

Requirements for future digital visitor flow management

Marcel Huettermann, Tatjana Thimm, Frank Hannich and Christine Bild

Abstract

Purpose – *The purpose of this paper is to examine visitor management in the German-Swiss border area of the Lake Constance region. Taking a customer perspective, it determines the requirements for an application with the ability to optimize personal mobility.*

Design/methodology/approach – *A quantitative study and a survey of focus groups were conducted to identify movement patterns of different types of visitors and their requirements concerning the development of a visitor management application.*

Findings – *Visitors want an application that provides real-time forecasts of issues such as traffic, parking and queues and, at the same time, enables them to create a personal activity schedule based on this information.*

Research limitations/implications – *Not every subsample reached a sufficient number of cases to yield representative results.*

Practical implications – *The results may lead to an optimization and management separation of mobility flows in the research area and be helpful to municipal planners, destination marketing organizations and visitors.*

Originality/value – *The German border cities of Konstanz, Radolfzell and Singen in the Lake Constance region need improved visitor management, mainly because of a high level of shopping tourism by Swiss visitors to Germany. In the Summer months, Lake Constance is also a popular destination for leisure tourists, which causes overtourism. For the first time, the results of this research presented here offer possible solutions, in particular by showing how a mobile application for visitors could defuse the situation.*

Keywords *Mobile application, Overtourism, Visitor flow management*

Paper type *Research paper*

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1. Introduction

Thailand's popular Maya Bay had to close down in 2018 due to the production of too much waste. In the Philippines, Boracay was closed to tourists for a six-month period to enable the island to recover and fix its sewage problem, while in Ibiza, more than 500 protestors took to the streets recently to show their discontent with the effects of overtourism (Walker, 2018). In 2015, the Äscher-Wildkirchli guesthouse in the Swiss mountains graced the cover of National Geographic and, as a result, it became a world-famous tourist destination. Two years later, due to overwhelming demand, it became very difficult to stay there (Büchel and Waser, 2018). Examples such as these show that overtourism is a worldwide problem and a highly topical phenomenon. In fact, the *Oxford Dictionary* chose "overtourism" as one of its words of the year in 2018 (Dickinson, 2018).

Richardson (2017) defined overtourism as relating to any destination suffering because of tourism. According to Borg *et al.* (1996), the term also refers to capacity, meaning the threshold in terms of tourism in any given location. Some measures have been developed to counteract overtourism, such as the management of tourist flows. In April 2018, for example, Venice installed temporary turnstiles to separate the visitors from local residents.

The research area is the Lake Constance region. Its unique location with the three neighboring countries of Germany, Austria and Switzerland all bordering one lake has made the region extremely popular with both international and domestic visitors. In addition to leisure tourism,

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exchange rate differences (and the ability to recover sales tax differences) have caused year-round shopping tourism to develop in the region. Due to the favorable exchange rate, many Swiss will cross the border to do their weekly shopping in the border cities of Konstanz, Singen or Radolfzell. Their location on the shores of Lake Constance has an effect on traffic infrastructure, which leads to congestion, especially in the high season in Summer, when the different streams of visitors coincide. Especially in Konstanz, overnight tourism is already being displaced by shopping tourism and there is increasing discontent among the population – a situation that definitely fits the definition of overtourism.

A study involving the collection, analysis and forecasting of data concerning the different visitor streams in the Lake Constance region, with the particular consideration of cross-border flow, can and should serve as a basis for measures to reduce the strain on the region's infrastructure and is, therefore, of great regional relevance.

To reach its goals, this paper benefits from the emergence of new information and communication technologies, advancing digitalization and the expansion of Wi-Fi infrastructure.

According to the “new mobilities paradigm” proposed by Sheller and Urry (2006), the new information and communication technologies are changing the mobility behavior; on the other hand, they offer new opportunities to direct, guide and manage people, events and activities.

2. Literature review

2.1 *Tourist mobility behavior, cross-border tourism*

The analysis of visitor flow belongs to the field of mobility research, which is of great importance not only in tourism research (Shoval and Isaacson, 2007) but also in other areas such as transportation, urban or regional planning and the design and marketing of tourist attractions (Lew and McKercher, 2006; Shoval and Isaacson, 2007).

In addition, the spatial mobility behavior of tourists can be used as an important tool of market segmentation. “Spatial tourism behaviour has been in the research agenda since last century and some researchers have pointed out its importance in market segmentation [...]” (Baggio and Scaglione, 2018, p. 2).

In order to better understand the complex and multifaceted concept of mobility, the concept is often subdivided into different categories (Bauder and Freytag, 2015; Groß and Menzel, 2016; Groß, 2017). Groß (2017) distinguished between informational, social and spatial mobility. Bauder and Freytag (Bauder and Freytag, 2015; Weber and Bauder, 2013) also divided the term into three categories, although they refer to the first category not as informational, but as virtual mobility. Groß and Menzel (2016) cited further approaches according to which mobility is subdivided into five categories. This includes the “new mobilities paradigm” with mobility aspects such as “physical travel,” “physical movement,” “imaginative travel,” “virtual travel” and “communicative travel” (Groß and Menzel, 2016).

