Tourists' Dynamic Needs and Affects in Personalised Travel Route Recommendations

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Abstract. The FP7 project cSpace unites the notion of augmented reality, micro-projection technology, near real-time 3D-video reconstruction and cultural tourism into a single experience that aims to unleash users' inventiveness and creativity. The goal of "smart cultural routing" within cSpace is to enrich tourists' experience by offering them very personalised travel route recommendations tailored to their dynamic user profiles. In particular, a special attention in the suggested approach is paid to changes to a tourist's dynamic needs and affects. As a result, the tourist's experience from visitation can be enriched by means of fine-tuning the route's program, schedule and routing, according to this tourist's individual dynamic requirements and affective state.

Keywords: Affective Computing, Recommender Systems, Tourism, User Preferences.

1 Motivation

The proliferation of smartphones/tablets and the mobile internet have made it easier to reach, share and exchange the vast amounts of information that are generated daily. On the other hand, in order to benefit from this information, a more sophisticated filtering approach is required that would yet better suit tourists' preferences in terms of what they want to visit, in which sequence, with which pace, for how long, and so on. A visiting plan for such a touristic route requires specification of activities on three levels: program (what to visit), schedule (in what sequence), and routing (which transport modes and routes to use for travelling between locations). One of the ideas the recently started FP7 project cSpace[1] rests on is to offer users an opportunity to utilise recent technological advancements in order to stimulate their creativity and increase their cultural touristic experience. The aim of the "smart cultural routing" sub-project within cSpace is to develop a recommender system that will generate advice that fits the tourist's profile on each of the three levels mentioned above.

Recent examples of daily travel recommendations, such as in iTour[2], have provided solutions that suggest different forms of transportation (i.e. routing) to users based on

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[1] http://c-spaceproject.eu
[2] http://www.itourproject.com

their preferences and real-time information about various travel-related details such as the road, traffic, and weather conditions.

The support of activity programming and scheduling requires combining heterogeneous personal interests, preferences and constraints within an additional tourism-related level that may often be dynamic and affect-driven. Emotions are fundamental to largely any kind of user experience, so that understanding the influence of emotions on user preferences and decision making is important. So far, researchers have already demonstrated how the knowledge about emotions can be included into the recommendation process elsewhere – from recommending movies [1], to choosing a more satisfying learning activity [4], to including emotions into a recommender system in general [5]. Examples of the most recent results in the field (e.g., [6]) clearly indicate that interpreting an individual's emotions remains a topic in research on recommender systems that is still in its infancy. Therefore, in order to enhance tourists' experience from visitation, we plan to include a tourist's affective state and motivational considerations into the tourist's dynamic user profile. And a tourist's individual dynamic needs, preferences and affective state will then be used all together in recommending the most suitable tour in terms of program, schedule and travel options.

2   Approach

The overall aim of the smart routing system is to offer the best possible experience to tourists under the given dynamic constraints and needs. Reflecting on this dynamics involves several considerations to be taken on a tourist's individual level, as follows.

Tourists may differ in terms of the type of advice requested, ranging from having specific interests and initial ideas to having no pre-defined preferences. They may also seek for varying types of cultural experience, have different amounts of time and money, use different approaches to trade-off travel costs against the value of experiences, and so on. A tourist's user profile defined as a set of personal interests, preferences and constraints thus determines to an important extent how a particular cultural route for the day is experienced and evaluated. We arrange all information in the user profile into four categories: *long-term*, *mid-term*, *short-term*, and *ultra-short-term* information (see Table 1). As their names suggest, the categories obey a time-frame criterion, so that each category relates to a different time interval and thus represents a measure of dynamicity of the parameters it contains.

