Intra-destination travel behavior of alpine tourists. A literature review on choice determinants and the survey work.

Bartosz Bursa[1], Markus Mailer[1], Kay W. Axhausen[2]

Abstract
In the face of a continuous increase in the number of tourists in the Alps, the associated traffic volumes, and the resulting negative externalities, there is an urgent need to design policies capable of managing tourist traffic efficiently and to invest in transport systems and infrastructure wisely, given the limited financial, spatial and environmental resources. Unfortunately, while there is a considerable research interest in long-distance travel and arrival/departure patterns of tourists, research on tourist mobility during the stay at the destination is almost non-existent. This prevents policy-makers from making informed decisions backed by scientific evidence. The paper presents a data collection study that contributes to filing this gap. This 'data paper' reports on the motivation, design and administration of a bespoke travel-activity survey of tourists at vacation destinations. It informs other researchers about the encountered difficulties and helps them optimize data collection effort in their future studies. Besides the contribution to survey methodology, the paper reports on a rare and policy-relevant dataset, provides descriptive results, and thereby contributes to evidence-based design of transport policies in tourist regions. With this paper, we also want to inspire and invite researchers to conduct further quantitative and modeling work in this under-studied field.

Keywords tourist travel behavior, intra-destination, tourist survey, survey design, survey work, data paper

Acknowledgements The first author would like to thank the Faculty of Engineering Sciences at the University of Innsbruck for supporting him in the data collection process with need-based scholarships (No. 1092191, No. 1354749). We would also like to thank Emma Komarek, former student assistant in the Unit of Intelligent Transport Systems at the University of Innsbruck, for her work on data digitalization and data cleansing.

Conflicts of interest On behalf of all authors, the corresponding author declares no conflict of interest.

Availability of data and material The survey data along with a codebook and metadata are currently being prepared for publication in a repository.

Code availability Not applicable.

Authors' contributions Bartosz Bursa: Conceptualization, Methodology, Formal analysis, Investigation, Writing - Original Draft, Visualization. Markus Mailer: Conceptualization, Resources, Writing - Review & Editing, Supervision. Kay W. Axhausen: Conceptualization, Writing - Review & Editing, Supervision.

Bartosz Bursa, https://orcid.org/0000-0002-6640-3203
bartosz.bursa@uibk.ac.at

Markus Mailer, https://orcid.org/0000-0002-4459-6438
markus.mailer@uibk.ac.at

Kay W. Axhausen, https://orcid.org/0000-0003-3331-1318
axhausen@ivt.baug.ethz.ch

[1] Unit of Intelligent Transport Systems, University of Innsbruck, 6020 Innsbruck, Austria
[2] Institute for Transport Planning and Systems (IVT), ETH Zurich, 8093 Zurich, Switzerland

1 Introduction and motivation

Tourism industry accounts for a substantial share of the direct Gross Domestic Product (GDP) in the Alpine areas of Austria, Switzerland, Italy or France. In the Austrian province of Tyrol, for example, it is responsible for 17.5% of the GDP (MCI, 2014). However, over the past two decades, vacation trends, characteristics and demands of customers who bring in these revenues have changed significantly. While the average length of stay of tourists in Tyrol decreased from 5.1 nights in 2000 to 4.0 nights in 2019, the number of arrivals increased by almost 60% from around 8 million to more than 12 million (Statistics Austria, 2020). This demonstrates the rising demand for tourist stays in the province of Tyrol (despite no expansion on the supply side, as the number of beds dropped by 7% between 2000 and 2019), which inevitably leads to an increase in tourism-related travel.

In Austria, nearly 75% of inbound holiday trips are made by private car (Austrian National Tourist Office, 2014). These trips have a substantial influence on traffic congestion on alpine roads and generate pollution in environmentally fragile areas. Car travel, due to its dominant role in Austrian tourism, heavily contributes to the sector's greenhouse gas emissions, both at the level of a single destination (Unger et al., 2016), as well as for the entire country (Gühnemann et al., 2021). Tourists appear to be well aware of their travel carbon footprint, yet are not willing to change their behavior substantially (Mailer et al., 2019). Furthermore, traffic generated by tourists can even disrupt daily activities and travel patterns of local inhabitants, who experience severe difficulties in traveling due to lack of alternative roads in densely built-up and narrow mountain valleys. The problem is recognized and present also in other non-urban destinations, but has so far attracted only limited attention of researchers, who addressed it in qualitative studies (Dickinson and Robbins, 2007, 2008). Local authorities still do not have any quantitative evidence at their disposal. In effect, transport policy measures in tourist regions are often shots in the dark, which, despite considerable expenses (e.g. free public transportation for tourists), lack proper evaluation and appraisal.

Compared to what we know about everyday travel behavior from representative household surveys, census studies and extensive scientific literature, our knowledge of transportation behavior during vacations is very limited. While these studies provide information on specific vacation decisions (destination preferences, spending, etc.), they look at the issue from the perspective of the country of origin, for which respondents' behavior during a stay abroad is not relevant. Similarly, data collected by national tourism agencies and international organizations on tourism markets and aggregate statistics on travelers moving between and within countries are not helpful here either. It is, however, rational and legitimate to assume that travel behavior of tourists at the destination is not only different from their everyday behavior at home (Schlemmer et al., 2019), but it is also dissimilar to travel behavior of local residents. Yet, current research in this field is limited and concentrates merely on international tourism demand and the long-distance component of vacation travel (Christensen and Nielsen, 2018; Gerike and Schulz, 2018; Janzen et al., 2018). There are virtually no quantitative data documenting tourists' travel decisions while at the destination, leaving their travel behavior still largely unexplored.

The fundamental goal of current work is to help fill this research gap by developing a scientifically-grounded approach to collecting data on tourist travel behavior at the destination and by providing tourism practitioners, transport planners and policy-makers with a first-of-its-kind dataset from a survey conducted in the Austrian Alps.

The paper is comprised of four sections with section 1 introducing the topic, describing the motivation and setting the objectives for the research. Section 2 reviews the literature on data collection methods and travel decisions, with a particular focus on tourists in vacation setting. Section 3 covers the survey work. First, the conceptual framework of tourist travel at the destination is presented. Next, a detailed description of survey methodology and design is given, followed by response behavior statistics from a survey conducted in the field. Section 4 provides a descriptive analysis of the collected data. Section 5 synthesizes and discusses the findings, and points out the limitations. We also provide an outlook on future research and suggest prospective study topics that could either extend the approach or resolve some of its limitations.

2 State of research on travel behavior of tourists

2.1 Definitions

As noticed by Arce and Pisarski (2009), there are many future challenges in describing tourists' mobility that are caused by i.e. data unavailability, different levels of analysis or inconsistencies in definitions. Therefore, several assumptions were made in the paper to avoid ambiguities. We operate with the definitions of tourism and tourist as proposed by United Nations (2010), so as to avoid confusion with traveler, vacationer or holidaymaker (Terrier, 2009). All these terms are used in the paper interchangeably though all meaning a tourist. The main restriction this definition of tourist imposes, is that a person should be out of home (place of residence) for at least one night. It can be either a domestic or an inbound (foreign) visitor. The person must not be specifically on vacation, business purposes or family visits are also allowed. It cannot be however a seasonal worker. Of interest are all trips and activities performed during the stay (leisure and non-leisure).

2.2 Data collection methods

The technological progress in recent years has provided academics with new opportunities for measuring mobility by utilizing passively collected big data. Apart from transport researchers also tourism researchers applied tracking technologies in a number of studies (Shoval et al., 2014; Shoval and Ahas, 2016). However, these deal with research questions relevant for tourism marketing or tourism geography, but not with the transportation-related aspects of tourist travel, such as traffic generated at destinations or transport mode choice.

Mobile positioning data have been widely utilized by tourism researchers in the last decade (Ahas et al., 2008; Zhao et al., 2018). Yet, they proved useful only in applications limited to long-distance travel demand and tourism statistics. In transportation, decisions strongly depend on characteristics of decision-makers (Lu and Pas, 1999) and mobile positioning data, for technical and ethical reasons, are lacking this information – only pure location data with time stamps are available. Unfortunately, the density of GSM transceiver stations in mountain regions is typically insufficient for high-resolution analysis at the destination level. In addition, in Alpine regions, cross-border trips are very common, resulting in frequent changes of network provider. Thus, only parts of these trips will appear in the dataset obtained from a national provider.

GPS tracking can deliver very fine-grained data on tourist mobility allowing analyses of specific activities or monitoring visitors to facilities, parks and venues (Li et al., 2019). If complemented with additional questionnaires, GPS tracking can serve as a superior alternative to traditional travel surveys among tourists. Currently, mobile phones appear to be used more often in research than independent GPS trackers, since smartphone apps allow for correcting and annotating trips by the user and answering supplementary questions (Prelipcean et al., 2018). Although the first studies reported on failed attempts of GPS tracking with mobile phones (McKercher and Lau, 2009), the success rate has increased over the last few years. So far, the most complete and successful approach that combines an annotated travel diary and GPS tracking in a smartphone app for tourist tracking was developed by Hardy et al. (2017), who distributed 240 smartphones with a preinstalled tracking app among visitors to Tasmania. However, besides high costs of such studies, there are also practical and organizational burdens. Tourists cannot be contacted before arrival to arrange handing over the GPS units. In the case of a smartphone app, a communication channel is necessary to make tourists aware of the app. Furthermore, battery consumption and data roaming in the case of foreign visitors have to be considered. Nonetheless, it is a promising approach and deserves further testing in the field.

Another alternative data source are social media platforms. Recent studies approximated tourist mobility patterns from geo-located Twitter data (Chua et al., 2016; Provenzano et al., 2018), Flickr photos (Önder et al., 2016; Yang et al., 2017) or Foursquare check-ins (Vu et al., 2018). However, in less populated areas, relevant Points-of-Interest are underrepresented and geo-tagged tweets and photos are scarce, making these methods more suitable studying urban tourism (Sobolevsky et al., 2015) or estimating inter-destination tourist flows (Barchiesi et al., 2015). Moreover, even though such data can deliver valuable information on tourist activity for the destination managers (Orsi and Geneletti, 2013), they are of little use to transportation planners since it is impossible to fully reconstruct all trips made.

Nevertheless, despite the expansion of big data, traditional surveys appear to be still in use when investigating tourist populations. Big data on their own are not capable of substituting traditional methods as they do not provide sociodemographic information, cannot measure unobserved variables or deliver strong causal evidence (Chen et al., 2016; Mokhtarian, 2018). Unfortunately, as opposed to well-established surveys on daily travel behavior (Brög, 2009), there is no consensus on the design and methodology of such surveys in the tourism context that could lead to a replicable approach. Also, very few researchers provide details on the survey design and report on the fieldwork when applying travel diaries (Newmark, 2014; Thornton et al., 1997; Tschopp et al., 2010). Authors' experiences confirm many weaknesses of diary-based surveys of tourists that are also known from surveys of daily mobility, i.e. high costs, low response rate and high dropout rate. Besides, due to high spatiotemporal dynamics of tourists on site, the sampling frame is unknown and it is difficult to approach a representative sample when surveying outdoors. Surveying visitors at their accommodations allows for more control over sampling (e.g. indirect sampling through hotels), but it requires a close cooperation with the accommodation providers, which is usually impossible without the support of local Destination Marketing Organizations (DMO). Even so, self-administered questionnaires distributed through tourism establishments prove very ineffective. It is therefore postulated that only fully-assisted interviews can guarantee good quality results. Moreover, although travel diary data is detailed enough to model destination and mode choice, it is usually insufficient to investigate route choice. Many of the above issues were discussed by Thornton et al. back in 1997 and are still valid today.

2.3 Destination choice on vacation

Provided that the decision to travel has been taken, decisions must be made about the nature of the trip. The three fundamental dimensions of travel decision-making are destination choice, transport mode choice and route choice. In the context of holiday travel, Bieger and Laesser (2013) distinguish between inter-destination mobility (long-distance travel from home to a destination) and intra-destination mobility (trips made in order to perform activities within the destination area).

The choice of vacation destination has always been of interest to researchers from tourism marketing and management (Decrop, 2006). Understanding these decisions is crucial for tourism-dependent destinations to promote their assets, attract more guests, and as a result, generate more revenue. Therefore, the inter-destination travel patterns have been widely investigated both in theoretical works (Rugg, 1973; Sirakaya et al., 1996; Sirakaya-Turk and Woodside, 2005; Woodside and Lysonski, 1989) and in numerous case studies (Armstrong and Mok, 1995; Eymann and Ronning, 1997; LaMondia et al., 2010; van Nostrand et al., 2013). At the same time, the research on the intra-destination movements, i.e. travel within the destination, is relatively limited. As McKercher and Zoltan (2014) argue, the reasons for that are threefold and pertain to the low accuracy of the geolocation data, insufficient resolution of travel-activity data collected from tourists, and lack of a theoretical framework. Only recently, there has been more attention paid to local travel behavior thanks to the use of GPS (Global Positioning System) traces from mobile devices (Shoval et al., 2014; Thimm and Seepold, 2016) and GIS (Geographic Information Systems) techniques (Lau and McKercher, 2006).

Yet, many of the existing studies are descriptive and focus on visualizing geographical and temporal dimensions of tourist movements or drawing conclusions on itinerary types and frequency of visits (McKercher et al., 2019; Wu and Carson, 2008). Lew and McKercher (2006), in the probably first theoretical work on tourist intra-destination travel, provide an extensive breakdown of factors[3] impacting intra-destination movements of tourists, ranging from tourist time budget to personal characteristics to place knowledge.

Works utilizing mathematical models are much less prevalent so far. However, the topic is slowly acquiring attention of researchers who start applying discrete choice models to quantify travel behavior of tourists and embed them into models. A relatively large study on tourist local travel (over 2000 face-to-face interviews in 29 tourism destinations) was conducted in three regions in Japan by Wu et al. (2011). Applying a latent class modeling framework, they revealed that, except travel time and distance, attractiveness of a destination (measured by number of attractions and number of visitors) is the main factor influencing destination choice, whereas sociodemographic variables (gender, age, marital status)

[3] Many of these factors are used in the design of the survey instrument (section 3.4).

are decisive for the travel party choice. Researchers have also started exploiting GPS data for model building. For instance, Hardy and Aryal (2020) employed neural networks to analyze GPS tracks of tourist movements in a national park in Australia. Based on survey data and GPS tracks, Li et al. (2019) built models of destination choice of tourist visitors to Gulangyu region in China. They observed that tourists who purchased a joint ticket that includes several attractions tend to travel to zones where these attractions are located. Tourists also avoid areas where they have already been to, and areas with poor signage. As far as the intra-destination mobility within the Alpine regions is concerned, Zoltan and McKercher (2014) analyzed visitors' behavior in the Swiss canton of Ticino based on destination card use. Their findings reveal that tourist movement patterns are defined largely by the spatial dimension rather than through activity-based segmentation. Nevertheless, none of the aforementioned studies distinguishes between movements that are part of tourist activities (e.g. making a hiking trip) and movements to activities (e.g. driving to a zoo), which are of greater importance for transport planning because they cause congestion on roads and crowding in public transportation.

Compared to daily travel, which is largely shaped by trips to primary activities (e.g. work, school) with stable locations that do not change at short notice, the choice set of available destinations during a vacation stay can be a more complex issue. Unlike residents, visitors do not have equal knowledge about the area and may or may not be aware of some of the alternatives (cf. the choice set formation process by Decrop (2010)) depending on whether they have been to the area before, or whether they have researched the available options in advance. Moreover, they usually have no fixed points governing their movement patterns (other than lodging), while residents are tied to the location where they work or take their children to school, which imposes constraints on their choice set. Due to the short nature of the stay, the visitors' choice set can be dynamic and change quickly over time (Crompton, 1992), making it even more difficult to recognize it in the models. It can be also be driven by habits, attachments or routine (Björk and Jansson, 2008), which contradicts the assumption of tourist's absolute rationality and optimization character of the decision process. For instance, a returning tourist might not consider a new alternative on-site (e.g., a restaurant) since they are used to the one that they have been visiting for the last few years.

Besides tourism, there have also been applications of choice models to leisure trips of domestic populations. For instance, Simma et al. (2002) analyze the destination choice for leisure activities of Swiss residents within Switzerland. Similarly, Juschten and Hössinger (2021) examined the joint choice of destination and transport mode among the Viennese population traveling on summer vacation within Austria. Bhat et al. (2016) apply the Multiple Discrete-Continuous Probit model to study the leisure destination choice of domestic tourists in New Zealand. To the author's knowledge, by far the most comprehensive study dealing with leisure and tourism destination choice specifically in the Alpine regions was conducted for Switzerland by Tschopp et al. (2010). Although the objectives and spatial area of their work are similar to the ones defined in current research, they concentrate merely on the arrival/departure trips to/from the final destinations for both leisure and tourism purposes. Moreover, their destination choice model for holiday trips is limited only to the winter season (skiing activities) and to the trips of Swiss citizens. An example of a more locally and less state-wide focused study is the one by LaMondia and Bhat (2013), who applied the Multivariate Binary Probit model to study the visitors' leisure travel behavior in Northwest Canada. Scarpa et al. (2008) analyzed the destination choice of members of the Italian Alpine Club (CAI) for one-day outdoor trips in the Alps and discovered that, except travel cost, also difficulty of hiking trails and number of mountain huts influence the decisions, while Scarpa and Thiene (2004) concentrated only on climbers and mountaineers and found travel cost, severity of the environment and number of alpine shelters to be influential factors.

2.4 Mode choice on vacation

Although transport mode choice is relatively well represented in tourism literature, studies using discrete choice methods are very scarce. Much research with discrete choice has been done in the fields of tourism demand (Morley, 2012), significantly less in long-haul tourism destination choice (LaMondia et al., 2010) and very little in modeling transport mode choice (Thrane, 2015).

Transport mode choice is strongly dependent on the destination choice and hence they should be considered and modeled jointly, which has been repeatedly demanded in the literature (LaMondia et al., 2010; Masiero and Zoltan, 2013). Clearly, the decision about transport mode choice for local trips within the vacation region depends strongly on the initial decision about transport mode for long-distance trip

to the destination (Bieland et al., 2017; Gross and Grimm, 2018). However, this relationship also works the other way around – the choice of transport mode for travel to the destination can be driven by factors related to on-site mobility. Visitors decide to travel to Alpine regions by car for fear of insufficient mobility at their destination and inflexibility of public transportation (Bursa and Mailer, 2018). In such a case, private car provides a high degree of independence and usually ensures the most effective utilization of time. Luggage transport is another factor deterring tourists from choosing transport mode other than car for their vacation trip (Böhler et al., 2006).