Spatial mobility is defined as a change in location in physical space, meaning changing location from A to B (Groß, 2017; Weber and Bauder, 2013). Groß (2017) further divided spatial mobility into traffic mobility, lifestyle mobility and migration mobility.

The visitor flow analyzed in this paper belongs to the field of traffic mobility. Traffic mobility can be described as circular or horizontal mobility which first involves a change of location from A to B, but which, after the activities to be undertaken at B such as shopping, work or school, vacation and leisure are finished, is followed by a return back to A. Mobility is further subdivided into everyday and extraordinary mobility (Groß, 2017).

According to infas and DLR (2010), mobility is a complex structure of relationships, the essential characteristics of which, however, can be represented as characteristic values. Stock and Bernecker (2014) identified these values as purpose, distance/space, means of transportation, time and frequency. Further, the term mobility can be interpreted as an individual's preference for one particular path over another to go from A to B (Weber and Bauder, 2013).

When investigating everyday and extraordinary mobility, it should be noted that “the traditional spatial segregation of locals and tourists has thus increasingly blurred” (Kagermeier and Gronau, 2017). As Kagermeier and Gronau (2017) noted in commenting on Maitland (2008), participating in the ordinary life of a city and its inhabitants can be an important element of the tourist experience. Visitors welcome authentic experiences off the beaten track.

The boundaries between local residents and visitors, or between everyday life and tourist life, are becoming increasingly blurred. The reasons for this are “postmodern patterns of multi-local living,” and the segments visiting friends and relatives and meetings, incentive, conferences and events (Kagermeier and Gronau, 2017).

It should also be noted that shopping as an activity has changed in significance. “Doing the shopping” to buy provisions has turned into “going shopping” as a pastime, a hobby that expresses a certain way of life or lifestyle (Gerhard, 1998). This change in perception (i.e. the increased recreational character of shopping), which is also reflected by the term “experience shopping,” blurs the boundaries between everyday life and leisure time.

Likewise, the boundaries between everyday shopping and leisure shopping are difficult to draw because the question to what extent a purchase is perceived as a necessity of everyday life or as a leisure activity is subjective (Kagermeier, 2008). Fastenmeier *et al.* (2001) demonstrated that men and women have different perceptions of the recreational value of shopping. There are also differences depending on the type of purchase (shopping at the hardware store vs clothes shopping, for example). A clear and unambiguous distinction between shopping to buy provisions and shopping as an experience is therefore fraught with difficulties (Gerhard, 1998).

Cross-border shopping tourism plays an important role in the border region of Lake Constance. Leal *et al.* (2010) described the phenomenon of cross-border shopping as follows:

The differences in the taxation of the same good or service between neighboring countries, neighboring regions, or municipalities in the same country encourage consumers to travel to the jurisdiction where taxation is lower to acquire that good or service, as long as the tax saving compensates for the costs of traveling from one jurisdiction to another. (p. 136)

According to Widmann (2008), this form of tourism, meaning visits at regular intervals from across the border to benefit from better prices, cannot really be called shopping tourism. However, if this form of tourism is leisure-oriented and if it occurs less regularly than would be necessary to buy provisions, it can be called shopping tourism (Widmann, 2008). The concept of shopping tourism given by Spierings and van der Valde (2013) falls in line with Widmann (2008) and is elaborating his idea: “recreational shopping,” “purposeful shopping” and “daily shopping” all form part of their definition of shopping tourism and therefore this paper follows this broad definition.

According to Leal *et al.* (2010), the phenomenon of cross-border shopping is not new. In fact, it has been discussed in the scientific literature since at least the 1930s. Widmann (2008) found that border traffic to Germany for shopping purposes takes place both with and without the experience component. Widmann mentioned two cases: regular trips by Danes to Germany to buy food as an example of shopping without the experience component and occasional visits by Poles to Germany to buy clothing and leather goods as an example of shopping with the experience component. Further studies dealing with cross-border shopping in Germany include Makkonen (2016) (the economic impact of cross-border shopping by Danes in Germany) and Sommer (2010) (shopping tourism by Swedes in Germany). Both studies show that according to the authors shopping tourism is not sufficiently included in destination marketing, respectively, tailored to the needs of the respective shopping tourists.

2.2 Methods in mobility research

There is a variety of quantitative and qualitative methods for recording mobility behavior (Groß and Menzel, 2016).

An article by Weber and Bauder (2013) gives an overview of the most common methods used in the geographic research of tourism to record mobility and discusses them critically. Groß and Menzel (2016) created another methodological overview with in-depth explanations of GPS

tracking and its different variants and possible combinations with other methods. An overview of traditional and modern methods with their respective advantages and disadvantages was provided by Shoval and Isaacson (2007). Thimm and Seepold (2016) also gave an overview of the methods for capturing mobility and their application in various studies. The authors found out that tourists refused being tracked by a mobile application, because they considered this procedure as too invasive.