There is a separate dimension within Table 1's ultra-short-term category – *emotion E*. Utilising information about a tourist's current emotions and needs in generating advice on which activities are the most suitable is expected to stimulate this tourist's involvement and to contribute to the overall cultural touristic experience. Therefore we want to consider tourists' motivational and emotional states and situational dynamic preferences, and plan to take the results of this analysis into account when generating a trip suggestion. The following challenges are pursued:

— Which dimensions of emotions and basic needs can be distinguished and are relevant for cultural touristic experiences?

─ How do particular activities, trips and environments influence affective states and, vice versa, how do emotions/needs influence preferences?

Table 1. Categories of a tourist's dynamic user profile.

Long-term (static)	- Demographics: age, gender, occupation, … - Mobility (M): vehicle types, driver licences, public transport cards, … - State profile: interests (I), needs (N), health-fitness-disabilities (F), …
Mid-term (trip)	- Mobility (M), State profile (I, N, F) - Accompanying persons (Y): number, relations, profiles (long-term), … - Available budget (B): time (trip length), money (rough indication), … - Program (P): wish list of things to do during trip
Short-term (day)	- History (H) - Mobility (M), State profile (I, N, F), Accompanying persons (Y) - Available budget (B): for the day - Program (P_v): **sites visited**; Program (P_w): wish list **for the day** - Route plan (R): program, schedule, travel routes, …
Ultra-short-term (moment)	- History (H), Mobility (M), Accompanying persons (Y), **updated** - Available budget (B): **remaining** for the day - State profile: I (**updated**), N (**updated**), **emotion E** - Route plan (R), **updated** - **Position: coord XY, current activity (position in route plan), …**

Potentially, the number of (combinations of) dimensions to be considered can be large. In order to identify the more important and relevant ones, we need to study and measure tourists' preferences under given conditions, and to further investigate the influence their emotions may have on the measured preferences. Although the study and modelling of consumers' preferences and choice behaviour has a long history in consumer, transportation and tourism research, the influence of emotions and needs on (dynamic) preferences for choice options has not received much attention. Recent results suggest that it is possible to model the relationships between perceived utilities of choice options and activated needs based on the concept of dynamic mental representations [2]. These mental representations underlying evaluations of choice options can be modelled as a causal network between decision options and needs (Fig. 1).
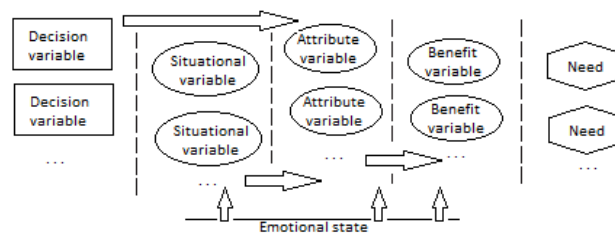

Fig. 1. Causal network and emotional layer in an integrated model of choice behaviour.

Such a model provides an integrated representation of the (dynamic) needs and preferences for choice options based on well-established cognitive and utility-based theo-

ries of choice behaviour. Dellaert et al. [3] argue that the approach has great potential for understanding tourism choice behaviour, so we plan to include a tourist's emotional state as an extra layer in the causal network and to apply the model to the case of our smart routing system.

3 Current State and Outlook

A preliminary survey of the potential of offering tourists the type of assistance the smart routing system intends to, conducted in Bologna, Italy revealed peoples' interest in using this kind of blending of technology and personalisation. Within the scope of cSpace, emotional information will be gathered from a number of sources, such as facial images and bio-signals, as well as by considering relevant context information. We are currently researching on the most appropriate emotion vocabularies that can be incorporated into the user profiles this way, in accordance with W3C's EmotionML specification (http://www.w3.org/TR/emotionml/) for describing the emotional state. Another primary direction of our ongoing work focuses on the inclusion of the affective state into the dynamic preferences and needs measurement phase, in accordance with the dynamic mental representations model. By doing so, we will be able to incorporate dynamic needs, preferences and emotions of a tourist into the recommendation process of selecting the most suitable and personally relevant program, schedule and route for the tour.

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