As far as the intra-destination mobility of tourists is concerned, a broad description of factors is included in Le-Klähn and Hall (2013). They found out that lack of information and personal preferences are the most common explanations for not using transit services in rural tourism sites. Additionally, not every single tourist spot in rural regions is accessible by public transport, which discourages the exploration-focused tourists from relying only on public transport services on-site. In urban areas on the other hand, tourists value the ease of use, efficiency and personal safety when choosing public transport, and parking facilities when driving private car, as Thompson and Schofield (2007) point out. Dickinson and Robbins (2008) also narrowed their research to rural destinations. In addition to general convenience and need to carry equipment as the main reasons for choosing private car, they also highlight a strong car attachment of some visitors who do not even consider alternatives no matter their availability, price, or other attributes. Gross and Grimm, in their review paper (2018), synthesized outcomes of many existing studies and found that, above all, sociodemographic factors, transport mode for travel to the destination, travel duration and travel cost, and type of vacation (organized or individual travel) play a role in transport mode choice at the destination. The potential influence of weather is discussed separately in section 2.6.

Within the alpine setting, specific factors affecting transport mode choice for the long-distance travel as well as for trips at the destination have been investigated by Rüger and Mailer (2020) and Bieger and Laesser (2013), who revealed that the family/group size and transport of sport luggage (e.g., skiing equipment, mountain bike) is dominant in the decision process, particularly in the winter season. Masiero and Zoltan (2013) applied a probit model for the mode choice of tourists in the Swiss canton of Ticino and observed, among other things, that domestic tourists and returning visitors (i.e. tourists who have been to the region before) are more likely to use public transportation, whereas older tourists and male tourists are more inclined to use private cars. The work by Pettebone et al. (2011) provides insights into mode choice at the destination from an American perspective. They found that visitors to the Rocky Mountain National Park are willing to switch from private car to shuttle bus if it enhances their chances of being in the park with fewer other people.

Unfortunately, none of the existing studies analyzed the importance of travel time and travel cost for the transport mode choice of tourists traveling within the destination in a quantitative way, which is a distinct gap in the research, making it impossible to apply a monetary measure to improvements or deteriorations in attributes of the available modes (e.g. higher transit frequency or longer travel time).

2.5 Route choice on vacation

Route choice is another element of the set of decisions that have to be made when planning a trip. The majority of studies on route choice behavior to date have concentrated on dense urban networks. This is understandable because these are the most challenging environments – urban networks are large, multimodal and the route choice plays a significant role in traffic management. In contrast, research on route choice in non-urban areas is very scarce. Tourism researchers address the topic from the perspective of destination management and roadside tourism facilities (Denstadli and Jacobsen, 2011), which is unusable for transport modeling purposes. However, they provide some interesting observations about how tourists differ in their route choice behavior from local residents, which should be considered when developing models of tourist route choice.

Lew and McKercher (2006) have raised the issue of tourists not possessing full knowledge about the transport system in the region they visit. They highlight the influence of topography on transport networks in mountainous regions, which makes the whole route choice process unlike in flat areas (shortest/fastest route). They also mention the factor of picturesqueness of routes that often prevails over travel time or distance when choosing a route to the destination or moving around within the destination. This is in line with Jacobsen (1996) who discovered that the views and landscape experience are cherished by motor tourists surveyed in Norway. The component of visual attractiveness of a route plays

a particularly important role on discretionary (i.e. non-work) trips, according to Ben-Akiva et al. (1984), who found that the disutility of travel time on non-scenic roads is about five times the disutility of travel time on scenic roads. Problematic is however how to define picturesqueness and how to quantify the scenic attributes of a route. Alivand et al. (2015) developed a very promising approach capable of computing scenery-related attributes ranging from road curviness to the viewshed from the road elements using data from different sources and providers e.g. volunteered geographic information (VGI), digital terrain model (DTM), *TomTom*, *Panoramio* geo-tagged photos, *Google Earth*, census data etc. They found that an increased presence of water bodies, mountains, forests and parks along a route positively contributes to the probability of choosing it as a scenic route, whilst urban areas along the route decrease this probability.

The common use of the built-in and external GPS navigation devices among tourists should not be neglected. In the context of car use, it is supposed to lead to tourists sometimes having even better knowledge about traffic conditions than local residents, who rely on their habits, common sense and heuristics (Prato et al., 2012). This, however, does not (yet) apply to the knowledge about parking facilities at tourist attractions.

Yet, routing decisions of travelers in mountain regions have not been analyzed by scholars so far. Presumably because alpine network systems provide limited routing alternatives. However, the valuation of the route's visual component as well as its windingness, steepness and the resulting difficulty to drive may be influential on visitors' other travel choices. In particular, the attractiveness of the route and the corresponding travel experience may lead to the phenomenon of undirected travel *"…in which travel is not a byproduct of the activity but itself constitutes the activity"* (Mokhtarian et al., 2001; Mokhtarian and Salomon, 2001). In other words, visitors might opt for car to be able to drive the scenic roads and stop for taking photos or choose train to observe nature from its panoramic windows. That is, they treat the ride itself as part of the vacation experience, not just the unpleasant necessity of relocation from A to B, which is a valid concept in daily commute (Singleton, 2020).

2.6 Impact of weather

Typical activities performed by tourists in mountain regions, e.g. hiking, climbing, cycling or skiing, are obviously weather-dependent. It can be argued that if the participation in an activity is weather-dependent, then the choice of location where the activity is conducted and the choice of transport mode used to reach that location may be affected by weather too. It is therefore worth investigating how and to what extent tourists at destinations adapt their travel behavior to (unfavorable) weather conditions and whether they react differently than at home. This section provides an overview of what is already known in terms of weather effects on various facets of transportation and tourism.

In the context of everyday travel, there is abundant evidence that precipitation correlates positively with congestion and accident frequency (Andrey et al., 2003; Golob and Recker, 2003). It also negatively affects the performance of transportation networks and traffic flow and thus travel time and travel time reliability (Maze et al., 2006), yielding larger effects of snowfall than of rainfall (Hranac et al., 2006). But, as Koetse and Rietveld (2009) conclude in their review paper, the average effects of weather on traffic volume, daily travel and commute patterns are of low magnitude and compensate each other in the long run (more leisure trips thanks to higher temperatures; less leisure trips due to longer heavy rains). There is, however, more clear evidence at the level of specific transport modes and instantaneous response of travelers to adverse weather. In particular, the use frequency of active modes – cycling and walking – decreases significantly in the presence of rain, very low or very high temperatures and strong wind (Sabir, 2011; Saneinejad et al., 2012). In the case of cycling, the effect is remarkably large for leisure trips, while bicycle commuters are more weather resistant (Heinen et al., 2010; Liu et al., 2015). Compared to cycling, walking starts to become weather-sensitive in case of a very sharp temperature drop or very intense rain. Studies on weather effects on the choice of private car and public transportation provide weaker outcomes than for active modes. In urban environments, adverse weather interacts strongly with other attributes such as traffic congestion, crowding and punctuality of transit, and the effects differ between cities, days of the week and population segments (Anta et al., 2016). In general, however, there is a distinct shift from walking and cycling to driving and transit in case of rain or snow (Sabir, 2011).

The influence of weather on tourism cannot be neglected, since the whole industry relies to a great extent on "good weather" (Day et al., 2013). Heavy rains, heat waves and frequent storms of increasing

severity can negatively affect local tourism markets. Also mountain regions have to face challenges and risks induced by climate change such as increasing snow uncertainty in winter and the resulting decline in demand (Elsasser and Bürki, 2002; Gössling and Hall, 2006; Koenig and Abegg, 1997), or extended summer seasons leading to intense traffic on alpine roads and mountain passes (Cavallaro et al., 2017). However, the evidence on if and how tourists' weather experiences influence their behavior is complex, ambiguous and segment- and region-dependent (Gössling et al., 2012). While, in general, weather is considered one of the strongest destination attributes and one of the most powerful motivators for tourism (Kozak, 2002), it must not always be a decisive factor. As far as the planning stage is concerned, according to Pröbstl-Haider et al. (2015), tourists may not perceive weather as a determinative decision component when choosing an alpine summer destination, as other factors (e.g. leisure attractions) often play a more important role. In terms of the effect during the stay, both Scott et al. (2008) and Steiger et al. (2016) found the absence of rain to be particularly important for visitors to mountain areas and their overall satisfaction, with a caveat that there are large differences between age groups, nationalities or first-time and returning tourists. However, satisfaction levels might not necessarily be reflected in the real behavior, and the nature of the visit as well as the attraction mix must be considered. McKercher et al. (2014) analyzed the GPS tracks of visitors to Hong Kong and found that urban tourists are rather indifferent to weather, in particular if they are staying only for a short period or on a tight budget. Similar resilience to weather, increasing with the length of stay, was found among campers in Canada (Hewer et al., 2017). Also in non-urban settings – as Becken and Wilson (2013) argue in their case study of New Zealand – tourists may have a great dose of understanding and acceptance of inclement weather, in particular if they are aware of and prepared for the unstable and variable weather that often occurs on New Zealand's islands (which is also the case of the Alps in Europe). They do not search for the most optimal choice, but rather proceed with the plan unless some threshold is exceeded and the weather turns very unappealing. However, whether the same holds for tourists' short-term transport mode choices or whether the effects of precipitation and temperature on choosing active transport modes are of the same magnitude as known from studies on everyday mobility remains unexplored.

3 Survey design

Researchers conducting studies on daily travel behavior usually have good-quality datasets at their disposal (see for example Aschauer et al. (2018) and Sammer et al. (2011) for Austria, Axhausen et al. (2000) for Germany, Bundesamt für Statistik (BFS) (2017) for Switzerland, NatCen Social Research (2019) for the UK and Federal Highway Administration (2017) for the US). These studies deal with local populations and serve as a basis for creating policies at regional or national levels. Consequently, government departments and agencies provide funding to ensure sufficient sample size and thus representative results.

This is not the case in tourist travel, which, despite being responsible for a substantial part of transport problems in countries with developed tourism industries (e.g. Austria, Italy, Switzerland), does not receive enough attention from policy-makers.

This study proposes a trade-off and attempts to achieve an acceptable sample size with a limited budget. By asking respondents to report on two days of their stay, fewer people need to be interviewed, which is very time-consuming and costly in the case of tourists. At the same time, limiting the diary length to two days keeps the response burden at a moderate level.

3.1 Travel pattern of a tourist

The conceptual representation of a full travel pattern of a tourist is given in Fig. 1. In its simplest form (i.e. no "road-trip" with multiple destinations), it is comprised of:

- Long-distance trip from home to the destination.
- At least one-night-long stay at the destination, during which activities are performed and tours are made.
- Long-distance return trip home.

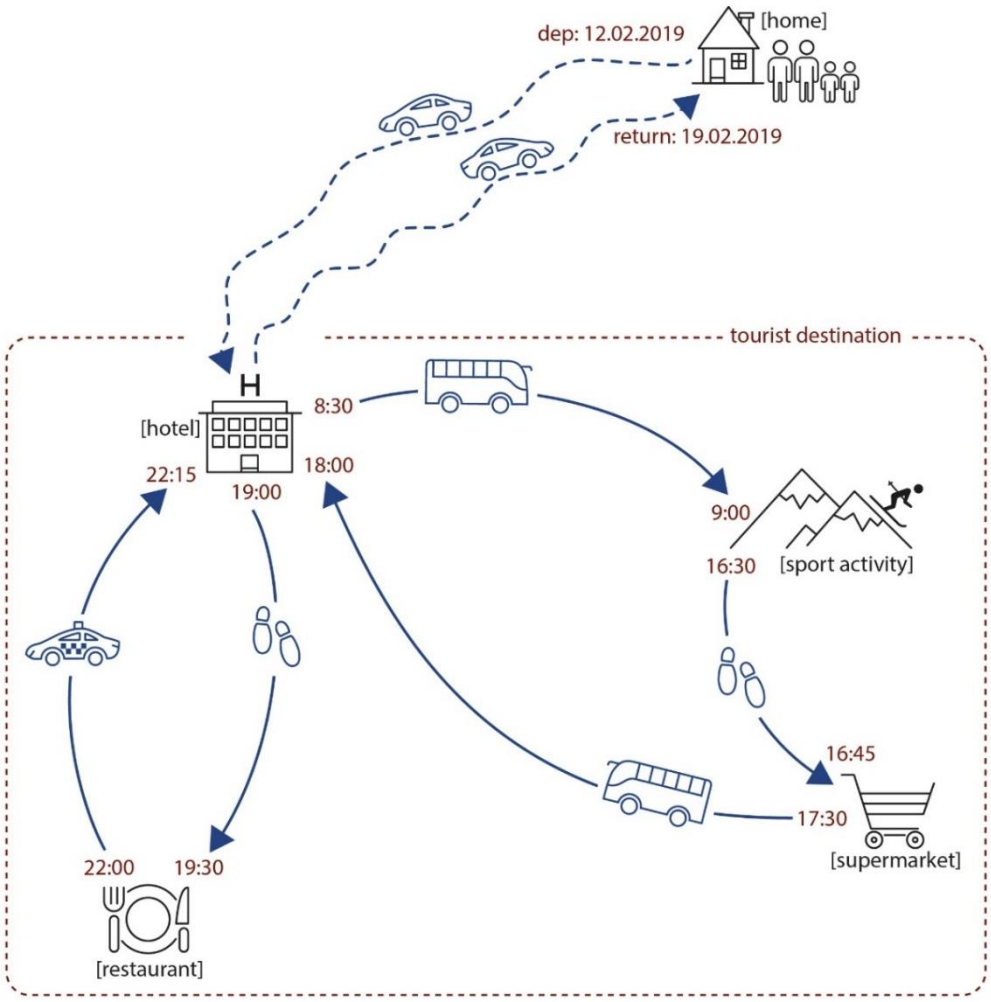


Fig. 1 Example of a tourist daily schedule with arrival and return trips to and from a tourist destination

3.2 Survey location

Three tourist regions were selected as locations for data collection: the Ötztal valley, the Zillertal valley and the region Hohe Salve. All three are located in the province of Tyrol in Austria (Fig. 2 and Fig. 3) and are characterized by extensive tourism industry (Table 1).

Table 1 Characteristics of the survey regions[a]

	Ötztal	Zillertal	Hohe Salve
Area [km^2]	881	1098	217
Residents	18,277	37,140	15,931
Accommodations	309	467	45
Beds[b]	27,865	51,457	5,826
Ski resorts	6	4	1
Ski slopes length [km]	326	535	258
Arrivals – Summer 2019	358,079	666,054	76,766
Overnights – Summer 2019	1,248,163	2,830,628	296,530
Arrivals – Winter 2018/19	618,600	882,405	66,459
Overnights – Winter 2018/19	2,903,563	4,584,125	312,437

[a]According to Abteilung Raumordnung und Statistik, Land Tirol, 2019
[b]Data from winter 2017/18.

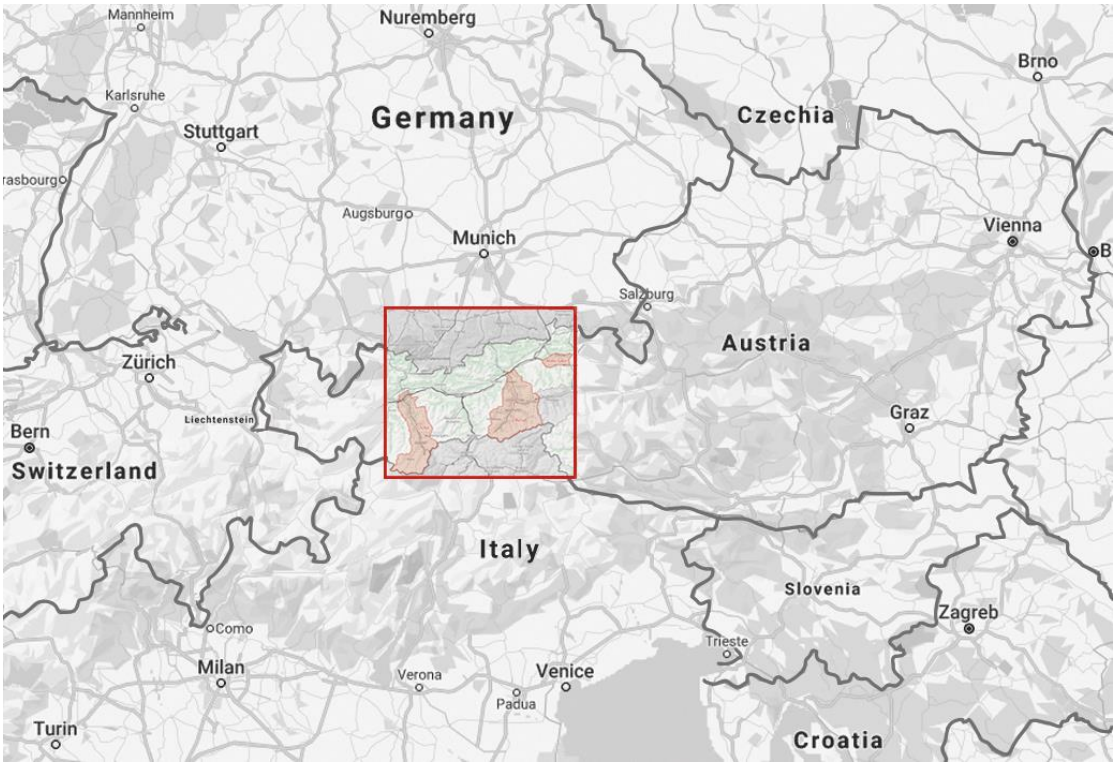


Fig. 2 Location of the study area on the map of Austria and its neighboring countries. Red-colored rectangle is presented in detail in Fig. 3

