How does topography influence the use of the mobile guide WebPark^{SNP} in the Swiss National Park?

Antonia Eisenhut, Ruedi Haller, Jonathan Raper

Abstract — Since 2005, the Swiss National Park offers a mobile information system called WebPark^{SNP} which provides content about the users surroundings using smart phone services and GPS. Up to now, little is known about the use of Location Based Services (LBS) by visitors of remote and protected areas and about the contents they are interested in. WebPark^{SNP} logs time, location and content of each action the user conducts. Contents are not only pushed but can be accessed from every location. With the consent of 419 users, WebPark^{SNP}'s log files of the summer season 2007 have been analysed in order to compare the user's actions with the topography of the Park. Topography is composed of specific places (vegetation classes, aspect, and slope of the trail), facilities (resting areas, huts) and viewpoints. The results show that clustering of access occurs on steeper slopes, within facilities, and on viewpoints on certain routes. The content accessed differs between facilities and other places. Nevertheless, these patterns are not only determined by topography but also by behavioural aspects; the use of the guide depends on the daytime and on the distance from the starting point of the walk as well. These results allow the evaluation and improvement of LBS concerning content and locations. In addition, conclusions can be drawn about the development and improvement of other offers in the Park. Further analysis and the integration of other visitor surveys like census and questionnaires will show the potential for more general insights into visitor behaviour in protected areas.

Index Terms — Location based services, Swiss National Park, Visitor management, Visitor monitoring

1 Introduction

WebParkSNP has been developed during the European Union research project "WebPark – Geographically relevant information for mobile users in protected areas" (2001-2004) [1]. It is a Location Based Service (LBS) application known as mobile guide according to Raper et al. [2] providing broad information about the Swiss National Park. Additionally to more than 400 Points of interest (POI), WebParkSNP offers different search functions like the location-based "what's around me" or the search by terms functions, interactive maps and self-updating elevation profiles indicating the user's position and calculating time and distance to the end of the hike, keys for flowers, birds, butterflies and grasshoppers, a bookmark function, a wildfire nature trail and further content [3].

Since 2005, the WebPark^{SNP} mobile guide is installed on PDAs and can be rented in the National Park's Information Centre. The actions taken by the users have been written anonymously to log files, which allow the analysis of the user's requests and the extraction of most visited sites, all fields with a high research need [4]. This paper aims to give a first overview of how user behaviour relates to the topography of the Swiss National hik-

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ing trail network, on the facilities on offer and on the distance to the start point of the hike.

2 Methods

2.1 Study area

The Swiss National Park (SNP) occupies an area of 170 km^2 between the Müstair Valley and the Engadine at the Eastern edge of Switzerland. Classified as IUCN level 1 [5], visitors are only allowed to enter the Park on 21 marked hiking trails of alpine and high alpine character with a total length of 80 km.

2.2 Data logging and analysis

Each action that a user performed (n actions = 78'348) on a device during the summer season 2007 was logged and written in a text file. The coded values were then written into a database and analysed with ArcGIS and SPSS.

Specific places are defined by the vegetation class, the aspect and the slope of the hiking trail. A digital elevation model (4m resolution) was used to extract aspect and slope. Vegetation classes were derived from the HABITALP-Project [6]. National Park facilities include junctions, huts, parking lots, resting areas and the information centre. Viewpoints include the official viewpoints as indicated in the park's map and other points which have been defined as viewpoints with the park rangers.

In order to compare the user's actions with the trail network of the park, a reference file has been created, containing one hypothetical action each 20m along the trail network showing the expected conditions of the hiking trail network. In the following, equ will refer to this reference file (Fig. 2, Fig. 3 and Fig. 4)

3 Results

3.1 General distribution

WebPark^{SNP} has been rented 419 times between June and November 2007. Fig. 1 shows the diurnal distribution of the recorded actions. The most popular time of use was the hour before noon (mean 11:21).