According to Baggio and Scaglione (2018), a lack of suitable data, due to traditional and less meaningful methods (e.g. surveys), referred to by Baggio and Scaglione as the “small data approach” constituted a major hurdle in presenting movement patterns in the twentieth century. Nowadays, due to new technology and strategies (GPS tracking, geo-tagged photos, hotel registration information, etc.), more accurate and reliable Big Data approaches have become available (Baggio and Scaglione, 2018).

In general, capturing the spatio-temporal behavior (mobility patterns) of individuals is extremely complex (Shoval and Isaacson, 2007; Weber and Bauder, 2013), which is why a combination of individual methods is recommended for recording them (Weber and Bauder, 2013). Weber and Bauder (2013) argued in favor of the use of a method mix of GPS tracking, a survey with questionnaires and text analysis. Another example of a mixed method can be found in Thimm and Seepold (2016), who used GPS loggers, smartphones and questionnaires to record tourist movement patterns in the Lake Constance region.

2.3 Aspects of IT-based visitor flow management

Valuable behavioral aspects can be derived from IT-based visitor flow management. A classification of general movement patterns can be generated from a comparison of different movement patterns of users in connection with metadata (e.g. weather or personal information). This allows companies to create personas to better understand their customers (Baker *et al.*, 2014; Fong *et al.*, 2015) and to offer personalized products and services (Cameron *et al.*, 2012; Barat *et al.*, 2013; Fang *et al.*, 2012; Muk, 2012). Accuracy in the evaluation and prediction of movement patterns can be increased by including automatically aggregated and evaluated information, as well as user input and context (e.g. “relaxation tourist” or “shopping tourist”). Of course, whether or not accuracy can be enhanced depends on the trust of customers and their willingness to disclose data and information about themselves (Zimmer *et al.*, 2012).

Several different approaches that are relevant in the context of the present research project have been published. Yang *et al.* (2009) analyzed taxi rides and were able to show that movement patterns and the resulting “critical spots” are time-dependent and may change fundamentally throughout the day. They made no predictions or even recommendations about future developments, however. Ong *et al.* (2010) discussed an automated classification of users based on their movement patterns, using information about users’ routes (speed and length of stops). The data were linked to semantic information (age, gender and group size) to classify future users semantically, based on their behavior (Hsiao-Ping *et al.*, 2011; Wenjun Zhou *et al.*, 2010). Millionig and Schechtner (2007) introduced a navigation system for pedestrians. This system uses visual markers to simplify orientation for users. Based on context information (e.g. pedestrian traffic), the user can calculate the most suitable route. Sousa *et al.* (2011) suggested a “comfortability factor” based on user input.

None of the sources listed above considers the interaction or influence of different groups on each other. Although there are approaches to classify individual groups based on their behavior, these are not correlated with each other.

Data provided by a customer can enable a targeted, personalized and location-dependent customer approach (Acquisti *et al.*, 2015; John *et al.*, 2011; Malheiros *et al.*, 2013). This does, however, require the customer’s consent (opt-in). Approaches to promoting these opt-ins using behavioral science (e.g. nudging) are promising. Since the communication medium for influencing behavior in the case of these investigations is an application, the question arises as to how the installation and long-term use of the application can be achieved and what incentivization to install and use the application is most suitable and effective.

Behavioral economics and specifically marketing (behavioral marketing), use gamification and nudging (Choe *et al.*, 2013; Goldstein *et al.*, 2008) to influence customer behavior. Findings about these approaches are mainly limited to offline environments (e.g. road traffic or insurance contracts (Thaler and Sunstein, 2009)). The transfer to an application remains largely unexplored. In the field of eHealth and the use of applications over a longer period, it has been shown that fatigue effects set in after only a few weeks (Ba and Wang, 2013; Cafazzo *et al.*, 2012). Approaches that use gamification show some promise in caring for the chronically ill (e.g. diabetes and heart disease sufferers) but are still largely unexplored in terms of using a predictive tool (Cafazzo *et al.*, 2012).

A review of regional specificities has shown that the heterogeneous catchment area of the region should be taken into account with regard to the use of applications and the mobile internet (Gerpott and Thomas, 2014). An important issue that needs to be addressed is the fact that people crossing the border from Switzerland into one of the two EU countries of the Lake Constance region still pay pricey roaming charges. As a result, tourists only use apps in places where they can benefit from free Wi-Fi.

Based on the availability of data, new shopping models (including home delivery, post in-shop purchase) are also conceivable to enable more visitors to use public transportation. Incentives in the form of discounts, dynamic pricing or faster service could encourage carpooling.

The implementation of such concepts requires research, however, which must take into account both the technological perspective (data availability) and the customer perspective (acceptance and customer benefit). The research and implementation of intelligent control systems is ongoing. The goal is the efficient use of infrastructural events by managing traffic flow. These approaches, however, either refer to the current situation, which means that people act based on current tourist flow or that they rely on predictions, which, however, only refer to homogeneous groups sharing the same goal.

