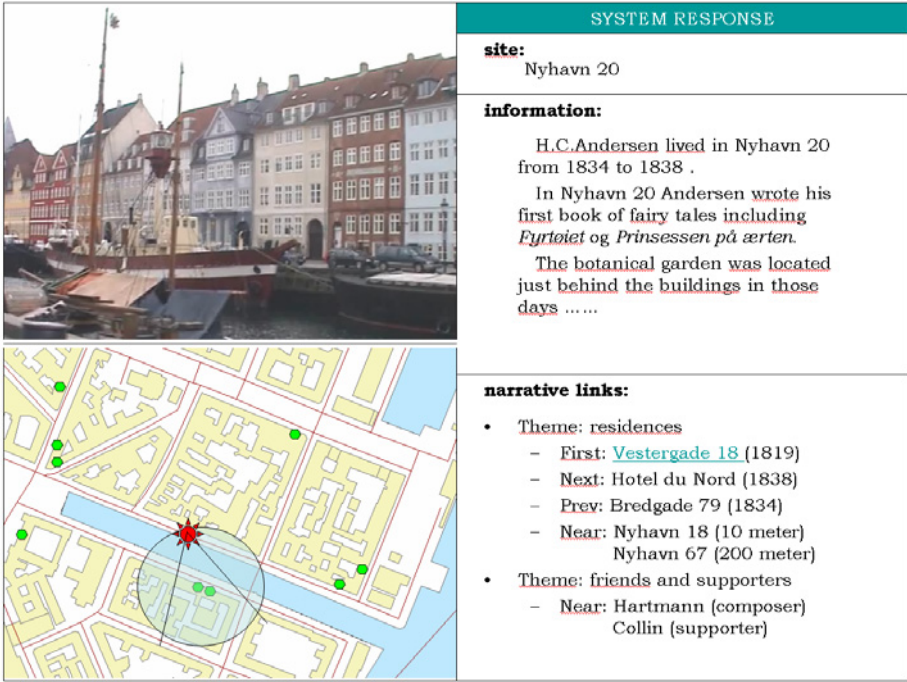


Fig. 4. Left part: User’s location in Nyhavn (indicated by sun symbol). Right part: Information and narrative links related to the site Nyhavn 20. Circle indicates zone of information relevance.



Fig. 5. Shortest routes towards the objects suggested by the narrative links at Nyhavn 20: (a) first residence after arrival, (b) nearby place of residence and (c) former residence of supporter Jonas Collin.

5 Conclusion

The general objective of the described approach is to enable a flexible adaptation to user movements while still provide the basis for suggestions by the system that may help the user to experience a more ‘complete picture’ compared to a random route selection.

The narrative links do not involve any specific optimization concerning the overall direction of movement or for visiting most sites per travelled kilometer. This would be potential features of planned guided tours. With the current implementation, there is therefore a risk that the user will experience some back and forth movements, if he or she chooses to follow the links chronologically. This may be seen as a natural consequence of the desire to experience sites in a sequence that enhances the understanding of f.ex. a historical process.

The alternative, expressed as “I might as well see this also, now I am in the area” is somewhat supported through the narrative links pointing towards nearby objects, but only if these objects are within the selected categories. There is clearly a trade-off process taking place: in some cases, it would make sense to visit all sites within an area before moving on - even if they belong to different narratives. This may be the case if the most suitable object is far away compared other sites within a short distance or if the user has a limited travel ability.

If focusing on a system that suggests interesting de-tours within the context of navigating a user from one point to another, it may be worthwhile to consider implementation of a direction awareness, so that the links presented to the user are selected so that any de-tour taken still brings the user closer to the target.

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