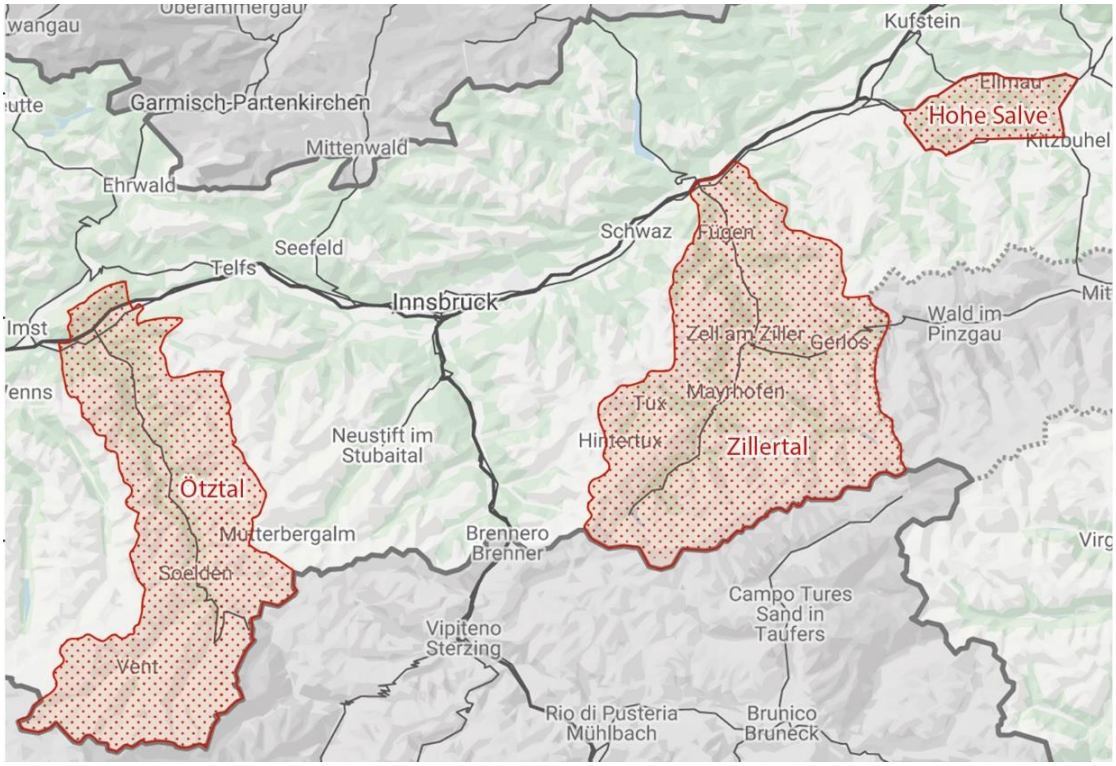


Fig. 3 Location of the tourist regions Ötztal, Zillertal and Hohe Salve (red dotted areas) in the province of Tyrol (color map) in Austria

3.3 Survey methods

Despite the benefits of automated and semi-automated data collection methods based on GPS (as described in section 2.2 and by Prelipcean et al. (2018)) and obvious drawbacks resulting from using a memory-based approach, the survey was designed as a revealed preference (RP) single cross-sectional survey in two forms: as a PAPI (Paper-and-Pencil Interview) survey and CAPI (Computer Assisted Personal Interview) survey conducted with tablet computers.

The choice of these instruments is justified by the characteristics of today's tourists, who prefer shorter but more frequent stays and booking on short notice, which results in organizational difficulty to contact them before the study, equip them with automated devices, instruct and advise during the study and collect the devices before they return home. Furthermore, the burden concerning software deployment for semi-automated measurements with smartphones was too large for the study.

The initial plan was to conduct the survey exclusively using self-administered PAPI questionnaires distributed in accommodations in the three regions, following the principles proposed by Cambridge Systematics Inc. (1996). This approach would have facilitated the control over the sampling process. However, recruiting the hotels to participate in the survey turned out to be a major hurdle. The only successful way to approach the hotel owners about the project was through the local DMO. The DMO employees knew which hoteliers in the area could be potentially willing to cooperate and were capable of convincing some of them to participate. Contacting them directly was ineffective and resulted in refusals justified by lack of time or human resources and concerns about disturbing guests during their vacation time (cf. Tschopp et al., 2010). All in all, however, the response rate proved extremely low (see section 3.5) and hence the survey method was changed to assisted PAPI and CAPI interviews conducted on-site in highly frequented locations spread over the valleys:

- Ski lodges, bars and restaurants
- Local hot-spots such as amusement parks, wellness and spa centers, hot springs
- Recreation facilities such as lakes, parks and playgrounds
- Sport facilities such as mountain bike trails, hiking paths

This change resulted in a loss of control over the sampling – a pure convenience sampling was now used. It inevitably implies that the results from the sample cannot be easily generalized to the entire study population (Lavrakas, 2008; Sirakaya-Turk et al., 2017).

A team of trained interviewers conducted interviews on selected days during the winter and summer peak season at various tourist sites. Both fully and partially assisted interviewing methods were tested. In the latter method, the interviewers assisted more than one person at a time and switched to a fully assisted personal interview only when they noticed difficulties or someone giving low-quality answers.

In the on-site survey, incentives proved ineffective, which to some extent contradicts what is known from the literature (Simmons and Wilmot, 2004; Singer and Ye, 2012; Tooley, 1996). However, studies on the impact of incentives have so far concentrated only on household surveys. Both monetary (5 EUR banknotes) and non-monetary (promotional items) incentives were tested. We could observe that, although incentives convinced some negatively oriented guests to fill out the questionnaire (which they presumably would not have done otherwise), the quality of their answers was low (blank fields, inadequate answers). On the other hand, among the positively oriented tourists, the motivation to fill out the questionnaire and the quality of their answers was not affected by the incentives, as they were willing participate anyway.

Regarding the quality of responses, despite the attached instructions for filling out the questionnaire as well as an example of a filled diary, respondents struggled to distinguish between trips and activities. Due to a high response burden, dropouts were not uncommon while filling out the questionnaire.

We argue that only a fully assisted interview and completing the questionnaire in the constant presence of the interviewer can guarantee good-quality results. Tourists approached in local tourist hotspots such as ski lodges must fill out the questionnaire in limited time (lunch break) and space (small tables) and under generally inconvenient conditions (children interrupting, wet clothes). This is a completely different environment compared to household surveys, where respondents can choose a suitable place, moment and take their time (e.g., to read the instructions). Additionally, various interaction techniques had to be used so as not to deter guests from completing the lengthy questionnaire, such as approaching only selectively chosen tables or approaching children first, who then, if they find it entertaining, convince parents to participate.

3.4 Survey instrument

Three fundamental parts constitute the survey instrument:

- Personal questions
- Questions about the stay and travel to the destination
- Activity diary

In addition to these elements, the questionnaire also contained text informing the respondent about purpose of the research, research team, processing of personal data, and estimated time for completing the survey. Further, the paper questionnaire contained instructions for answering the questionnaire and an example of a completed diary. Fig. 17 to Fig. 20 in the appendix present the physical design of the paper questionnaires used in the PAPI survey. The CAPI forms were implemented in the SoSci Survey on-line system (Leiner, 2020) and have an identical content. The survey instrument was prepared in both English and German. The following sections describe the content of the questionnaire and provide reasoning for the selection of questions.

3.4.1 Personal questions

According to Crawford et al. (1991) and Godbey et al. (2010), participation in leisure activities is subject to intrapersonal, interpersonal and structural constraints. Therefore, in this section, data on factors constituting these constraints were collected using variables such as gender, age, nationality, education/employment status, age and number of children, health/fitness level and car availability.

The selected tourist regions of Ötztal, Zillertal and Hohe Salve are very sport-oriented, both in winter and in summer. While information on sport activity of tourists during their stay is collected through the activity diary, our questionnaire also collects data on guests' physical activity at home. It is argued that frequency of sport activities in daily life influences sport-related behavior on vacation (De Knop, 2007).

3.4.2 Questions about the stay and travel to the destination

Lew and McKercher (2006) have classified the factors influencing local travel behavior of tourists into three categories:

- The size and expenditure of tourist time budget
- Personal motivations, interests and travel group composition
- Tourist knowledge of the destination

In this section, respondents were asked basic questions about the length of stay, exact place of stay, travel party composition and transport mode used for travel to the destination. By collecting information on the exact arrival and departure dates of visitors, one can analyze the effect of the (fixed) length of stay, as well as the effect of the (varying) moment of the stay, represented by the elapsed fraction of stay. This is driven by two hypotheses. The first one posits that with the vacation days going by, people are becoming more relaxed[4], and hence, may react less negatively to travel time. Their positive attitude might also follow a non-linear curve, as proposed by Lin et al. (2014), reaching its peak around the middle of the stay. The second one assumes the opposite – visitors are becoming more stressed and impatient and hence are reacting more negatively, which would be in line with the findings of Nawijn et al. (2013).

According to LaMondia and Bhat (2013), tourists tend to have a main purpose characterizing the long-distance activity component of their holiday trip, which then drives them to choose a particular destination and particular activities. The topic of holiday and leisure motivations has been intensively studied by many researchers who developed different measurement scales and items (Beard and Ragheb, 1983; Crompton, 1979; Iso-Ahola, 1984; Ryan and Glendon, 1998). Given the restricted space in the questionnaire, eight predefined purpose categories were proposed (see the Appendix).

According to Lehto et al. (2004), whether a tourist has visited a destination before or it is their first visit, affects their knowledge about the destination (activities and attractions, local transportation), which ultimately influences their activity and travel choices on-site. The same applies to whether a destination

[4] The phenomenon of positive vacation effect on travelers' happiness and well-being is widely researched and its existence is confirmed (see for example Gilbert and Abdullah (2004) and Sirgy et al. (2011)). There is, however, no consensus on its dynamics over the course of the vacation stay. Nor is there any work so far that studied this phenomenon in the context of perception of travel time or travel cost.

is the main and only place of stay during vacation or is it one of many stops. A touring trip implies different on-site behavior than stationary vacation (Lew and McKercher, 2006). Questions regarding these two aspects have been incorporated in the survey.

The information search behavior is considered crucial for tourists' knowledge about the destination (Bieger and Laesser, 2016; Fodness and Murray, 1999; Gursoy and McCleary, 2004; Klassen, 2001). Therefore, two additional questions were asked, aiming to find out how, if at all, visitors inform themselves in advance about the journey to the destination and about the mobility on-site.

3.4.3 Activity diary

The travel-activity diary operates on a selection of terms proposed by Axhausen (2008), that is, trip, tour and activity. An activity-oriented approach was applied for the design of the diary, since it is the activities, not trips that are of greater importance and interest for people during vacation, and hence should prove more effective for the respondents to recall their movements. All travel data was collected at the resolution of trips. Stages (trip legs) were ignored in the survey.

In the activity diary, the respondents were asked to give information on all the activities that they performed out of their accommodation during two days of their stay. The diary included questions on the exact type and location of the activity, start/end time, as well as expenses, company and the influence of weather on the activity choice. Furthermore, information about trips made between the activities was collected, including transport mode, cost, company, impact of weather etc. The activities performed at the accommodation were disregarded, since they do not induce any travel in the transport network.

The design of the diary draws from the existing well-established examples of household travel surveys (HTS) including the American *NHTS (National Household Travel Survey)* (Federal Highway Administration, 2017), the German *Mobidrive* (Axhausen et al., 2000) as well as the Austrian *Österreich Unterwegs* (Sammer et al., 2011) and *MAED (Mobility-Activity-Expenditure-Diary)* (Aschauer et al., 2018), all based on the trusted *New KONTIV Design* (Brög, 2009), and transposes them into the field of tourism. So as to keep the response burden in the PAPI survey low, the activity diary for two days along with personal, situational and preference questions was fit on a single A3 sheet (half-fold). The PAPI diary takes 50% of the questionnaire (two A4 pages) and provides space for 7 activities and 8 trips per day. In the case of the CAPI survey, the on-line questionnaire included exactly the same questions as the paper version. Automated rules controlled the data quality, correctness of variable types and detected missing answers. This, together with the positive effect of the interviewers conducting the CAPI survey, resulted in noticeably better quality of the collected data.

In contrast to typical HTS questionnaires, we decided not to provide any predefined activity types in the questionnaire. While reliable and validated categories have been developed for daily activities (e.g., work, education, pick-up/drop-off, shopping, leisure), it is very difficult to create categories for all possible leisure activities (although there are some attempts, see Lanzendorf (2002)). Therefore, it is common to ask the respondent for their own detailed description of the performed activity (Axhausen, 2015) and classify it afterwards.

With regard to the influence of weather on the activity and mode choice, the respondents were asked to indicate whether they chose the activity/mode that they had planned to choose or whether they had to choose another ("plan B") activity/mode because of the (unfavorable) weather. This novel approach makes it possible to directly capture the impact of weather on every decision made during the reported day. In combination with historical weather measurement data for the survey dates, it is a very powerful dataset. In the few existing studies (Liu et al., 2016; Termida et al., 2016), only the information on subjective weather perception on a given day was collected.

3.5 Survey participation and response burden

As long as the choice and wording of survey questions and the definition of the survey area were relatively comprehensive and manageable tasks, the actual implementation of the survey in a tourist region was a much more complex undertaking. The most difficult issues included the choice of the survey method, distribution method for the PAPI questionnaires, arranging meetings with accommodation providers, convincing them to participate in the project, defining incentives and finding a way to reach out to guests in the field and to overcome their participation and response burden. A summary of these efforts is provided in Table 2.

Table 2 Summary of the survey protocol depending on survey region, wave, method and language

Season	Region	Wave	Method	Incentives	Language	Conducted PAPI/CAPI interviews	Distributed PAPI questionnaires	Returned PAPI questionnaires
Summer	Ötztal	16-19.7.2019	CAPI	Promotional items	EN	15	-	-
					DE	139	-	-
		31.7-2.8.2019	CAPI	Promotional items	EN	2	-	-
					DE	12	-	-
		31.7-3.8.2019	CAPI	Promotional items	EN	4	-	-
					DE	26	-	-
		20-23.8.2019	CAPI	Promotional items	EN	17	-	-
					DE	109	-	-
	Zillertal	26-30.7.2019	CAPI	Promotional items	EN	4	-	-
					DE	44	-	-
		26.8-4.9.2019	CAPI	Promotional items	EN	1	-	-
					DE	38	-	-
Winter	Ötztal	12.2018-4.2019	PAPI self-administered	No	EN	-	270	0
					DE	-	370	28
		25-27.12.2018	PAPI	Promotional items	EN	45	-	-
					DE	41	-	-
		4-5.1.2019	PAPI	5 EUR banknotes	EN	14	-	-
					DE	75	-	-
		27.2-1.3.2019	PAPI	Promotional items	EN	12	-	-
					DE	60	-	-
	Zillertal	18-20.2.2019	PAPI	Promotional items	EN	40	-	-
					DE	77	-	-
	Hohe Salve	8.3.2019	PAPI	Promotional items	EN	15	-	-
					DE	31	-	-
					Sum	**821**	640	**28**

For the paper questionnaire with a travel-activity diary for two days, the total response burden was calculated following the methodology by Axhausen et al. (2015). In the minimum scenario of only one activity and two trips per day, the response burden is 381, whereas the maximum case of seven activities and eight trips (all boxes filled) results in a response burden of 1309. Employing their regression equation, one would expect a response rate of 8.00% to 24.35% respectively.

Out of the 640 questionnaires (270 in English, 370 in German) distributed in the hotels during the winter season, only 28 were returned, yielding an average response rate of 4.4%. It is below the lower bound of the range estimated using the method by Axhausen et al. (2015). Potential reasons for that are:

- Difficulties in recruiting hotels for the study that are truly willing to cooperate.
- No control over if, how, when and to whom the questionnaires were distributed after they were handed over to the hotel.
- Possibly negative mediating role of the reception staff (not all questionnaires were distributed; guests were not sufficiently encouraged to participate).
- Questionnaires were lost in several cases.

In the face of a very low response rate, the remaining part of the PAPI survey was conducted in form of (semi-) assisted interviews where dropouts were no longer noted. There were refusals when interviewers approached potential respondents, but interviewers were not obliged to report this. In the CAPI survey, which was also conducted in the form of an interview as well, all started interviews were completed, and denials were not reported.

4 Descriptive analysis

4.1 Complementary datasets

The survey results comprise the primary data source used in the paper. These data are complemented by following secondary datasets:

- Historical weather data
- Geodata from *Google Maps* API
- Geodata from the regional transportation model
- Accommodation data from booking systems of the tourist regions

Historical weather data were obtained from the Central Institution for Meteorology and Geodynamics (*Zentralanstalt für Meteorologie und Geodynamik, ZAMG*) in Austria. The data include measurements of air temperature, precipitation, cloud cover, wind speed and snow depth, and were collected at one-hour resolution from following six monitoring stations:

- Haiming, 669m a.s.l.
- Umhausen, 1035m a.s.l.
- Obergurgl, 1942m a.s.l.
- Mayrhofen, 640m a.s.l.
- Söll, 697m a.s.l.
- Innsbruck, 578m a.s.l.

Information about lodging comprises:

- object type (hotel, guesthouse, apartment, camping)
- standard (only for hotels, represented by star rating)
- price per person per night (in EUR) in summer and winter
- price per room/apartment per night (in EUR) in summer and winter

4.2 Data cleansing

In order not to lose valuable observations where only few items were missing, it was necessary to impute the missing data. The multiple imputation method was chosen (van Buuren, 2018), as it delivers less biased results than the ad-hoc solutions (e.g. mean imputation) (Andridge and Little, 2010). The *missForest* package for *R* (Stekhoven and Bühlmann, 2012) was used for the following variables: income, age, gender, education, employment, country of residence, nationality, car availability, car use frequency, driver's license possession, main transport mode for travel to the destination, main purpose of stay, number of adults in household, number of children under 6, number of children aged 6 to 17, length of the stay, knowledge about travel options to the destination, knowledge about on-site mobility, sport frequency, time spent on sport,, and hotel-related variables. The results presented in the following sections are based on data after the imputation process.

Regardless of the data imputation, following exclusion rules were employed:

- The only respondent from a group/family is below 18 (assumed not to be the decision-maker in a family/group).
- Respondent's place of stay is outside the study area.
- The answer quality is unacceptable (contradictory answers, misunderstood questions).

As a result, out of 849 questionnaires 224 were eliminated (predominantly PAPI questionnaires from winter) and 625 remained (388 in summer and 237 in winter) (Table 3). The descriptive results are reported at the level of individual respondents (unless otherwise specified).