Building on this literature review, the following research questions were identified:

- RQ1. What movement and activity patterns can be identified for local residents and tourists in the border cities of Konstanz, Radolfzell and Singen?
- RQ2. What requirements does each user group have with regard to a mobile application that optimizes individual mobility?

3. Methodology and methods

The current literature review shows that there are a variety of approaches and methods for capturing visitor streams. It is, however, the new approaches and methods (GPS tracking and big data) which are most promising in terms of analysis and prediction. Yet, even these new approaches and methods are not without problems. One fundamental problem is how to procure the data required for effective forecasting tools. Users of apps or similar tools must be convinced of the benefits of the application before they agree to disclose personal data. This is why the authors decided to use a mixed-method approach with the following stages to minimize the data problem (Table I).

In a first step, an online survey was conducted using an online questionnaire to investigate travel behavior in detail and determine requirements for the application to be developed. Next, a typology through face-to-face interviews was developed to gain a better understanding of the

Table I Methods			
	Stage 1	Stage 2	Stage 3
Methodology	Online survey	Face-to-face interviews	Focus groups
Time period	Summer 2017	Winter 2017/2018	Summer 2018
<i>n</i>	2.661	664	24

local residents and the tourists to the region. This typology was to be used to make statements about the extent to which the types differ in their mobility behavior. Third, focus groups were conducted to clarify the for an application:

1. How do you usually plan a trip?
2. Are applications used in planning your visit and if so, which ones?
3. What benefits and drawbacks do you see in a potential application?
4. What are your concerns about the potential application?
5. What features and incentives do you expect from such an application?

3.1 Online survey

The behavioral study of the tourists involved recording the needs and requirements of different user groups with regard to the application to be developed. The focus was on Swiss shopping and leisure tourists, who make up a significant proportion of shopping and leisure tourists in the Lake Constance region. Another reason why this group is relevant is that Swiss cellphone users usually pay high roaming charges in the EU countries in the Lake Constance region, which will affect how well a new tourist application will be received.

In order to reach the largest possible number of possible subjects, an online survey was conducted in the largest Swiss daily newspaper, *20 Minuten*. A total of 2,661 people participated via a link which was available on the newspaper's homepage from May 6–13, 2017.

The survey included questions on the respondents' shopping and leisure behavior, data disclosure, a possible new application and socio-demographic information. From a methodological point of view, this form of survey was chosen for several reasons. Online surveys provide an excellent opportunity to conduct large-scale trials (Couper, 2000; Sheehan and Hoy, 1999; Weible and Wallace, 1998) and are cost-effective (Watt, 1999). In the last 10–15 years, internet usage and computer-aided communication has increased considerably (Fox *et al.*, 2001; Horrigan, 2001; Nie and Erbring, 2000). Advantages of online surveys include low cost; short reaction time; ability of researcher to manage the sample; data can be loaded directly into the data analysis software, saving time and resources associated with the data entry process (Ilieva *et al.*, 2002).

3.2 Face-to-face interviews

The analysis and classification of visitor flow involves studying the mobility behavior of visitors (day visitors as well as tourists) and local residents. The paper therefore focuses on both everyday and extraordinary mobility.

Empirical data collection was carried out by means of face-to-face interviews using standardized questionnaires in combination with GPS loggers. While the GPS loggers recorded the routes taken by the respondents and provided information about route preferences, the questionnaires were used to record mobility indicators.

A pretest took place in the Winter of 2017/2018. This consisted of ordinary interviews (sample size: $n = 274$, 48 percent participation) and short interviews in combination with GPS loggers (sample size: $n = 8$, return in percent: 17.02).

Concerning the main survey, there was no difference between the ordinary interviews and the short interviews. Due to a lack of willingness in some cases to use the GPS logger, however, an analysis of route preferences proved impossible. The empirical data collection for the main survey took place on various dates in the Spring of 2018 in the cities of Konstanz, Singen, Radolfzell (Germany) and Kreuzlingen (Switzerland). The remarks and assessments which follow refer to the main survey in the three German cities.

A total of 2,119 people were contacted. In total, 742 participated in the face-to-face interviews (35 percent participation). Due to inconsistencies in answers, broken off interviews and item nonresponse concerning questions relevant to typing (origin, place of overnight stay and activities on the day of the survey), a total of 78 questionnaires had to be discarded. The number of questionnaires that were finally evaluated was 664.

A typology was created by *a priori* segmentation as a method to classify the respondents according to Dolnicar (2002). The typology developed in this paper is based on two criteria, “type of stay” and “type of activity,” with “type of stay” consisting of two components, namely “place of residence” and “place of overnight stay.” This typology, in the following referred to as “type of stay/activity” typology, was used to provide information about potential application users. In addition, it was also used to determine to what extent the different types of people differ in their mobility behavior. Since, as has been noted earlier, sufficient data could not be collected on route preferences, the analysis is based on mobility indicators only. Typology-specific naming of the individual types (Bailey, 1994) is omitted in this paper because of the complexity of the typology.