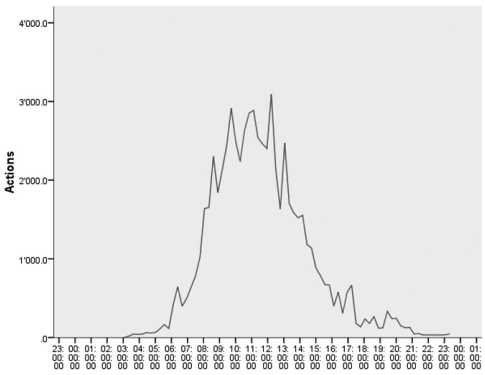

Fig. 1. Diurnal distribution of the actions during summer season 2007.

The 21 trails in the SNP differ concerning length, difficulty and topographic factors. The most popular trails (Fig. 2) for the use of WebPark^{SNP} are Margunet (17), Chamanna Cluozza (7), Murter (8) and Val Trupchun (1).

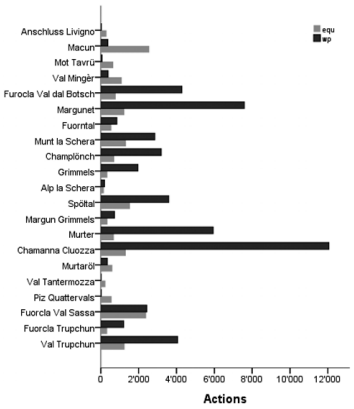

Fig. 2. Comparison of the actions performed (wp) and the expected conditions (equ – one hypothetical action each 20m).

3.2 Specific places

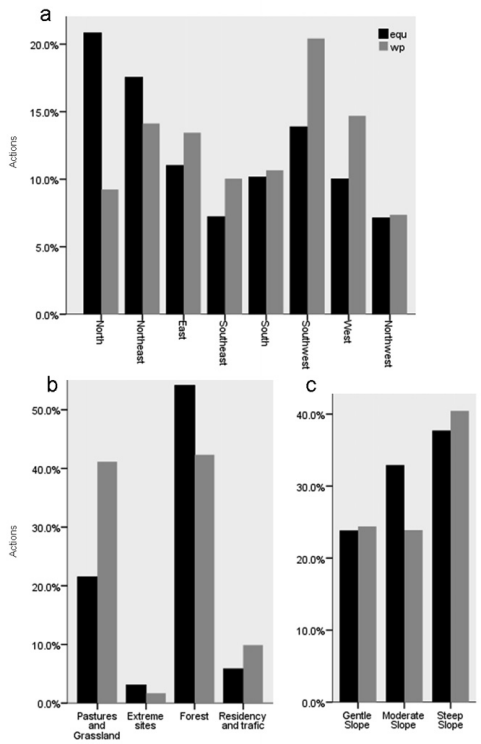

Fig. 3. Frequency analysis of a.) aspect, b.) vegetation classes and c.) slope of routes 1, 7, 8 and 17 (equ: expected conditions with a hypothetical action each 20m; wp: actions performed).

Topographic factors like aspect, vegetation class and slope have a considerable influence on the use of WebPark^{SNP} in the field (Fig. 3). Since topographic factors are distinctive between trails, only the most popular routes (see 4.1) are included in order to avoid information overload.

The user clearly prefers the southern and western aspects to the northern ones, despite the fact that they are less numerous (Fig. 3a).

54.1% of the chosen trails run in the forest, whereas only 42.3% of the actions were realised between trees. On the other hand, pastures and grassland are present on 21.5% of the trails where 41.1% of the actions were realised (Fig. 3b).

Concerning the influence of slope, the user prefers to use the device either in nearly flat (< 2.33°; 24.4%) or steep terrain (> 5.12°; 40.45%); moderate slope is relatively under represented (Fig. 3c).

3.3 Facilities and viewpoints

The use of WebPark^{SNP} depends as well upon human created infrastructure and perception of the landscape (Fig. 4). 96.1% of all the trails are not part of a park facility (i.e. trail forks, parking, resting areas, huts), but 30.5% of all the logged actions were realized around these facilities (Fig. 4a). The viewpoints show a similar pattern: Only 3.5% of the trail net has been defined as viewpoints, on which 8% of all the logged actions have been realized (Fig. 4b).