Table 3 Valid responses depending on survey method and season

Share of responses	Summer		Winter	
	Number	%	Number	%
Self-administered PAPI	0	0	25	10.5
PAPI	0	0	212	89.5
CAPI	388	100	0	0
Sum per season	388	62.1	237	37.9
Sum total	625			

4.3 Characteristics of the respondents

4.3.1 Socio-demographics

Table 4 provides a statistical summary (group frequencies and mean values) of the respondents' sociodemographic characteristics from the summer and winter survey periods.

Table 4 Sociodemographic description of the sample

Variable	Value	Summer		Winter	
		Number	%	Number	%
Age		Mean (SD): 47.7 (15.0)		Mean (SD): 39.3 (14.2)	
	6-17	4	1.0	7	3.0
	18-24	26	6.7	44	18.6
	25-40	98	25.3	69	29.1
	41-64	207	53.4	111	46.8
	65+	53	13.7	6	2.5
Gender	Female	210	54.1	109	46.0
	Male	176	45.9	128	54.0
Residence country	Germany	238	61.3	142	59.9
	Austria	82	21.1	12	5.1
	Netherlands	20	5.2	38	16.0
	Switzerland	11	2.8	6	2.5
	Italy	6	1.6	0	0.0
	France	5	1.3	1	0.4
	UK	5	1.3	21	8.9
	Other	21	5.4	17	7.2
Education	Primary level	25	6.4	5	2.1
	Secondary level (high school)	125	32.2	36	15.2
	A-levels / High school diploma	98	25.3	72	30.4
	University degree (Bachelor's, …	140	36.1	124	52.3
Employment	Full-time employed	191	49.2	135	57.0
	Retired	72	18.6	7	3.0
	Part-time employed	54	13.9	13	5.5
	Pupil or student	27	7.0	43	18.1
	Doing housework, looking after…	21	5.4	8	3.4
	Self-employed / own business	21	5.4	28	11.8
	Unemployed or looking for a job	2	0.5	0	0.0
	Apprentice or trainee	0	0.0	3	1.3
Household size		Mean (SD): 2.72 (1.4)		Mean (SD): 2.85 (1.28)	
	3	1	0.3	0	0.0
	4	59	15.2	39	16.5
	5	151	38.9	66	27.9
	6	57	14.7	49	20.7
	7	86	22.2	60	25.3
	8	27	7.0	21	8.9
	>8	7	1.9	2	0.8
Number of children under 6 in the household	1	334	86.1	0	0
	2	40	10.3	214	90.3
	3	13	3.4	15	6.3
	4	1	0.3	8	3.4
Number of children 6-17 in the household	1	274	70.6	152	64.1
	2	57	14.7	46	19.4
	3	47	12.1	28	11.8
	4	8	2.1	11	4.6

Variable	Value	Summer		Winter	
		Number	%	Number	%
	5	2	0.5	0	0
Monthly net household income in EUR	< 1,000	20	5.2	26	11.0
	1,000-2,000	53	13.7	16	6.8
	2,001-3,000	106	27.3	26	11.0
	3,001-4,000	95	24.5	39	16.5
	4,001-5,000	35	9.0	41	17.3
	5,001-6,000	14	3.6	17	7.2
	6,001-7,000	22	5.7	22	9.3
	7,001-8,000	8	2.1	12	5.1
	8,001-9,000	4	1.0	14	5.9
	9,001-10,000	3	0.8	4	1.7
	10,001-12,000	3	0.8	3	1.3
	12,001-14,000	8	2.1	2	0.8
	14,001-16,000	3	0.8	2	0.8
	16,001-18,000	10	2.6	3	1.3
	18,001-20,000	1	0.3	1	0.4
	> 20,000	3	0.8	9	3.8
Annual leave (days)		Mean (SD): 17.6 (6.3)		Mean (SD): 17.7 (6.9)	
Nights away in the last year	I did not go away	8	2.1	2	0.8
	1-5 nights	23	5.9	8	3.4
	6-10 nights	70	18.0	18	7.6
	11-20 nights	144	37.1	54	22.8
	21-30 nights	82	21.1	69	29.1
	More than 30 nights	61	15.7	86	36.3
Driver's license	No	20	5.2	23	9.7
	Yes	368	94.8	214	90.3
Car availability	Never	54	13.9	18	7.6
	Sometimes	44	11.3	28	11.8
	Always	290	74.7	191	80.6
Car use frequency	Less than once a month	26	6.7	8	3.4
	1-3 times a month	45	11.6	29	12.2
	1-3 days a week	92	23.7	42	17.7
	4-6 days a week	64	16.5	37	15.6
	Daily	161	41.5	121	51.1
Health status	Very bad	2	0.5	1	0.4
	Bad	5	1.3	0	0.0
	Fair	52	13.4	6	2.5
	Good	154	39.7	97	40.9
	Very good	175	45.1	133	56.1
Physical limitations	Severely limited	6	1.6	2	0.8
	Limited but not severely	87	22.4	18	7.6
	Not limited at all	295	76.0	217	91.6
Sport frequency (days in a week)	0	63	16.2	13	5.5
	1	76	19.6	34	14.4
	2	88	22.7	65	27.4
	3	59	15.2	53	22.4
	4	38	9.8	23	9.7
	5	35	9.0	26	11.0
	6	6	1.6	9	3.8
	7	23	5.9	14	5.9
Sport time (hours in a week)		Mean (SD): 3.70 (3.6)		Mean (SD): 4.60 (4.0)	

There are notable differences between the seasons. Winter tourists are substantially younger and better educated. They are also more professionally active and possess higher incomes. Their health is better, possibly because they are more physically active. Summer visitors on the other hand are older, less educated, often already retired or working part-time. They have less disposable income, lower car availability and use private cars less often than winter guests. Visitors from Germany dominate in both seasons. Noteworthy, they are followed by Austrian domestic tourists in summer, whilst in winter Dutch tourists come in second place.

Fig. 4 illustrates correlations between selected sociodemographic variables. The categorical variables with a self-explanatory order of levels, that is, education, employment, income, and health, were transformed into numeric variables, assuming the lowest level equals 1 and all higher levels are equidistant.

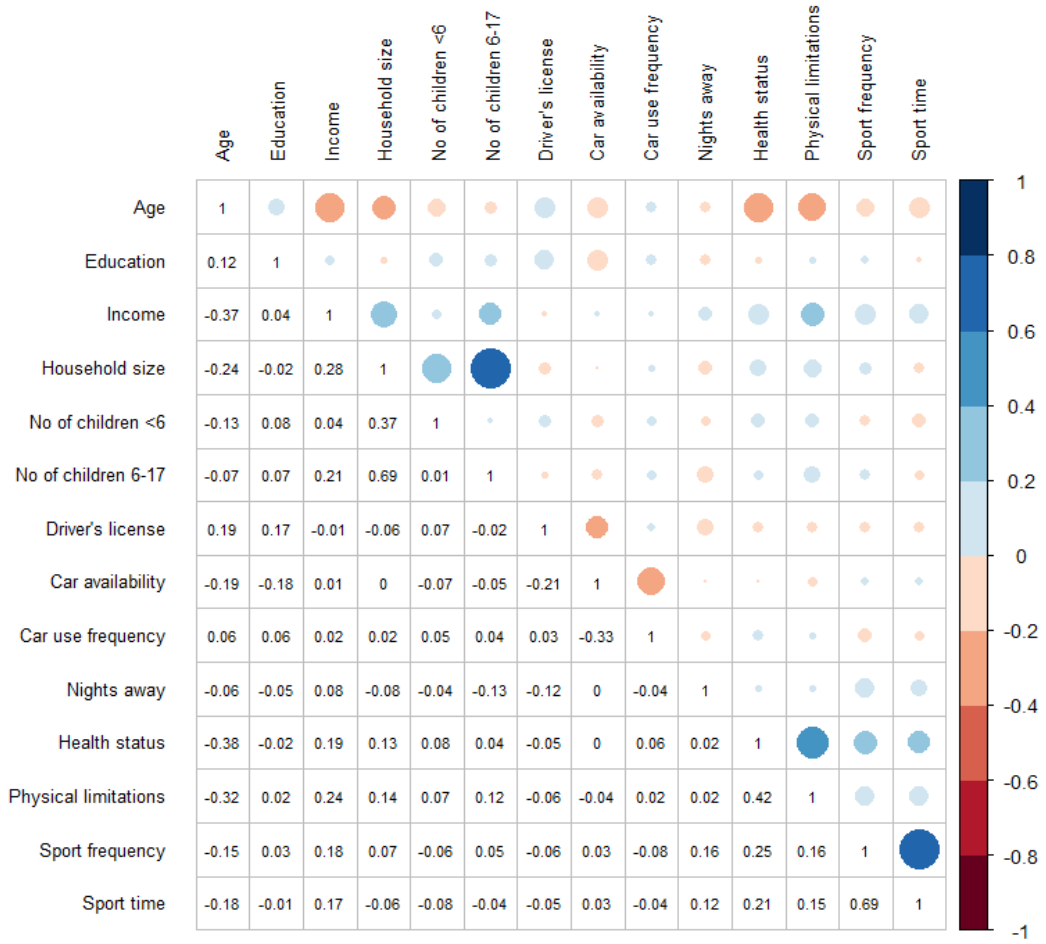


Fig. 4 Correlations of the decision-makers' characteristics

4.3.2 Stay and travel to the destination

Responses to questions concerning the stay and travel to the destination (part 2 of the questionnaire) are summarized in Table 5.

Table 5 Description of the stay and travel to the destination

Variable	Value	Summer		Winter	
		Number	%	Number	%
Length of stay		Mean (SD): 8.70 (5.1)		Mean (SD): 6.25 (1.84)	
	1-5	95	25.3	68	28.7
	6-10	178	45.9	165	69.6
	11-15	62	16.0	3	1.3
	>16	50	12.9	1	0.4
Company during the stay	Household size	Mean (SD): 2.44 (1.4)		Mean (SD): 2.77 (1.9)	
Alone	Yes	43	11.1	5	2.1
	No	345	88.9	232	97.9
With a spouse	Yes	271	69.9	127	53.6
	No	117	30.1	110	46.4
Children under 6	0	338	87.1	213	89.9
	1	37	9.5	13	5.5
	2	12	3.1	8	3.4
	>2	1	0.3	3	1.3
Children 6-17	0	280	72.2	154	65.0
	1	53	13.7	46	19.4
	2	43	11.1	26	11.0

Variable	Value	Summer		Winter	
		Number	%	Number	%
	>2	12	3.1	11	4.6
Other household members	0	365	94.1	188	79.3
	1	12	3.1	11	4.6
	2	4	1.0	22	9.3
	>2	7	1.8	16	6.8
Other known persons	0	302	77.8	133	56.1
	1	29	7.5	23	9.7
	2	16	4.1	22	9.3
	>2	41	10.6	59	24.9
Type of holiday	Individual trip	327	84.5	197	85.3
	Organized travel (by tour operator, …	60	15.5	34	14.7
Number of previous visits	0	177	46.0	96	40.9
	1	50	13.0	28	11.9
	2	40	10.4	21	8.9
	3-5	51	13.3	36	15.3
	6-10	28	7.3	31	13.2
	>10	39	10.1	23	9.8
Main destination	Yes	330	85.7	227	97.4
	No, I am on a stopover here and will…	55	14.3	6	2.6
Main purpose	Business	4	1.0	0	0.0
	Culture, heritage, sightseeing	16	4.1	0	0.0
	Health, wellness	47	12.1	6	2.5
	Rest, relaxation	115	29.6	26	11.0
	Shopping, fun, entertainment	2	0.5	5	2.1
	Social (time with family, friends)	60	15.5	13	5.5
	Sport, recreation	144	37.1	187	78.9
Main transport mode used for travel to the destination	Airplane	7	1.8	23	9.7
	Coach	18	4.6	10	4.2
	Motorcycle as a driver	2	0.5	0	0.0
	Private car as a driver	180	46.4	101	42.6
	Private car as a passenger	138	35.6	94	39.7
	Rented car, car-sharing as a driver	3	0.8	1	0.4
	Rented car, car-sharing as a passenger	3	0.8	1	0.4
	Train	37	9.5	7	3.0
Reason for choosing this mode[a]	No other mode was available	55	14.2	9	3.8
	Because of the distance of the journey	50	12.9	72	30.6
	Fastest mode	51	13.1	79	33.6
	Cheapest mode	54	13.9	70	29.8
	Safest mode	7	1.8	16	6.8
	Most convenient mode[b]	236	60.8	120	51.1
	Most comfortable mode	59	15.2	56	23.8
	Personal mobility constraints	9	2.3	3	1.3
	Luggage transport	84	21.7	101	43.0
	Weather conditions	7	1.8	5	2.1
	Other	46	11.9	5	6.3
Information level about travel options to the destination	Not informed at all	84	21.7	45	19.0
	Slightly informed	30	7.7	13	5.5
	Somewhat informed	46	11.9	43	18.1
	Well informed	128	33.0	83	35.0
	Very well informed	100	25.8	53	22.4
Source of this information[a]	On websites/mobile app of the region/…	92	23.7	81	34.8
	On websites/mobile app of the hotel	18	4.6	26	11.2
	On online/mobile map services…	97	25.0	56	24.0
	At the travel agency	9	2.3	10	4.3
	From travel guidebooks	8	2.1	2	0.9
	From friends and relatives	18	4.6	35	15.0
	Other	56	14.4	13	5.5
	I have not informed myself in advance	203	52.3	84	36.1
Information about the on-site mobility	Not informed at all	97	25.0	22	9.3
	Slightly informed	46	11.9	19	8.0
	Somewhat informed	56	14.4	44	18.6
	Well informed	105	27.1	86	36.3
	Very well informed	84	21.7	66	27.9
Source of this information[a]	On websites/mobile app of the region/…	89	22.9	95	41.0
	On websites/mobile app of the hotel	34	8.8	46	19.8
	On websites/mobile apps of the local…	35	9.0	16	6.9
	On online/mobile map services…	37	9.5	30	12.9
	At the travel agency	7	1.8	5	2.2
	From travel guidebooks	16	4.1	4	1.7
	From friends and relatives	10	2.6	36	15.5
	Other	54	13.9	23	9.7

Variable	Value	Summer		Winter	
		Number	%	Number	%
	I have not informed myself in advance	219	56.4	53	22.7

[a]Multiple choice question. Values indicate percent share of people who chose one of the answers.
[b]Convenient mode was defined in the questionnaire as direct, accessible and flexible, whereas comfort pertained to e.g. cleanliness, seats and ventilation. See the items used in question 28 in the questionnaire in the appendix.

Overall, summer stays are longer than winter stays. The high standard deviation suggests a wide spread of stay durations in summer. In winter, the length of stay oscillates around 6-7 overnights, which corresponds to a typical holiday week that starts and ends on a Saturday. A winter tourist is accompanied by more household members. Both summer and winter tourists prefer individually organized holidays, which comprise around 85% of all stays. In over 50% cases they have already been to Tyrol before. Winter stays are predominantly stationary, whereas in summer, a 15% share of respondents declare being on a road trip and moving to another place soon. An average winter tourist comes to almost 80% for sport and recreation, while a summer visitor is attracted similarly by sport (37%) and rest and relaxation (30%), followed by social and health purposes.

In terms of transport mode used to travel from home to the destination, private car with around 80% share dominates in both seasons. This is followed by air travel in winter (mostly from the UK thanks to a convenient direct connection from London to Innsbruck) and by train in summer. The major reason for choosing a particular transport mode is convenience (most direct, accessible and flexible mode) in both seasons. In winter, luggage plays an important role, as do price, journey time and distance. In summer, factors other than convenience are far less important. Fig. 5 illustrates the relationship between the chosen transport mode and the factors specified as driving this decision. Visitors in both seasons declare to be generally well informed about the journey options. However, only winter tourists state that they are sufficiently informed about the transportation at the destination.

In terms of accommodation types, summer tourists definitely prefer hotels (65%) to guesthouses (19%), apartments and campsites (Table 6). Winter tourists lean towards hotels (44%), but also choose guesthouses relatively often (35%). Average prices (per person per night) are, even despite a higher share of guesthouse stays in the sample, about 15 EUR higher in winter than in summer, which clearly implies that winter is the more expensive season.

Table 6 Characteristics of the accommodations reported in the survey

Variable	Value	Summer		Winter	
		Number	%	Number	%
Type of accommodation	Apartment	42	10.8	49	20.7
	Camping	19	4.9	3	1.3
	Hotel	252	65.0	103	43.5
	Guesthouse	75	19.3	82	34.6
Standard (number of stars)[a]	2	2	0.8	0	0
	3	50	19.8	15	14.6
	4	165	65.5	72	69.9
	4.5	35	13.9	13	12.6
	5	0	0	3	2.9
Price per person per night [EUR]		Mean (SD): 68.4 (32.9)		Mean (SD): 82.3 (39.3)	

[a]Only for hotels. Not available for apartments, campsites and guesthouses.