3.3 Focus groups

In total, 24 people, all of whom travel regularly, were invited to participate and were divided into four groups of six persons. The participants were between 20 and 67 years old. In total, 12 of them were male, 12 female. The survey took place in August 2018.

4. Results

4.1 Online survey

A total of 2,661 people took part in the survey. The sample includes people of all ages and income levels. Men are over-represented in terms of gender distribution. The majority of respondents (80.8 percent) are Swiss, 11.2 percent are Germans living in Switzerland and 1.5 percent are Italians living in Switzerland. The others are from other countries or did not provide any information on their country of origin (Table II).

With regard to shopping and leisure time behavior, it was found that 73.7 percent of respondents sometimes or frequently combine shopping and leisure activities in the border region. In general, however, the shopping and leisure activity frequencies vary. While people living in Switzerland generally shop in their own country several times a week, 26 percent of them shop abroad only about once a month. Significantly fewer, but still more than four out of ten people, go abroad once a year for recreational purposes. The frequency of cross-border trips for shopping and leisure underlines the importance of dealing with visitor flow in border regions (Table III).

A closer look at shopping behavior shows that cross-border shopping is especially common on Mondays (17.1 percent) and in the evenings between 6 and 10 p.m. (27.6 percent). For many respondents (21.9 percent), on the other hand, the timing was not so important. To shop across the border, people usually travel by car, accompanied by a family member. The car rather than

Table II Socio-demographic information from the behavioral survey

Age group	Percentage	Origin	Percentage
< 16	18.2	Switzerland	80.8
17–35	18.3	Germany	11.2
36–45	20.3	Other country	5.2
46–55	21.1	Italy	1.5
> 56	22.1	No details	1.3
	100		100
Gender	Percentage	Income	Percentage
Male	58.3	0	5.2
Female	38.1	CHF20,000–39,000	9.5
No details	3.6	CHF40,000–59,000	11.7
	100	CHF60,000–79,000	20.5
		CHF80,000–99,000	16.3
		CHF100,000–119,000	15.6
		CHF120,000–139,000	9.1
		> CHF 140,000	12.1
			100

Note: $n = 2,661$

Source: The authors' illustration, online survey 2017

Table III Shopping and leisure activity frequency

	<i>Shopping frequency</i>		<i>Leisure activity frequency</i>	
	<i>Switzerland (%)</i>	<i>Other country (%)</i>	<i>Switzerland (%)</i>	<i>Other country (%)</i>
Once a week	19.6	19	2.6	2.0
More than once a week	59.5	7	0.6	0.4
Once a month	4.6	26	17.2	13.3
More than once a month	8.8	17	6.6	4.2
Once a year	0.9	5	32.6	42.5
Several times a year	6.6	25	40.4	37.5

Source: The authors' illustration, online survey 2017

public transportation (train or bus) is by far the most popular means of transport. This is mainly due to factors such as "easier to travel," "easier to transport purchases" and "saving time." The main driver of cross-border shopping is price. What was also mentioned frequently is the ability to find products that are not available at home. Other reasons include easy parking, good sales advice and the need to collect internet orders (many online stores do not ship to Switzerland).

A K-means cluster analysis, an investigation method for grouping objects according to measured or perceived intrinsic features or similarity (Jain, 2010), identified three clusters for different types of purchases ($p < 0.001$):

- Type 1: it chooses to travel abroad for price reasons only.
- Type 2: it has a high price affinity, likes to link shopping abroad with collecting internet orders.
- Type 3: it has a high price affinity, also appreciates the parking facilities, the sales advice, the combination of leisure and shopping and the smooth flow of traffic.

Looking more closely at recreational activities, it becomes clear that most people avoid the end of the week to cross the border. A mere 6.6 percent stated that they engage in recreational activities abroad on a Saturday, while between 15 and 16.4 percent prefer doing so between Monday and Thursday. The time for leisure activities (such as wellness, eating out, or attending concerts and other public events) appears to be morning (between 9 and 12 o'clock, 23.1 percent) and evening (between 6 and 10 o'clock, 26 percent, Table IV).

When searching for information, the respondents usually rely on their own experience or the opinions of friends and/or acquaintances. Also popular are internet search engines. Brochures, books (electronic and print editions), tourist information centers, automobile clubs, travel agencies and the print media (magazines and newspapers) are much less relevant in finding information.

Table IV Preferred days for activities

<i>Preferred day of recreational activities</i>		<i>Preferred time of recreational activities</i>	
Monday	16.4%	9–12 o'clock.	23.1%
Tuesday	16.3%	12–15 o'clock	15.0%
Wednesday	15.2%	15–18 o'clock	16.9%
Thursday	15.0%	18–22 o'clock	26.0%
Friday	11.2%	The time does not matter	19.0%
Saturday	6.6%		100.0%
Sunday (open for sale)	8.9%		
the day of the week doesn't matter	10.5%		
	100%		

Notes: Preferred day of recreational activities: $n = 3,479$; preferred time of recreational activities: $n = 1,329$. Multiple answers allowed unless someone checked that day or time does not matter

The majority of consumers spend between CHF200 and 399 (47.8 percent) per day on shopping and leisure activities (according to the Swiss Federal Customs Administration, goods up to a total value of CHF300 may be imported VAT (sales tax)-free.). These amounts show that cross-border shopping tourism is a major economic driver (Table V).