It is remarkable that specifically location based information (e.g. the wildfire nature trail), is not only accessed at the corresponding point on the path, but also within other park facilities.

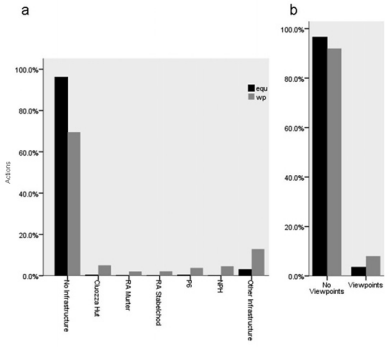

Fig. 4: Frequency analysis of a.) the facilities (with RA = Resting Area, P = Parking and NPH = National Park House) and b.) Viewpoints (equ: expected conditions with a hypothetical action each 20m; wp: actions performed).

3.4 Distance

Not only topographical and infrastructural factors influence the user behaviour, but also the distance from the starting point. Along Margunet trail, a sub-sample of 30 individual logs was analysed (Fig. 5).

Since all these users moved in the same direction, a clear pattern can be seen: The use of the device is less attractive towards the end of the hike.

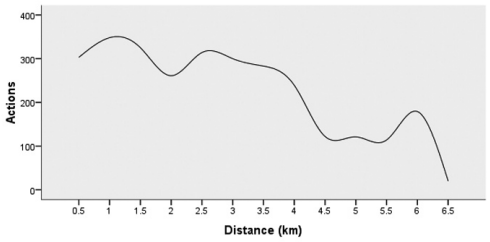

Fig. 5: Number of actions at places along Margunet trail, measured in km from the starting point (Parking 9).

3.5 Accessed content

Content differs depending on the place the action is realized. As shown in Table 1, the difference between facility and non-facility access is striking: At facility locations, where people sit down to rest, map functions play a less significant role. Away from such places, almost 50% of the logged actions are related to the map.

TABLE 1

CONTENT ACCESSED AT PARK FACILITIES AND OTHER PLACES

Content	Park facilities	Other Places
Main Page	17.44%	13.46%
Show Map (from Main Page)	3.30%	5.71%
Route Information	4.64%	5.23%
Route vertical Profile	4.25%	5.03%
Route Map	5.52%	8.44%
Around me	8.63%	10.58%
Get Map IFOI List	9.26%	13.35%
Get Top 20	7.03%	6.23%
Content: Vegetation	4.42%	3.40%
Content: Birds	3.35%	1.90%
Content: IFOI	6.87%	6.70%
Bookmarks	3.57%	3.12%
Others	21.70%	16.85%
Map Functions	**35.60%**	**48.34%**

Table 1: Content accessed at park facilities and other places. Grey shading marks map functions.

Content access is also related to the slope: The steeper the trails, the more the vertical profile has been checked and the more "What's around me"-searches were performed.

4 CONCLUSION

The 2007 log files of the WebPark^{SNP} application have shown that the use of a LBS in a protected area depends on the topography of the study area, the park facilities, the perception of landscape and the distance to the trail starting point. The user prefers the sunnier aspects to the shadow and is much more active above the tree line. Concerning the slope, the device is especially used in flat and steep trails, less in trail segments with a moderate slope. Even though facilities are limited in the SNP, the visitor welcomes it in order to consult the application; this is also valid for points with an especially beautiful view. During the hike, the number of logged actions decreases towards the end of the hike.

The content that is accessed differs between facilities where the user wants general information about the park and its habitants, and other places (i.e. regular trail sectors), where the user is more interested in his own position.

These results allow the improvement of existing LBS in protected areas by adapting the content to the topography and can be useful during the development of new applications. Further investigation will be needed to define the nature of places within the park more precisely, to learn about user preferences and about the adaptation of the content to these places.

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