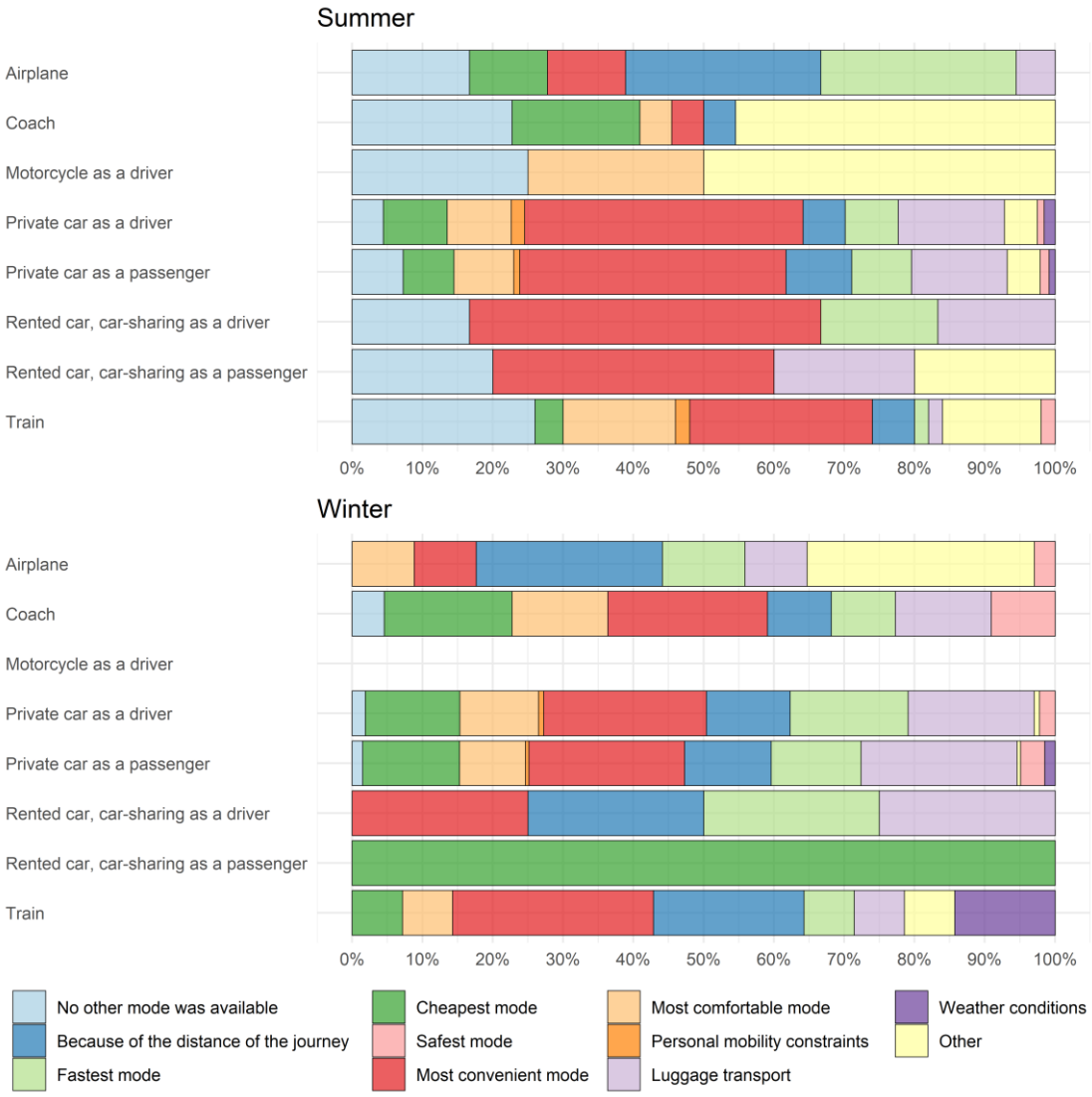


Fig. 5 Reasons for choosing particular transport mode for travel to the destination (multiple choice possible)

4.3.3 Activities

Fig. 6 presents locations of the accommodations where the respondents stayed.

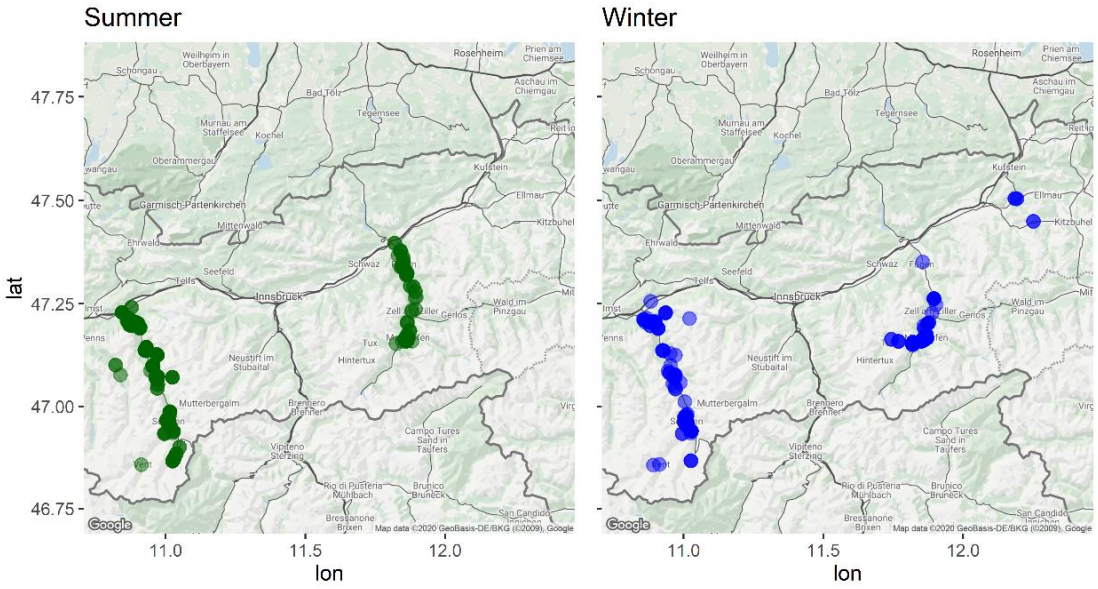


Fig. 6 Locations of the accommodations reported in the survey

Fig. 7 illustrates activity locations (i.e. trip start points). The area overlaps to a large extent with Fig. 6, which means that activities are performed predominantly within the valley, in the vicinity of the place of stay. Tourists make excursions outside their region relatively rarely. The locations of activities are very concentrated in winter and are close to the main road axis and ski resorts, whereas in summer they are more uniformly distributed across the regions and are more distant from the center of the regions. Visits to places outside the valleys, such as picturesque lakes (Achensee) or cities with tourist attractions (Innsbruck, Schwaz, Kufstein) were reported more frequently in summer than in winter.

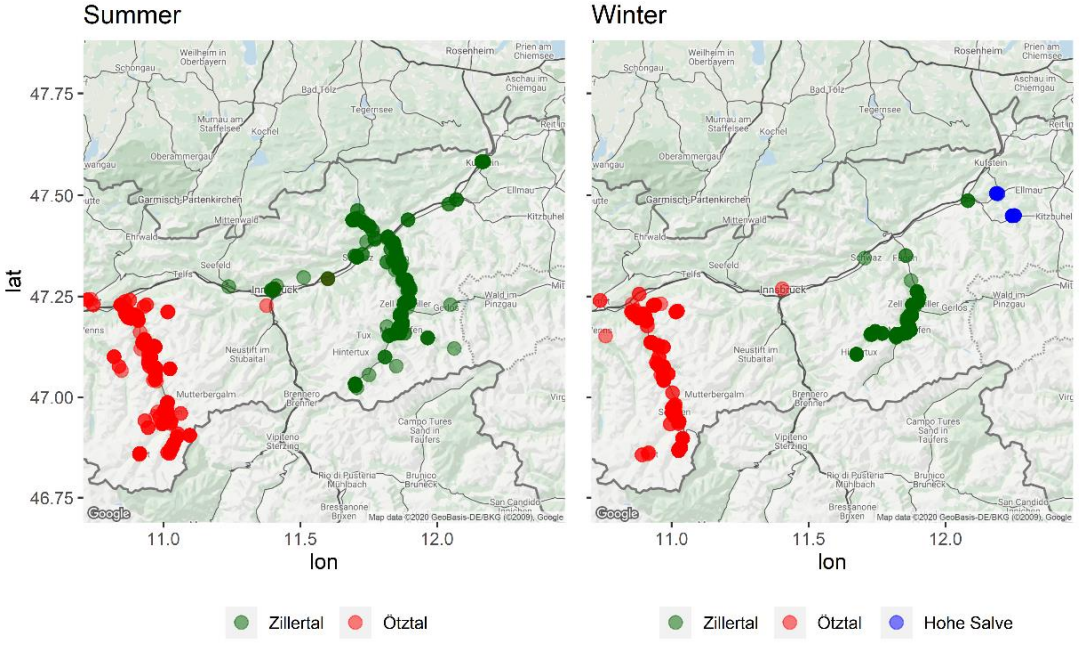


Fig. 7 Location of the activities depending on survey location

4.3.4 Mobility rates

The general level of mobility of tourists at the destination can be described by number of trips, kilometers traveled and time spent on travel. The average number of trips per person per day in the sample is 2.5 (Table 7). Compared to the values generated by the residents of Tyrol, tourists appear to be less mobile. The difference becomes even more apparent when compared to mobility rates of residents in municipalities with intensive tourism, who make 3.8 trips per day (Köll and Bader, 2011). Similarly, in comparison with mobility levels measured in countries where the visitors come from, mobility levels during vacation are also trending lower (except for the UK[5] (NatCen Social Research, 2019)). This implies that people are generally less mobile during their out-of-home stays than on a typical day at home. However, one should point out regional variations within these countries and methodological differences between the studies before generalizing the results.

Table 7 Mobility rates of the surveyed sample of tourists and the corresponding rates in countries where the majority of guests in Tyrol originates from. Values per day per person (mobile and non-mobile persons together)

Study population	Daily distance [km]	Daily travel time [min]	No of trips per day[a]
Tourists – total	23.2 (28.8 / 14.2)[b]	59 (72 / 39)[b]	2.5 (2.4 / 2.7)[b]
Tourists from AT	11.3	22	2.1
Tourists from DE	27.2	75	2.6
Tourists from NL	16.4	38	2.7
Tourists from CH	22.3	45	2.2
Tourists from UK	21.1	26	2.9
Residents in AT (2013/2014)[c]	36	68	2.6
Residents in AT, Tyrol (2013/2014)[c]	35	69	2.7
Residents in AT, Tyrol (2011)[d]	-	-	4.1
Residents in AT, Tyrol (intensive tourist municipalities) (2011)[d]	-	-	3.8
Residents in DE (2018)[e]	39	80	3.1
Residents in NL (2013)[f]	35.6	65	3.1
Residents in CH (2017)[g]	36.8	90.4	3.4
Residents in England (2018)[h]	29	62	2.7

[a]Excluding cable car trips.
[b]Values for summer and winter respectively.
[c]Bundesministerium für Verkehr, Innovation und Technologie (2016)
[d]Köll and Bader (2011)
[e]Bundesministerium für Verkehr und digitale Infrastruktur (2018)
[f]Hoogendoorn-Lanser et al. (2015)
[g]Bundesamt für Statistik (BFS) (2017)
[h]NatCen Social Research (2019)

In terms of distance traveled, tourist cover substantially fewer kilometers per day on vacation than on an average day at home. However, there are large country-dependent differences, with Austrians traveling the shortest and Germans the longest distances. In terms of time spent on travel, both the Austrian and foreign tourists achieve significantly lower values during vacation than when at home. Only German visitors stand out, spending on average 75min per day compared to 80min in their daily behavior.

4.4 Transport mode choice of the respondents

The descriptive analysis of tourists' choices in this paper is limited to transport mode choice. In summer, the share of trips made by car in the sample hits the highest value of almost 50%, followed by walking with 40%, transit (9%) and cycling (1%). In winter, walking is the dominating mode reaching 47%, followed by driving and transit, with 36% and 17% respectively. Cycling was not reported in winter.

[5] There are no fully comparable data on trips rates available for the UK – only for England.

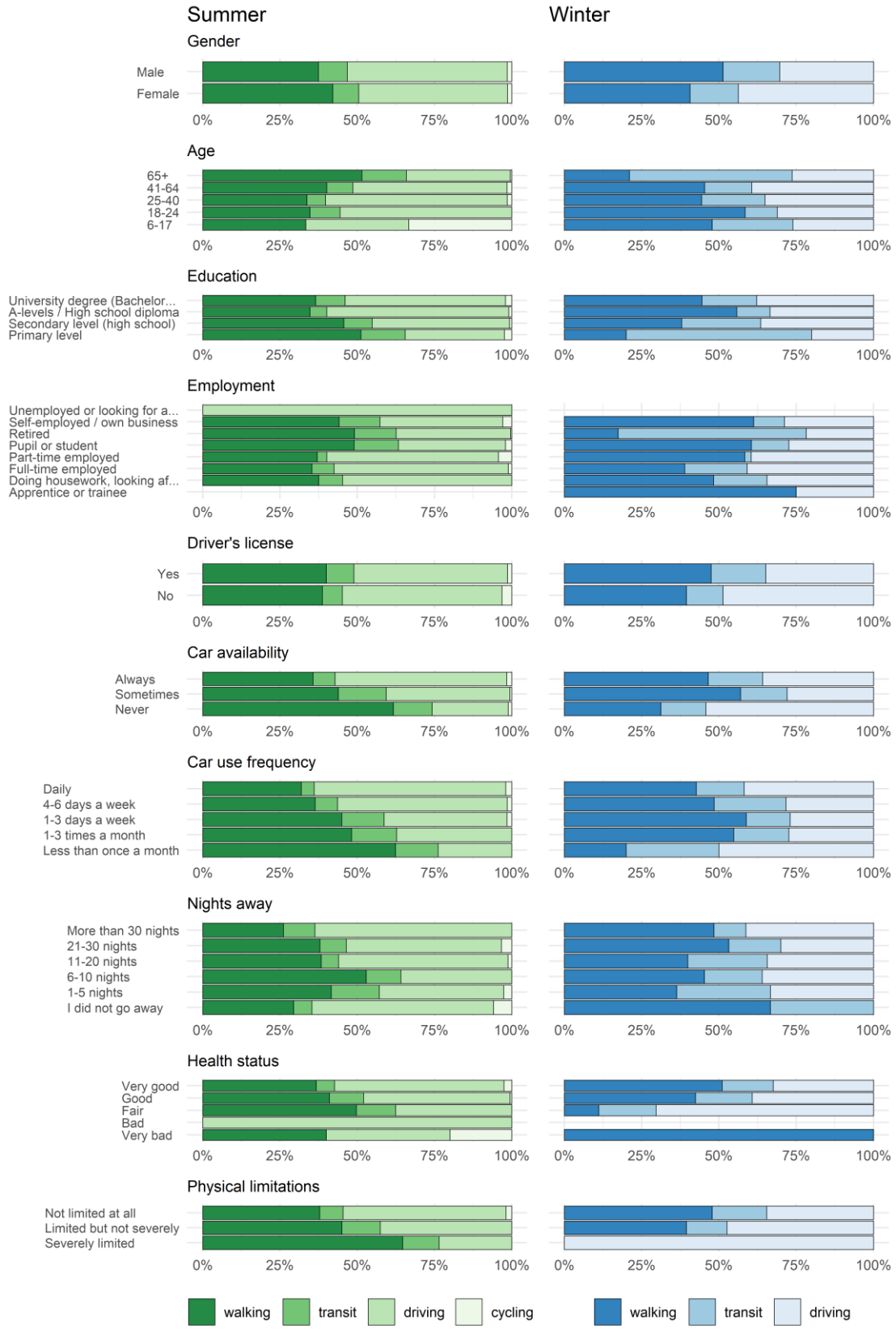


Fig. 8 Chosen mode depending on the sociodemographic characteristics

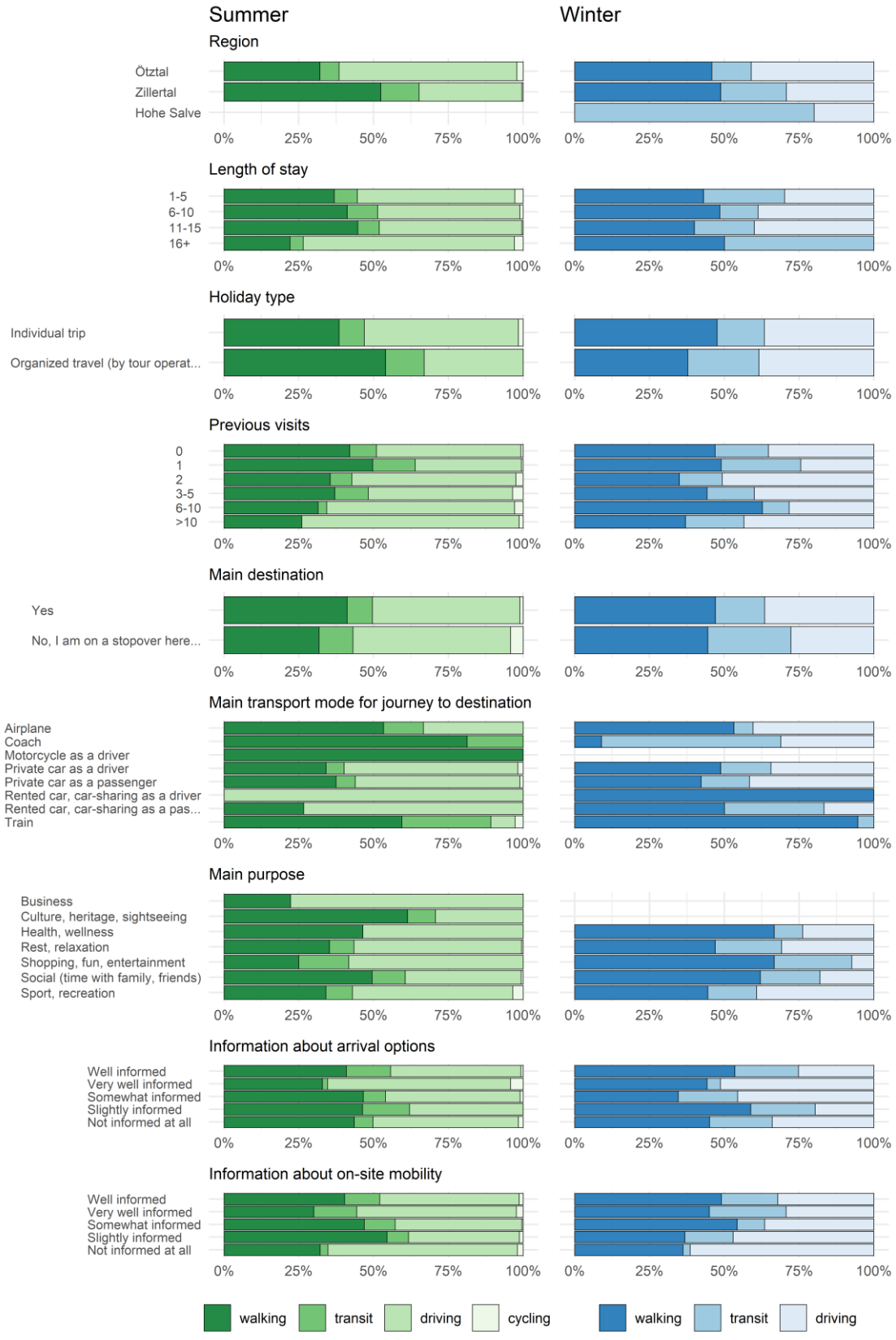


Fig. 9 Chosen mode depending on characteristics of the stay and travel to the destination

Fig. 8 and Fig. 9 provide informative insights into the relationship between transport mode choice and sociodemographic and stay-related variables. For instance, tourists over 65 years old choose transit more often than other age groups, especially in winter. Those who frequently use cars at home are also more likely to choose cars on vacation (in summer). Interestingly, good health and lack of physical disabilities results in more walking trips in winter, but less in summer.