The following section looks at questions concerning the features of a potential new online platform and what respondents replied concerning their willingness to share personal data. In general, 33.5 percent of respondents could imagine using an online platform to obtain information about their destination. However, this platform must meet the following requirements: it must be simple to operate, provide the relevant information and have useful features. Based on the content analysis of the focus groups, the following features or functions should be included in the application (in descending order of importance):

1. real-time information that adds value to the cross-border experience (e.g. forecasts of traffic flow, parking situation or congestion in the city center);
2. ability to receive information on additional services (e.g. delivery service or customs clearance);
3. information about exclusive offers;
4. information about special offers;
5. search functions (e.g. to find products or offers);
6. information on discounts; and
7. comparison functions (e.g. prices).

Especially the first point is valuable since it confirms the need of customers for data that are available in real time.

Data disclosure is an issue of special importance. Only if users are prepared to disclose their data it is possible to improve the application based on user data, exchange information in real time, and, ultimately, create benefits and influence user behavior.

The exchange of information takes place, on the one hand, between the users themselves and, on the other hand, between the users and the application. Concerning the topic of data usage, three different clusters could be identified: people who mainly use Wi-Fi abroad and therefore refrain from using features that would incur costs; people who refrain from using mobile data because they are worried about their privacy, the costs incurred, the risk of draining their the cellphone battery and because the data would consume storage space (preferring to download data beforehand to use offline and using Wi-Fi while abroad); and people who generally not only use mobile data but also make use of free Wi-Fi offers to save costs.

Very few people (11.6 percent) are willing to reveal information about themselves on an online platform, such as (sorted in descending order of importance):

1. geographical data (current location);
2. data on travel behavior (e.g. favorite places or travel times);
3. data on shopping behavior (e.g. favorite shops or shopping times);

Table V Expenditure of shopping and leisure tourists per excursion

<i>Expenditure in EUR in %</i>	
400–5,000	9.7%
300–399	11.0%
200–299	22.3%
100–199	22.3%
55–99	24.7%
5–49	10.1%

Source: The authors' presentation, online survey 2017

4. socio-demographic data; and
5. motion profile.

Most interesting, this is inconsistent with other studies that found out the contrary (O'Hara, Nguyen, and Haynes, 2014).

4.2 Interviews

The results of creating the typology are presented and interpreted below. This is followed by a discussion of the results.

As has been explained earlier while discussing the methodology, the segmentation criterion "type of stay" incorporates the two criteria "place of residence" and "place of overnight stay." Table VI provides further details, cross-referencing them with the various types of stay (1.1–8.6). The classification of Table VI was applied to a survey identifying movement patterns of visitors in Konstanz, Singen and Radolfzell.

The places of stay within the areas of survey are not explored any further because the focus of this paper is on the "type of stay/activity" typology. For this typology, six activities (A–F) were identified. These were related to the different types of stay, resulting in the following typology (Table VII).

The most frequent "types of stay/activity" is the types of stay "resident of Konstanz," "day visitor from the Lake Constance region, narrow, Switzerland," "day visitor from the Lake Constance

Table VI Type of stay in Konstanz							
Place of residence	Place of overnight stay						
	No. of overnight stay	Place of survey	Place of survey and lake Constance	Lake Constance and other places	Germany	Other country	
Place of survey	1.1	1.2	1.3	1.4	1.5	1.6	
Lake Constance narrow, Germany	2.1	2.2	2.3	2.4	2.5	2.6	
Lake Constance narrow, Switz.	3.1	3.2	3.3	3.4	3.5	3.6	
Lake Constance wide, Germany	4.1	4.2	4.3	4.4	4.5	4.6	
Lake Constance wide, Switz.	5.1	5.2	5.3	5.4	5.5	5.6	
Germany	6.1	6.2	6.3	6.4	6.5	6.6	
Switzerland	7.1	7.2	7.3	7.4	7.5	7.6	
Other country	8.1	8.2	8.3	8.4	8.5	8.6	

Source: The authors' illustration, survey 2017

Table VII "Type of stay/activity" typology							
Type of stay	Activities						
	Shopping, errands	Shopping, errands, ad recreation	Leisure	Work	On the way	Other	
1.1	1.1 A	1.1 B	1.1 C	1.1 D	1.1 E	1.1 F	
1.2	1.2 A	1.2 B	1.2 C	1.2 D	1.2 E	1.2 F	
1.3	1.3 A	1.3 B	1.3 C	1.3 D	1.3 E	1.3 F	
1.4	1.4 A	1.4 B	1.4 C	1.4 D	1.4 E	1.4 F	
...							
8.6	8.6 A	8.6 B	8.6 C	8.6 D	8.6 E	8.6 F	

Source: The authors' illustration

region, far, Switzerland” and “German overnight visitor from Konstanz.” A comparison of types of stay shows that among guests from Switzerland, the activities A and B are the most common. The activities of the local residents are concentrated on the activities A to C. For the overnight visitors, the focus is on the activity C.