As far as the characteristics of the stay are concerned, one can notice that guests in the Ötztal valley choose car more often than guests in the other two regions. This holds in both seasons. The Zillertal, on the other hand, has the highest percentage of transit users, which can be attributed to a more extensive transit network, including a 32-kilometer-long narrow-gauge railway that runs through the valley. Traveling to the destination by private car leads to a high share of car trips on site. In contrast, train and coach travelers tend to use local public transport relatively frequently. Also, better knowledge of the destination has a favorable effect on choosing transit at the cost of car.

Fig. 10 illustrates the temporal distribution of trips during one day (averaged) in summer and winter seasons. In winter, two distinct peaks are apparent for all three modes, which clearly reflects how the mobility patterns are associated with the opening hours of ski resorts. Driving in summer exhibits similar morning and evening peaks as it is in winter, whereas walking trips are more uniformly distributed over the course of a day. In summer, unlike in winter, afternoon return trips on transit are spread over several hours and do not form a peak as they do in the morning.

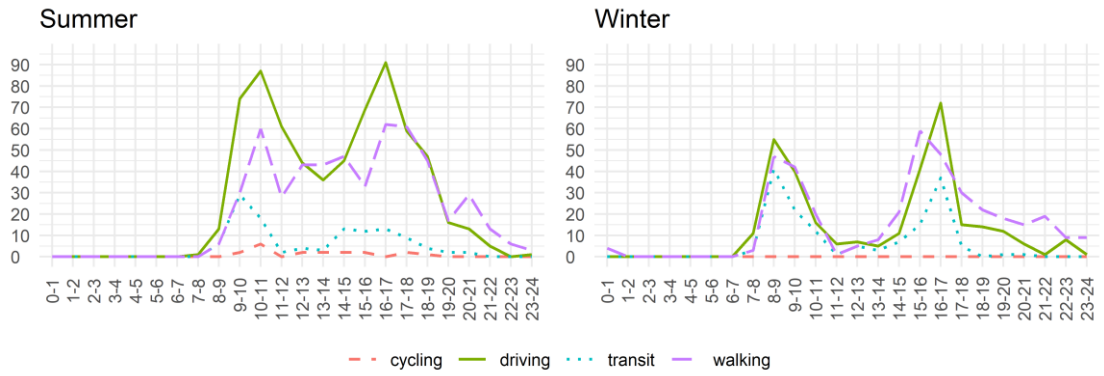


Fig. 10 Number of trips made by a given mode depending on time of day

Fig. 11 presents the modal split with respect to the trip purpose. A distinct pattern can be observed, in particular in summer, in mode choice preferences between for traveling to social activities (e.g. going out, restaurant visit) and traveling to outdoor and sport activities. In the first case, walking is the dominant mode, whereas in the latter, and generally with the increasing need to transport any kind of luggage or specific items (trekking poles, climbing or water sports equipment, etc.), the share of car trips escalates. An exception to this rule is skiing, where a relatively high proportion of transit trips can be explained by the high-quality ski-bus services offered in winter, tailored specifically to skiers' and snowboarders' needs.

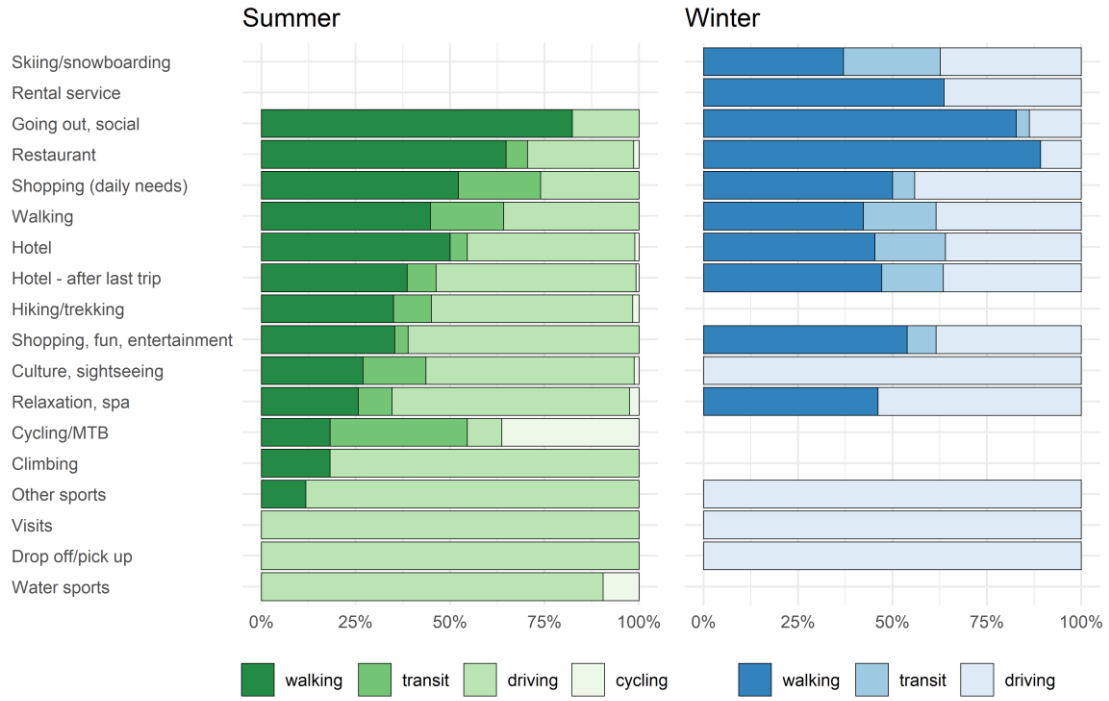


Fig. 11 Chosen mode depending on current trip purpose (i.e. the activity following the current trip)

Fig. 12 and Fig. 13 illustrate how long the trips undertaken by tourists are by each mode (data at the level of individual observations, not respondents). Tourists in summer travel longer distances and spend more time traveling than in winter, regardless of which transport mode they choose (see also Table 7).

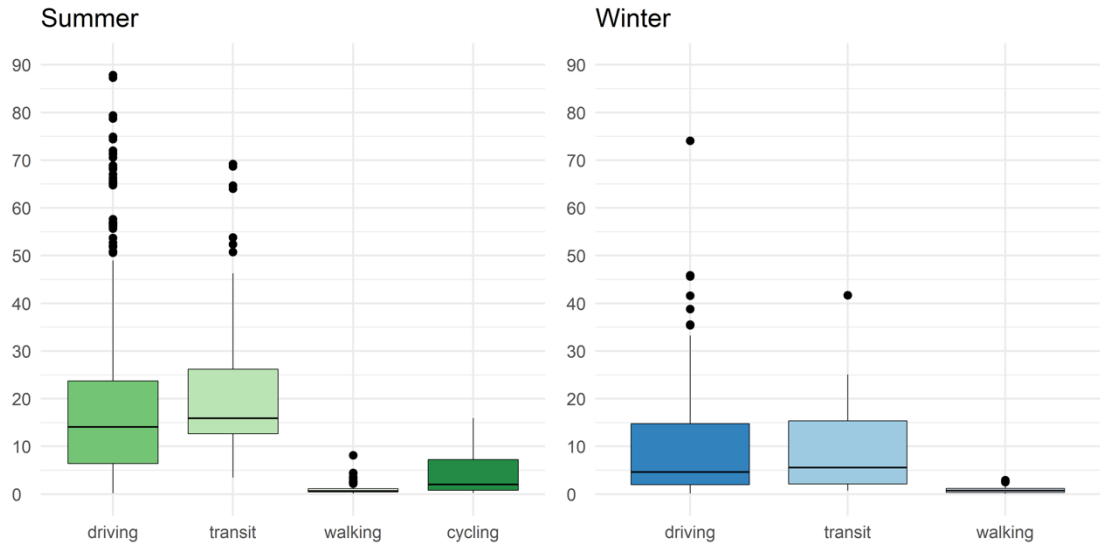


Fig. 12 Length of trips [km] depending on chosen mode

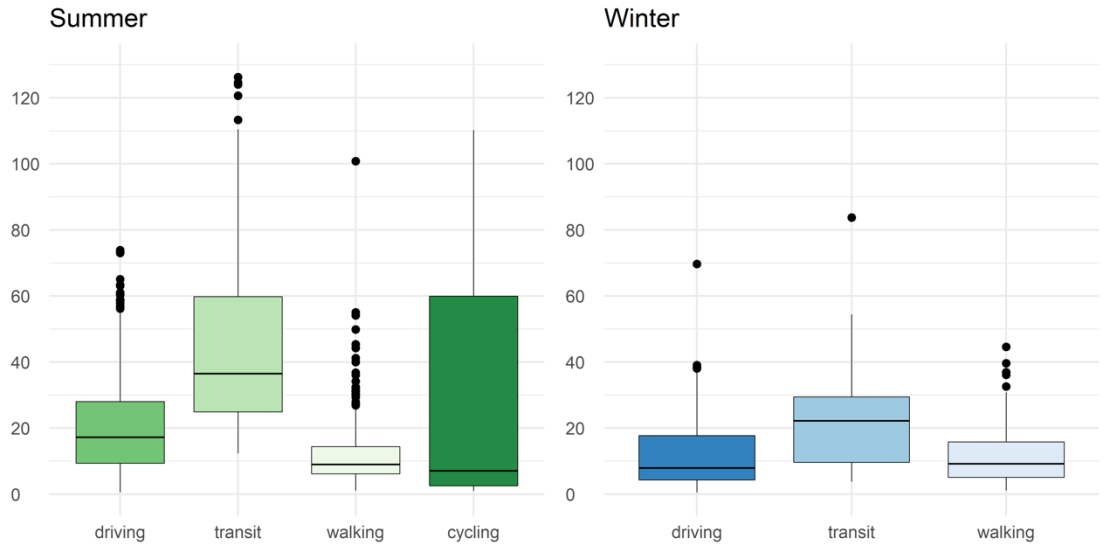


Fig. 13 Duration of trips [min] depending on chosen mode

4.5 Joint travel

Joint travel accounts for a very high share of all trips in the sample. Out of 3120 trips, 3048 trips (98%) were made with an accompanying person (not necessarily a relative or household member), 2671 trips (86%) with at least one household member (this includes e.g. grandparents living with the family), whereas 2594 trips (83%) were made with immediate family members, i.e. a spouse or children.

Fig. 14 illustrates the relationship between the chosen mode and the family composition on a trip, as well as between the chosen mode and the number of accompanying household members. In principle, as the group size increases, the preference for walking decreases and instead the preference for driving increases.

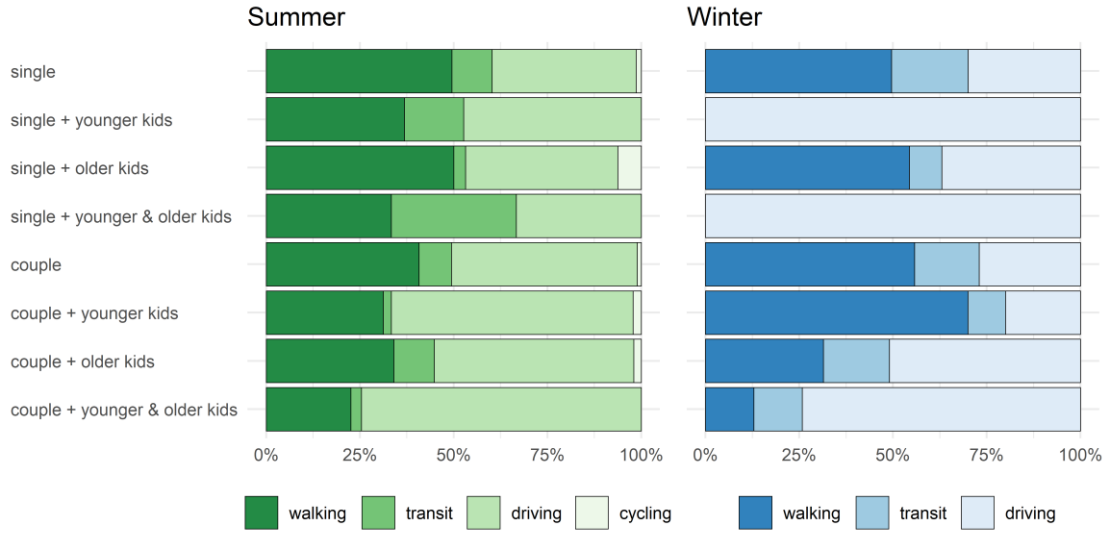


Fig. 14 Chosen mode depending on family composition during the trip

Fig. 15 illustrates the relationship between trip distance and family composition. As long as traveling with children clearly influences the choice of transport mode, it does not seem to influence the choice of destination much. Parents with and without children, alone and with spouses, undertake longer trips

equally often. Apparently, parents do not avoid traveling with kids to distant locations within the vacation region. They adapt the mode choice in the first place, but the final destination choice remains unaffected.[6]

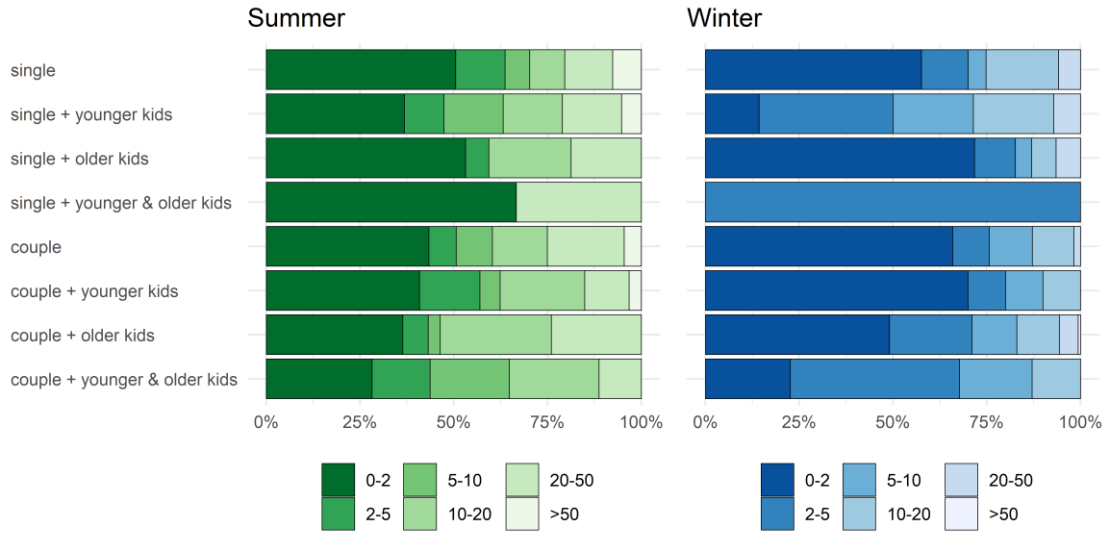


Fig. 15 Distance traveled depending on family composition

4.6 Impact of weather

Respondents were asked to assess the impact of weather on their activity and transport mode choices. In 5.92% cases in summer and 1.52% cases in winter, they were forced to choose an alternative activity, whereas only in 0.98% cases in summer and 1.8% cases in winter, they had to resort to another means of transport due to unfavorable weather conditions. These statements show a very low impact of weather on tourists' choices and suggest that tourists are determined to follow the vacation schedule (that they probably diligently prepared beforehand) no matter the weather.

If we combine the responses based on personal weather perception with real measurement data from weather stations located near the starting points of the trips, a similar picture emerges (Table 8). Only in up to 5% observations, when it rained in summer, respondents declared to have chosen another transport mode than planned.

Table 8 Impact of (perceived) weather on mode choice

Variable	Value	Summer		Winter	
		Precip. > 0	Precip. = 0	Precip. > 0	Precip. = 0
Impact of weather on mode choice	1st choice transport mode (as planned)	95.1%	99.6%	100.0%	98.0%
	2nd choice transport mode (plan B)	4.9%	0.4%	0.0%	2.0%

This is confirmed in Fig. 16 illustrating the transport mode choice as a function of precipitation. Visitors seem to be very indifferent to precipitation – in fact, the share of trips made on foot is higher on rainy days in summer and snowy days in winter than on days with no precipitation. This positive effect on walking raises doubts about the plausibility of this outcome (however a similar finding was reported also by Saneinejad et al. (2012)). It is postulated that studying the activity, destination and mode choice jointly may explain the underlying dependencies more precisely. Not accounting for interference of weather on the activity and destination choice, can lead to questionable results at the mode choice level – an issue also raised by Liu et al. (2015).

[6] It might however result from a small number of destinations for pursuing the planned activities, forcing families to travel far (e.g. only one ski resort nearby).

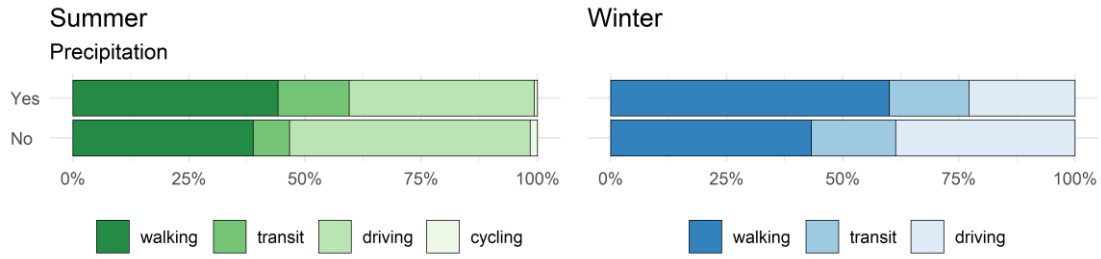


Fig. 16 Mode choice of tourists depending on precipitation

5 Conclusion

The paper reports on the motivation for, design and administration of a data collection effort on tourists' travel behavior at vacation destinations, as well as on basic descriptive results from the sample collected. Given the rising leisure mobility of modern societies (Larsen et al., 2006), there is a growing demand for understanding people's travel behavior in discretionary travel and mobility at non-home locations. This study responds to that demand and contributes to the development of quantitative research on the transport behavior of tourists at the same level as that of residents. The presented dataset is unique in that it describes tourists' actual observed behavior (revealed preferences) at a disaggregate level rather than behavioral intentions (stated preferences), making it a solid basis for developing behavioral choice models, as is typically done for local residents for which census and national travel survey data are available. This paper provides researchers, transport planners and policy-makers with a groundwork for further analytical and modeling work on tourist travel behavior and should ultimately foster better design of transport policies in tourist regions.