In the following, we examine the extent to which each of these four “types of stay/activity” varies according to mobility behavior, using the indicator “places visited on the survey day” as an example.

The results also show locations mentioned most frequently regarding the visitor’s movements.

The Lago Shopping Center in Konstanz was named less frequently in favor of the Old Town/city center of Konstanz and Lake Constance itself. Mainau Island, a traditional attraction of the Lake Constance region, was mentioned more often here than other locations. This means that the Old Town of Constance is the main focus of all visitors’ movement patterns.

4.3 Focus groups

The following subsection deals with the findings of the focus groups. These were analyzed using tape-based analysis (Casey and Krueger, 1994). The moderator creates a written report based on a truncated transcript after listening to the tapes, reading the notes and debriefing the facilitator. This method has the advantage that it can be applied relatively quickly, while being mostly error-free.

In order to derive insights for an application, the focus groups were first asked to discuss how the group members plan a trip in advance. The participants of the focus groups were divided into two camps: some said that they plan their trip in advance, mainly because they travel as a family and especially with children. Others said they prefer to plan their trips on a daily basis and after they arrive, especially when it comes to individual travel, short city trips and traveling with friends.

The “advance planners” also differed from the “spontaneous travelers” with regard to the sources of information used. The “advance planners” use sources of information such as opinions, recommendations and tips from friends and acquaintances. They also use online services such as Google/Google Maps, city portals, TripAdvisor, YouTube videos, or hotel websites. They may also watch previews and documentaries on TV. Further, they may check satellite images online to see, for example, how far a hotel is from the airport and what sites are close by (e.g. museums, parks, highways, industrial sites, etc.). “Spontaneous travelers,” on the other hand, rely on information gained locally, from talking to locals and asking them for tips, from hotel receptionists and at tourist information centers. They might also take a tour on a sightseeing bus (hop-on hop-off bus) to get a first impression of a city. Weather forecasts, city or travel guides (physically and/or as an application), local newspapers and Facebook are also sources of information consulted by this type of visitor.

Applications used for travel planning by both groups can be classified into different categories: navigation/orientation, meeting people, gathering information, booking transportation, booking accommodation and searching for and booking activities. There is currently no application that combines all these needs and is also equipped with route suggestions.

In a next step, the groups were shown a mock-up and thus presented with an idea of an application that would allow tourists (and local residents) to move easily side by side. The respondents recognized not only the benefits but also some drawbacks of such an application. These are shown in Table VIII.

At this point, respondents also mentioned several important features that such an application would need to have in order to be more valuable. From a customer perspective, the application should include congestion messages (with a push feature) for tourist attractions, alternative route suggestions, enable the user to create a daily itinerary, get general city information and advice, (offline) maps and have a ticket booking system. The respondents were aware of the complexity of such an application and therefore suggested integrating this idea into an existing application. Above all, Google Maps was rated as the application that might be able to do this most effectively since this application already has features that are used by tourists (route planning, busy times/rush hour, waiting times and reviews). If the application meets requirements such as those

Table VIII Benefits and drawbacks of the possible application

<i>Benefits</i>	<i>Drawbacks</i>
Less stress	Can overwhelm you
Incentives/goodies/benefits	Spontaneity is lost
Planning reliability	You do not meet new people
Managing tourist flow – less congestion at peak times	Needs data volume/incurs roaming costs
Time savings/less waiting time/more efficiency	The user becomes increasingly transparent
Better day planning	Uncertainty whether the live data are correct
Protection of infrastructure	Tourists are constantly on their cellphones/dependent on their device
Relief for local residents	Data protection and data handling
More space at sights	Concern that the application might have the opposite effect
Ability to be more creative	No more individual experiences – all tourists have the same experiences

mentioned above, a majority of respondents would be ready to pay for it. The accepted price range varies from CHF1 for a location (country or city) to up to CHF20. The respondents would be ready to pay this in lieu of a printed travel guide.

5. Discussion

It can be concluded that price is the main reason why shopping tourists cross the border. Participants state that their demand for electronic devices, medical services, watches, jewellery and business travel will increase in the future. In addition, the demand for food and drugstore products will remain high. Consumers favor online platforms that offer information about their stay, guarantee easy operation, provide relevant information and have useful features. The analysis also shows that Wi-Fi is an important data access point for foreign tourists, who will switch off the mobile data function on their cellphones once they cross the border to avoid the high roaming charges. Finally, it must be emphasized that users of such an application will only disclose their data if they are assured that information about themselves is rendered completely anonymous.