The data collection process builds to some extent on the design of established surveys of everyday travel behavior. However, it is applied in a novel context and to an unconventional population of tourist visitors staying for a short time at a destination for vacation purposes. We postulate that surveys of tourist travel behavior should collect disaggregate data on trips and activities of single respondents using a diary-based approach, if possible accompanied by GPS tracking, and should account for additional variables, beyond travel time, travel cost and level of service, which are typical predictors of home- and work-related travel choices (Frank et al., 2007). The survey instrument must allow the analyst to precisely differentiate between activities involving movement (e.g. cycling for pleasure) and movements to activities (e.g. cycling to a supermarket), i.e. displacement to a place where the activity is performed, which can be confusing in a vacation context, where many trips tend to have a strong recreational or sporting character and may serve not only relocation purposes.

We experienced difficulties in establishing effective cooperation with the accommodation providers, both without and with the support of the local DMOs. This affected the choice of the survey methods and, consequently, led to a loss of control over the sampling process (change from distributed PAPI questionnaires to face-to-face CAPI interviews). The study also revealed an ambiguous effect of incentives. Prospective studies should secure a larger budget and test an effect of higher monetary incentives. In particular, a successful implementation of a survey conducted in close cooperation with accommodation providers and accompanied with substantial incentives for the participants and the accommodations would be of value to the scientific community.

The paper also analyzes and compares seasonal differences between mode choice behavior of tourists in summer and winter. The basic descriptive results suggest that the effects of group composition, trip purpose, weather, information about the destination might be of non-negligible magnitude. Thus, although accounting for additional variables leads increases data collection costs, complexity, and response burden, it is strongly advised that this be done as early as at the survey design stage.

The results of a modeling work based on this study revealed several limitations of the dataset. Some specific information that could have contributed to a deeper understanding of tourists' mobility choices was not collected in the survey. These include, in particular, the following:

- Whether respondents had to carry luggage (e.g. climbing equipment, snow sleds for kids, stroller) on their trip to the activity start location and whether it was bulky and troublesome.

- Whether they brought their own bicycles or e-bikes with them.
- Whether their hotel offered them bicycles or e-bikes for rent or free of charge.
- Whether they purchased any kind of regional guest card in the summer season entitling them to free or discounted use of public transportation.
- The exact age of children (or at least stratified 0-6, 7-15 and 16-20 years) so that it would correspond to single fare categories and allow for more accurate cost calculations.

Sample size is another clear limitation of the study. With 849 respondents, the sample is within the range of comparable studies on tourist mobility. However, it is rather small (approx. 2.5%) in relation to the average of 34,000 tourists staying in all three regions at any time (given over 85,000 beds available and an average load factor of around 40%). It is also not representative, as most of the data was collected using convenience sampling and the response rate to questionnaires distributed in the hotels was very low (which would otherwise have made it possible to control the sampling process). It must be borne in mind that results based on a sample of this kind cannot be easily generalized to larger or different study populations.

As discussed in section 4, a large share of trips within the tourist destination are shorter than 2 km and are made on foot. The accuracy of distance and travel time calculation for short trips using *Google Maps* API might become questionable, since factors other than pure walking speed[7] come into play. Walking speed may, besides personal factors (age, gender, fitness, trip purpose, mood, etc.), depend also on physical conditions such as carried items (sports equipment, baby carriage, groceries), altitude difference, sidewalk surface, or weather conditions (snow layer). This might have implications for prospective choice modeling work, given the considerable share of short walking trips in the current dataset. Future studies should consider collecting even more precise data to account for this.

[7] Google does not disclose what speed they use in their routing system. As long as transit is concerned, it is based on timetable; car speeds are based on live traffic data, but the assumptions behind walking and cycling are unknown. However, one can observe that the speed varies depending on the elevation difference.

References

Abteilung Raumordnung und Statistik, Land Tirol (2019) Landesstatistik Tirol. https://www.tirol.gv.at/statistik-budget/statistik/.

Ahas, R., Aasa, A., Roose, A., Mark, Ü. and Silm, S. (2008) Evaluating passive mobile positioning data for tourism surveys: An Estonian case study. *Tourism Management*, *29*, 469–486.

Alivand, M., Hochmair, H. and Srinivasan, S. (2015) Analyzing how travelers choose scenic routes using route choice models. *Computers, Environment and Urban Systems*, *50*, 41–52.

Andrey, J., Mills, B., Leahy, M. and Suggett, J. (2003) Weather as a chronic hazard for road transportation in Canadian cities. *Natural Hazards*, *28*, 319–343.

Andridge, R.R. and Little, R.J.A. (2010) A Review of Hot Deck Imputation for Survey Non-response. *International statistical review*, *78*, 40–64.

Anta, J., Pérez-López, J.B., Martínez-Pardo, A., Novales, M. and Orro, A. (2016) Influence of the weather on mode choice in corridors with time-varying congestion: a mixed data study. *Transportation*, *43*, 337–355.

Arce, C.H. and Pisarski, A. (2009) Surveys of Tourists and Transients: Synthesis of a Workshop, *Transport survey methods: Keeping up with a changing world* eds P. Bonnel, M. Lee-Gosselin, J.P. Zmud and J.-L. Madre, pp. 243–248. Bingley, UK: Emerald.

Armstrong, R.W. and Mok, C. (1995) Leisure Travel Destination Choice Criteria of Hong Kong Residents. *Journal of Travel & Tourism Marketing*, *4*, 99–104.

Aschauer, F., Rösel, I., Hössinger, R., Kreis, H.B. and Gerike, R. (2018) Time use, mobility and expenditure: An innovative survey design for understanding individuals' trade-off processes. *Transportation*.

Austrian National Tourist Office (2014). *T-MONA Urlauberbefragung*. Vienna.

Axhausen, K.W. (2008) Definition Of Movement and Activity For Transport Modelling, *Handbook of transport modelling* eds D.A. Hensher and K. Button, pp. 329–343. Amsterdam, London: Elsevier.

Axhausen, K.W. (2015). *Kommentar SN 640003 Verkehrserhebungen: Methoden der Verkehrsbefragungen - Schlussbericht VSS 2009/103.* Arbeitsberichte Verkehrs- und Raumplanung, 1064, IVT, ETH Zürich.

Axhausen, K.W., Schmid, B. and Weis, C. (2015). *Predicting response rates updated.* Arbeitsberichte Verkehrs- und Raumplanung, 1063, IVT, ETH Zürich.

Axhausen, K.W., Schönfelder, S., PTV AG and Fell, B. (2000). *Mobidrive questionnaires*, ETH Zurich.

Barchiesi, D., Moat, H.S., Alis, C., Bishop, S. and Preis, T. (2015) Quantifying International Travel Flows Using Flickr. *PloS one*, *10*, e0128470.

Beard, J.G. and Ragheb, M.G. (1983) Measuring Leisure Motivation. *Journal of Leisure Research*, *15*, 219–228.

Becken, S. and Wilson, J. (2013) The impacts of weather on tourist travel. *Tourism Geographies*, *15*, 620–639.

Ben-Akiva, M., Bergman, M.J., Daly, A.J. and Ramaswamy, R. (1984) Modelling inter-urban route choice behaviour, *Proceedings of the ninth international symposium on transportation and traffic theory* eds R. Hamerslag and J. Volmuller, pp. 299–330. Utrecht: VNU Science Press.

Bhat, C.R., Astroza, S. and Bhat, A.C. (2016) On allowing a general form for unobserved heterogeneity in the multiple discrete–continuous probit model: Formulation and application to tourism travel. *Transportation Research Part B: Methodological*, *86*, 223–249.

Bieger, T. and Laesser, C. (2013) Future Living Conditions and Mobility: Travel Behavior of Alpine Tourists, *The tourism and leisure industry: Shaping the future* eds K. Weiermair and C. Mathies, pp. 253–270. New York: Abingdon; Routledge.

Bieger, T. and Laesser, C. (2016) Information Sources for Travel Decisions: Toward a Source Process Model. *Journal of Travel Research*, *42*, 357–371.

Bieland, D., Sommer, C. and Witte, C. (2017) Uncommon leisure traffic – Analyses of travel behaviour of visitors. *Transportation Research Procedia*, *25*, 3971–3984.

Björk, P. and Jansson, T. (2008). *Travel Decision-making: The Role of Habit*. MPRA Paper.

Böhler, S., Grischkat, S., Haustein, S. and Hunecke, M. (2006) Encouraging environmentally sustainable holiday travel. *Transportation Research Part A: Policy and Practice*, *40*, 652–670.
Brög, W. (2009) The New KONTIV® Design. http://www.socialdata.de/info/KONTIV_engl.pdf. Accessed 30.08.2018.
Bundesamt für Statistik (BFS) (2017). *Verkehrsverhalten der Bevölkerung: Ergebnisse des Mikrozensus Mobilität und Verkehr 2015.* Statistik der Schweiz. Neuchâtel, CH.
Bundesministerium für Verkehr und digitale Infrastruktur (2018). *Mobilität in Deutschland − MiD: Ergebnisbericht*. Bonn.
Bundesministerium für Verkehr, Innovation und Technologie (2016). *Österreich unterwegs 2013/2014: Ergebnisbericht zur österreichweiten Mobilitätserhebung*.
Bursa, B. and Mailer, M. (2018) Car-less on holiday: Sustainable tourist travel in Alpine Regions, *Tourism Naturally Conference*.
Cambridge Systematics Inc. (1996). *Travel Survey Manual*. United States.
Cavallaro, F., Ciari, F., Nocera, S., Prettenthaler, F. and Scuttari, A. (2017) The impacts of climate change on tourist mobility in mountain areas. *Journal of Sustainable Tourism*, *25*, 1063–1083.
Chen, C., Ma, J., Susilo, Y., Liu, Y. and Wang, M. (2016) The promises of big data and small data for travel behavior (aka human mobility) analysis. *Transportation research. Part C, Emerging technologies*, *68*, 285–299.
Christensen, L. and Nielsen, O.A. (2018) What Do European Tourism Demand Surveys Tell About Long Distance Travel?, *TRB 97th Annual Meeting Compendium of Papers*.
Chua, A., Servillo, L., Marcheggiani, E. and Moere, A.V. (2016) Mapping Cilento: Using geotagged social media data to characterize tourist flows in southern Italy. *Tourism Management*, *57*, 295–310.
Crawford, D.W., Jackson, E.L. and Godbey, G. (1991) A hierarchical model of leisure constraints. *Leisure Sciences*, *13*, 309–320.
Crompton, J. (1992) Structure of vacation destination choice sets. *Annals of Tourism Research*, *19*, 420–434.
Crompton, J.L. (1979) Motivations for pleasure vacation. *Annals of Tourism Research*, *6*, 408–424.
Day, J., Chin, N., Sydnor, S. and Cherkauer, K. (2013) Weather, climate, and tourism performance: A quantitative analysis. *Tourism Management Perspectives*, *5*, 51–56.
De Knop, P. (2007) Sport tourism in Belgium. Opinion paper. *Journal of Sport & Tourism*, *9*, 291–292.
Decrop, A. (2006). *Vacation decision making*. Wallingford, CABI.
Decrop, A. (2010) Destination Choice Sets: An Inductive Longitudinal Approach. *Annals of Tourism Research*, *37*, 93–115.
Denstadli, J.M. and Jacobsen, J.K.S. (2011) The long and winding roads: Perceived quality of scenic tourism routes. *Tourism Management*, *32*, 780–789.
Dickinson, J.E. and Robbins, D. (2007) Using the car in a fragile rural tourist destination: A social representations perspective. *Journal of Transport Geography*, *15*, 116–126.
Dickinson, J.E. and Robbins, D. (2008) Representations of tourism transport problems in a rural destination. *Tourism Management*, *29*, 1110–1121.
Elsasser, H. and Bürki, R. (2002) Climate change as a threat to tourism in the Alps. *Climate Research*, *20*, 253–257.
Eymann, A. and Ronning, G. (1997) Microeconometric models of tourists' destination choice. *Regional Science and Urban Economics*, *27*, 735–761.
Federal Highway Administration (2017) National Household Travel Survey. https://nhts.ornl.gov.
Fodness, D. and Murray, B. (1999) A Model of Tourist Information Search Behavior. *Journal of Travel Research*, *37*, 220–230.
Frank, L., Bradley, M., Kavage, S., Chapman, J. and Lawton, T.K. (2007) Urban form, travel time, and cost relationships with tour complexity and mode choice. *Transportation*, *35*, 37–54.
Gerike, R. and Schulz, A. (2018) Workshop Synthesis: Surveys on long-distance travel and other rare events. *Transportation Research Procedia*, *32*, 535–541.
Gilbert, D. and Abdullah, J. (2004) Holidaytaking and the sense of well-being. *Annals of Tourism Research*, *31*, 103–121.
Godbey, G., Crawford, D.W. and Shen, X.S. (2010) Assessing Hierarchical Leisure Constraints Theory after Two Decades. *Journal of Leisure Research*, *42*, 111–134.

Golob, T.F. and Recker, W.W. (2003) Relationships Among Urban Freeway Accidents, Traffic Flow, Weather, and Lighting Conditions. *Journal of Transportation Engineering*, *129*, 342–353.

Gössling, S. and Hall, C.M. (2006). *Tourism and global environmental change: Ecological, social, economic and political interrelationships / edited by Stefan Gössling and C. Michael Hall.* Contemporary geographies of leisure, tourism, and mobility. London, Taylor & Francis Group / Books.

Gössling, S., Scott, D., Hall, C.M., Ceron, J.-P. and Dubois, G. (2012) Consumer behaviour and demand response of tourists to climate change. *Annals of Tourism Research*, *39*, 36–58.

Gross, S. and Grimm, B. (2018) Sustainable mode of transport choices at the destination – public transport at German destinations. *Tourism Review*, *73*, 401–420.

Gühnemann, A., Kurzweil, A. and Mailer, M. (2021) Tourism mobility and climate change - A review of the situation in Austria. *Journal of Outdoor Recreation and Tourism*, *34*, 100382.

Gursoy, D. and McCleary, K.W. (2004) AN INTEGRATIVE MODEL OF TOURISTS' INFORMATION SEARCH BEHAVIOR. *Annals of Tourism Research*, *31*, 353–373.

Hardy, A. and Aryal, J. (2020) Using innovations to understand tourist mobility in national parks. *Journal of Sustainable Tourism*, *28*, 263–283.

Hardy, A., Hyslop, S., Booth, K., Robards, B., Aryal, J., Gretzel, U. and Eccleston, R. (2017) Tracking tourists' travel with smartphone-based GPS technology: a methodological discussion. *Information Technology & Tourism*, *17*, 255–274.

Heinen, E., van Wee, B. and Maat, K. (2010) Commuting by Bicycle: An Overview of the Literature. *Transport Reviews*, *30*, 59–96.

Hewer, M.J., Scott, D.J. and Gough, W.A. (2017) Differences in the importance of weather and weather-based decisions among campers in Ontario parks (Canada). *International journal of biometeorology*, *61*, 1805–1818.

Hoogendoorn-Lanser, S., Schaap, N.T. and OldeKalter, M.-J. (2015) The Netherlands Mobility Panel: An Innovative Design Approach for Web-based Longitudinal Travel Data Collection. *Transportation Research Procedia*, *11*, 311–329.

Hranac, R., Sterzin, E.D., Krechmer, D., Rakha, H. and Farzaneh, M. (2006). *Empirical Studies on Traffic Flow in Inclement Weather*.

Iso-Ahola, S.E. (1984) Social psychological foundations of leisure and resultant implications for leisure counseling, *Leisure counseling: Concepts and applications* ed E.T. Dowd, pp. 97–125. Springfield, IL: C.C. Thomas.

Jacobsen, J.K.S. (1996) Segmenting the use of a scenic highway. *The Tourist Review*, *51*, 32–38.

Janzen, M., Vanhoof, M., Smoreda, Z. and Axhausen, K.W. (2018) Closer to the total? Long-distance travel of French mobile phone users. *Travel Behaviour and Society*, *11*, 31–42.

Juschten, M. and Hössinger, R. (2021) Out of the city – but how and where? A mode-destination choice model for urban–rural tourism trips in Austria. *Current Issues in Tourism*, *24*, 1465–1481.

Klassen, N. (2001). *Einfluss der Information auf die individuelle Freizeitmobilität: Anwendung der Stated Preference Methode auf die Potentialabschätzungen eines Freizeit- und Naherholungsinformationssystems*. PhD Thesis,Technische Universität München. München.

Koenig, U. and Abegg, B. (1997) Impacts of Climate Change on Winter Tourism in the Swiss Alps. *Journal of Sustainable Tourism*, *5*, 46–58.

Koetse, M.J. and Rietveld, P. (2009) The impact of climate change and weather on transport: An overview of empirical findings. *Transportation Research Part D: Transport and Environment*, *14*, 205–221.

Köll, H. and Bader, M. (2011). *Auswertung Mobilitätserhebung Tirol 2011*. Reith bei Seefeld.

Kozak, M. (2002) Comparative analysis of tourist motivations by nationality and destinations. *Tourism Management*, *23*, 221–232.

LaMondia, J. and Bhat, C.R. (2013) A study of visitors' leisure travel behavior in the northwest territories of Canada. *Transportation Letters*, *3*, 1–19.

LaMondia, J., Snell, T. and Bhat, C.R. (2010) Traveler Behavior and Values Analysis in the Context of Vacation Destination and Travel Mode Choices. *Transportation Research Record: Journal of the Transportation Research Board*, *2156*, 140–149.

Lanzendorf, M. (2002) Mobility Styles and Travel Behavior: Application of a Lifestyle Approach to Leisure Travel. *Transportation Research Record: Journal of the Transportation Research Board*, *1807*, 163–173.

Larsen, J., Urry, J. and Axhausen, K.W. (2006). *Mobilities, networks, geographies*, Ashgate.

Lau, G. and McKercher, B. (2006) Understanding Tourist Movement Patterns in a Destination: A GIS Approach. *Tourism and Hospitality Research*, *7*, 39–49.

Lavrakas, P.J. (2008). *Encyclopedia of survey research methods*. Thousand Oaks, Calif., SAGE Publications.