Findings confirm that cross-border shopping and leisure activities are popular and engaged in frequently. Above all, however, the findings show that it will be a major challenge to develop an application that provides functional, informative and real-time data while fully anonymizing user information. These requirements will, in turn, make it difficult for the application to provide useful information.

It was also shown that customers appreciate the German border towns for their smooth flow of traffic and good parking facilities. This is surprising, inasmuch as media reports of traffic collapsing are frequent (Büchel, 2018; Rotzinger, 2018). An application could do much to relieve traffic congestion by controlling the situation. At the same time, however, users will need incentives to install and continue using it.

Due to the high costs residents of Switzerland have to pay when they use mobile data in the neighboring EU countries, it will be essential to offer extensive Wi-Fi capabilities. This will allow them to retrieve data free of charge that will help them manage their cross-border leisure and shopping activities. An offline feature providing historical data on traffic flow might be an added benefit in directing users and their activities while at the same time providing support for the local traffic infrastructure.

A comparison of the frequency distributions shows that the largest group of respondents are the residents of the respective place of survey. With regard to Konstanz, it is interesting to note that the majority of overnight guests stay exclusively in Konstanz, while overnight guests visiting Radolfzell and Singen are distributed across various places of accommodation in the Lake Constance region, in addition to the place of survey. Furthermore, Konstanz seems to be more popular among German guests as a place to stay overnight than the other two cities. With regard to Swiss visitors, it should be noted that they stay in Singen more frequently than in Radolfzell or Konstanz.

The results show that there are differences between “types of stay/activity” with regard to the indicator “places visited on the survey day.” However, the sample sizes of individual types may be too small to draw reliable conclusions. The typology does, however, enable the identification of potential users of a tourist application to be developed and provides useful first information about the mobility behavior of the various types of visitors.

6. Conclusion and outlook

In an applied method mix, purchasing behavior, activities, movement patterns and the requirements for a mobile application for visitor guidance were determined. With regard to answering the research questions, it became clear that some shopping tourists combine their stay with leisure activities for an overall tourist experience. From a mobile application to be used for visitor management, users expect time savings through enhanced personal mobility in terms of real-time data on parking possibilities, traffic situation or high number of visitors/queues. To realize such a tool, it must be possible to provide such real-time data using suitable interfaces (e.g. Wi-Fi and mobile communication). In Europe, this raises data protection issues.

The mixed methods approach of qualitative and quantitative survey methods has proven useful in answering the two research questions in analyzing the needs and behavior of tourists in detail and in allowing some quantification and the identification of appropriate needs-based and behaviorally based segments.

Concerning the first research question on the activity and movement patterns of tourists, three different tourist groups have emerged among visitors from Switzerland. All groups are to some extent price-driven in their behavior, but at least one group combines shopping with recreational activities. The second survey also revealed clear differences in the patterns of activity and movement depending on the origin of the visitors, especially regarding the different importance of shopping and leisure activities. One conclusion is, in particular, that guests from outside the Lake Constance region are more attractive to leisure and tourism providers. One practical implication is, therefore, that care must be taken that especially overnight guests are not displaced by shopping tourists. This, in turn, underlines the importance of managing traffic flow, which is made easier by the fact that activities vary, at least in part.

Concerning the requirements for an application, in-depth qualitative indications and quantitative results were generated which show, on the one hand, a desire for price-related information, but also the potential to create a benefit for visitors through visitor flow management features.

For destination management organizations (DMO) within and beyond the research area (the Lake Constance region), the results are particularly relevant for destinations in two situations: first, where cross-border tourism is important and, in particular, where there are also large differences in spending power. In addition, destinations affected by overtourism will benefit most from the results.

The results show the necessity to cooperate within applications, within destinations and beyond. Above all, it is recommended not to offer the visitor management features as part of a separate application, but, if possible, to integrate them as additional features into an existing, proven application. In most cases, it will be very hard to generate enough users and to offer sufficient benefits for the application.

The requirement to generate enough benefits for tourists to use the application is interlinked with another finding. Both from a research methodological and a practical point of view the willingness to share data by the potential application users must not be disregarded. The clear result of this paper is that the subjective benefit of data sharing in the perception of tourists must be large enough to offset any privacy concerns. The use of external data like Google data could somewhat reduce this problem.

For cross-border tourists between Switzerland and EU countries, intensive use of any application is only realistic if the destinations provide free Wi-Fi. At the same time, how many mobile phones are logged into a specific router provides basic information of visitor movements and quantities. In this situation, Wi-Fi develops an additional importance for DMOs, especially as many destinations have little information on tourism flows.

The present paper is based on various surveys in the Lake of Constance region. Future research should validate, if the results can be verified in other regions as well. Additionally experiments within an existing application could test real reactions of tourists to the features suggested here. A major additional step could be allowed by the usage of observational data from existing applications or from the practical implementation of the above information regarding the application design and features. Observational data over a period of several years will, as a further research step, enable reliable predictions on movement patterns using predictive analytics. This would enable DMOs to react beforehand to estimated tourism flows and to reduce the negative effects of tourism flows to tourists and inhabitants alike.

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