Lehto, X.Y., O'Leary, J.T. and Morrison, A.M. (2004) The effect of prior experience on vacation behavior. *Annals of Tourism Research*, *31*, 801–818.

Leiner, D.J. (2020). *SoSci Survey*.

Le-Klähn, D.-T. and Hall, C.M. (2013) Tourist use of public transport at destinations – a review. *Current Issues in Tourism*, *18*, 785–803.

Lew, A. and McKercher, B. (2006) Modeling Tourist Movements: A local destination analysis. *Annals of Tourism Research*, *33*, 403–423.

Li, Y., Yang, L., Shen, H. and Wu, Z. (2019) Modeling intra-destination travel behavior of tourists through spatio-temporal analysis. *Journal of Destination Marketing & Management*.

Lin, Y., Kerstetter, D., Nawijn, J. and Mitas, O. (2014) Changes in emotions and their interactions with personality in a vacation context. *Tourism Management*, *40*, 416–424.

Liu, C., Susilo, Y.O. and Karlström, A. (2015) Investigating the impacts of weather variability on individual's daily activity–travel patterns: A comparison between commuters and non-commuters in Sweden. *Transportation Research Part A: Policy and Practice*, *82*, 47–64.

Liu, C., Susilo, Y.O. and Termida, A.N. (2016). *Subjective perception towards uncertainty on weather conditions and its impact on out-of-home leisure activity participation decisions*.

Lu, X. and Pas, E.I. (1999) Socio-demographics, activity participation and travel behavior. *Transportation Research Part A: Policy and Practice*, *33*, 1–18.

Mailer, M., Abegg, B., Jänicke, L. and Bursa, B. (2019) Mobilitätsbedingte Klimawirkung einer alpinen Tourismusdestination. *Zeitschrift für Tourismuswissenschaft*, *11*, 211–236.

Masiero, L. and Zoltan, J. (2013) Tourists intra-destination visits and transport mode: A bivariate probit model. *Annals of Tourism Research*, *43*, 529–546.

Maze, T., Agarwai, M. and Burchett, G. (2006) Whether Weather Matters to Traffic Demand, Traffic Safety, and Traffic Operations and Flow. *Transportation Research Record: Journal of the Transportation Research Board*, *1948*, 170–176.

MCI (2014). *Tourismussatellitenkonto Tirol*. Innsbruck.

McKercher, B., Hardy, A. and Aryal, J. (2019) Using tracking technology to improve marketing: insights from a historic town in Tasmania, Australia. *Journal of Travel & Tourism Marketing*, *36*, 823–834.

McKercher, B. and Lau, G. (2009) Methodological Considerations when Mapping Tourist Movements in a Destination. *Tourism Analysis*, *14*, 443–455.

McKercher, B., Shoval, N., Park, E. and Kahani, A. (2014) The [Limited] Impact of Weather on Tourist Behavior in an Urban Destination. *Journal of Travel Research*, *54*, 442–455.

McKercher, B. and Zoltan, J. (2014) Tourist Flows and Spatial Behavior, *The Wiley Blackwell Companion to Tourism* eds A.A. Lew, C.M. Hall and A.M. Williams, pp. 33–44. Oxford, UK: John Wiley & Sons.

Mokhtarian, P.L. (2018) Why travel surveys matter in the Age of Big Data?, *Transportation Research Circular E-C238*, pp. 2–4. Washington DC, United States.

Mokhtarian, P.L. and Salomon, I. (2001) How derived is the demand for travel? Some conceptual and measurement considerations. *Transportation Research Part A: Policy and Practice*, *35*, 695–719.

Mokhtarian, P.L., Salomon, I. and Redmond, L.S. (2001) Understanding the Demand for Travel: It's Not Purely 'Derived'. *Innovation: The European Journal of Social Science Research*, *14*, 355–380.

Morley, C. (2012) Technique and Theory in Tourism Analysis. *Tourism Economics*, *18*, 1273–1286.

NatCen Social Research (2019). *National Travel Survey 2018: Technical Report*. London.

Nawijn, J., Mitas, O., Lin, Y. and Kerstetter, D. (2013) How Do We Feel on Vacation? A Closer Look at How Emotions Change over the Course of a Trip. *Journal of Travel Research*, *52*, 265–274.

Newmark, G. (2014) Conducting Visitor Travel Surveys: A Transit Agency Perspective. *Journal of Public Transportation*, *17*, 136–156.
Önder, I., Koerbitz, W. and Hubmann-Haidvogel, A. (2016) Tracing Tourists by Their Digital Footprints. *Journal of Travel Research*, *55*, 566–573.
Orsi, F. and Geneletti, D. (2013) Using geotagged photographs and GIS analysis to estimate visitor flows in natural areas. *Journal for Nature Conservation*, *21*, 359–368.
Pettebone, D., Newman, P., Lawson, S.R., Hunt, L., Monz, C. and Zwiefka, J. (2011) Estimating visitors' travel mode choices along the Bear Lake Road in Rocky Mountain National Park. *Journal of Transport Geography*, *19*, 1210–1221.
Prato, C.G., Bekhor, S. and Pronello, C. (2012) Latent variables and route choice behavior. *Transportation*, *39*, 299–319.
Prelipcean, A.C., Susilo, Y.O. and Gidófalvi, G. (2018) Collecting travel diaries: Current state of the art, best practices, and future research directions. *Transportation Research Procedia*, *32*, 155–166.
Pröbstl-Haider, U., Haider, W., Wirth, V. and Beardmore, B. (2015) Will climate change increase the attractiveness of summer destinations in the European Alps? A survey of German tourists. *Journal of Outdoor Recreation and Tourism*, *11*, 44–57.
Provenzano, D., Hawelka, B. and Baggio, R. (2018) The mobility network of European tourists: a longitudinal study and a comparison with geo-located Twitter data. *Tourism Review*, *73*, 28–43.
Rüger, B. and Mailer, M. (2020) Autofreie Anreise in Urlaubsregionen: Maßnahmen zur Stärkung der Bahn. *ETR - Eisenbahntechnische Rundschau*, *7+8*, 18–23.
Rugg, D. (1973) The Choice of Journey Destination: A Theoretical and Empirical Analysis. *The Review of Economics and Statistics*, *55*, 64.
Ryan, C. and Glendon, I. (1998) Application of leisure motivation scale to tourism. *Annals of Tourism Research*, *25*, 169–184.
Sabir, M. (2011). *Weather and travel behaviour*. Dissertation,Vrije Universiteit Amsterdam.
Sammer, G., Fellendorf, M., Herry, M., Karmasin, H., Klementschitz, R., Kohla, B., Meschik, M., Rehrl, K. and Reite, T. (2011). *KOMOD - KOnzeptstudie MObilitätsDaten Österreichs: Im Auftrag des Bundesministeriums für Verkehr, Innovation und Technologie, Programmlinie ways2go des Forschungs- und Technologieprogramms iv2splus*. Vienna.
Saneinejad, S., Roorda, M.J. and Kennedy, C. (2012) Modelling the impact of weather conditions on active transportation travel behaviour. *Transportation Research Part D: Transport and Environment*, *17*, 129–137.
Scarpa, R. and Thiene, M. (2004) Destination Choice Models for Rock Climbing in the Northeast Alps: A Latent-Class Approach Based on Intensity of Participation. *SSRN Electronic Journal*.
Scarpa, R., Thiene, M. and Train, K. (2008) Utility in Willingness to Pay Space: A Tool to Address Confounding Random Scale Effects in Destination Choice to the Alps. *American Journal of Agricultural Economics*, *90*, 994–1010.
Schlemmer, P., Blank, C., Bursa, B., Mailer, M. and Schnitzer, M. (2019) Does Health-Oriented Tourism Contribute to Sustainable Mobility? *Sustainability*, *11*, 2633.
Scott, D., Gössling, S. and Freitas, C.R. de (2008) Preferred climates for tourism: case studies from Canada, New Zealand and Sweden. *Climate Research*, *45*, 61–73.
Shoval, N. and Ahas, R. (2016) The use of tracking technologies in tourism research: the first decade. *Tourism Geographies*, *18*, 587–606.
Shoval, N., Isaacson, M. and Chhetri, P. (2014) GPS, Smartphones, and the Future of Tourism Research, *The Wiley Blackwell Companion to Tourism* eds A.A. Lew, C.M. Hall and A.M. Williams, pp. 251–261. Oxford, UK: John Wiley & Sons.
Simma, A., Schlich, R. and Axhausen, K.W. (2002). *Destination choice modelling of leisure trips: The case of Switzerland.* (99th ed.). Arbeitsberichte Verkehrs- und Raumplanung. Zürich.
Simmons, E. and Wilmot, A. (2004) Incentive Payments on Social Surveys: A Literature Review. *Survey Methodology Bulletin*, *53*, 1–11.
Singer, E. and Ye, C. (2012) The Use and Effects of Incentives in Surveys. *The ANNALS of the American Academy of Political and Social Science*, *645*, 112–141.
Singleton, P.A. (2020) Exploring the positive utility of travel and mode choice, *Mapping the travel behavior genome* eds K.G. Goulias and A.W. Davis, pp. 259–277. Amsterdam, Netherlands: Elsevier.

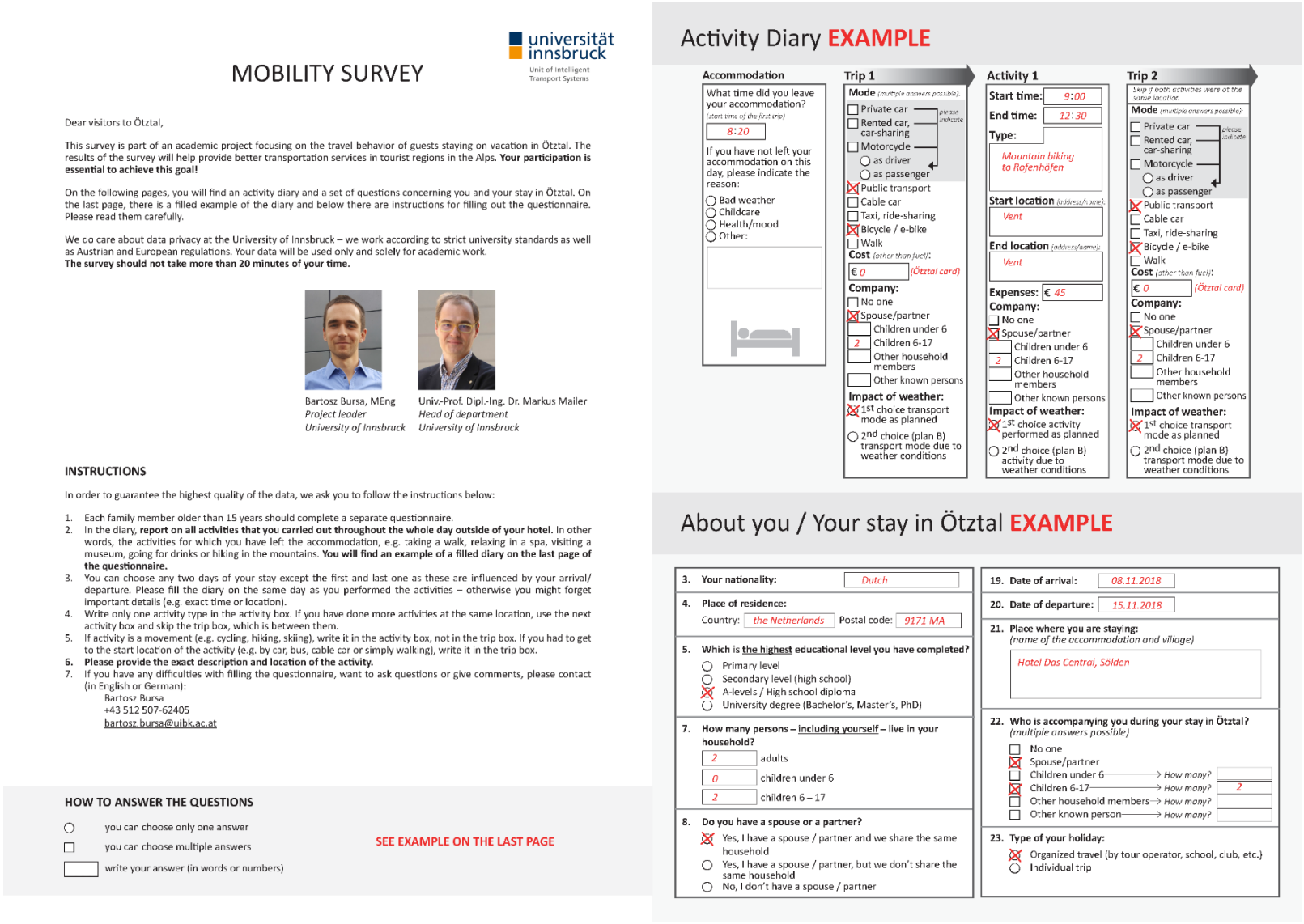
Sirakaya, E., McLellan, R.W. and Uysal, M. (1996) Modeling Vacation Destination Decisions. *Journal of Travel & Tourism Marketing*, *5*, 57–75.
Sirakaya-Turk, E., Uysal, M., Hammitt, W.E. and Vaske, J.J. (2017). *Research methods for leisure, recreation and tourism.* (2nd edition). CABI tourism texts. Wallingford, Oxforshire, UK, CABI.
Sirakaya-Turk, E. and Woodside, A.G. (2005) Building and testing theories of decision making by travellers. *Tourism Management*, *26*, 815–832.
Sirgy, M.J., Kruger, P.S., Lee, D.-J. and Yu, G.B. (2011) How Does a Travel Trip Affect Tourists' Life Satisfaction? *Journal of Travel Research*, *50*, 261–275.
Sobolevsky, S., Bojic, I., Belyi, A., Sitko, I., Hawelka, B., Arias, J.M. and Ratti, C. (2015) Scaling of City Attractiveness for Foreign Visitors through Big Data of Human Economical and Social Media Activity, *2015 IEEE International Congress on Big Data (BigData Congress): June 27, 2015 - July 2, 2015, New York, New York, USA* ed B. Carminati, pp. 600–607. Piscataway, NJ: IEEE.
Statistics Austria (2020) STATcube: Statistical Database of Statistics Austria. http://www.statcube.at.
Steiger, R., Abegg, B. and Jänicke, L. (2016) Rain, Rain, Go Away, Come Again Another Day. Weather Preferences of Summer Tourists in Mountain Environments. *Atmosphere*, *7*, 63.
Stekhoven, D.J. and Bühlmann, P. (2012) MissForest--non-parametric missing value imputation for mixed-type data. *Bioinformatics*, *28*, 112–118.
Termida, A.N., Susilo, Y.O. and Franklin, J.P. (2016) Observing dynamic behavioural responses due to the extension of a tram line by using panel survey. *Transportation Research Part A: Policy and Practice*, *86*, 78–95.
Terrier, C. (2009) Tourist Flows and Inflows: On Measuring Instruments and the Geomathematics of Flows, *Transport survey methods: Keeping up with a changing world* eds P. Bonnel, M. Lee-Gosselin, J.P. Zmud and J.-L. Madre, pp. 219–241. Bingley, UK: Emerald.
Thimm, T. and Seepold, R. (2016) Past, present and future of tourist tracking. *Journal of Tourism Futures*, *2*, 43–55.
Thompson, K. and Schofield, P. (2007) An investigation of the relationship between public transport performance and destination satisfaction. *Journal of Transport Geography*, *15*, 136–144.
Thornton, P.R., Williams, A.M. and Shaw, G. (1997) Revisiting Time—Space Diaries: An Exploratory Case Study of Tourist Behaviour in Cornwall, England. *Environment and Planning A: Economy and Space*, *29*, 1847–1867.
Thrane, C. (2015) Examining tourists' long-distance transportation mode choices using a Multinomial Logit regression model. *Tourism Management Perspectives*, *15*, 115–121.
Tooley, M.S. (1996) Incentives and Rates of Return for Travel Surveys. *Transportation Research Record: Journal of the Transportation Research Board*, *1551*, 67–73.
Tschopp, M., Beige, S. and Axhausen, K.W. (2010). *Verkehrssysteme, Touristenverhalten und Raumstruktur in alpinen Landschaften*. Forschungsbericht NFP 48, vdf Hochschulverlag AG.
Unger, R., Abegg, B., Mailer, M. and Stampfl, P. (2016) Energy Consumption and Greenhouse Gas Emissions Resulting From Tourism Travel in an Alpine Setting. *Mountain Research and Development*, *36*, 475–483.
United Nations (2010). *International Recommendations for Tourism Statistics.* (Rev. 1). Studies in Methods. New York.
van Buuren, S. (2018). *Flexible imputation of missing data.* (Second edition). Chapman and Hall/CRC interdisciplinary statistics series. Boca Raton, CRC Press Taylor & Francis Group.
van Nostrand, C., Sivaraman, V. and Pinjari, A.R. (2013) Analysis of long-distance vacation travel demand in the United States: a multiple discrete–continuous choice framework. *Transportation*, *40*, 151–171.
Vu, H.Q., Li, G., Law, R. and Zhang, Y. (2018) Tourist Activity Analysis by Leveraging Mobile Social Media Data. *Journal of Travel Research*, *57*, 883–898.
Woodside, A.G. and Lysonski, S. (1989) A General Model Of Traveler Destination Choice. *Journal of Travel Research*, *27*, 8–14.
Wu, C.-L. and Carson, D. (2008) Spatial and Temporal Tourist Dispersal Analysis in Multiple Destination Travel. *Journal of Travel Research*, *46*, 311–317.
Wu, L., Zhang, J. and Fujiwara, A. (2011) Representing tourists' heterogeneous choices of destination and travel party with an integrated latent class and nested logit model. *Tourism Management*, *32*, 1407–1413.

Yang, L., Wu, L., Liu, Y. and Kang, C. (2017) Quantifying Tourist Behavior Patterns by Travel Motifs and Geo-Tagged Photos from Flickr. *ISPRS International Journal of Geo-Information*, *6*, 345.

Zhao, X., Lu, X., Liu, Y., Lin, J. and An, J. (2018) Tourist movement patterns understanding from the perspective of travel party size using mobile tracking data: A case study of Xi'an, China. *Tourism Management*, *69*, 368–383.

Zoltan, J. and McKercher, B. (2014) Analysing intra-destination movements and activity participation of tourists through destination card consumption. *Tourism Geographies*, *17*, 19–35.

Appendix



universität innsbruck
Unit of Intelligent Transport Systems

MOBILITY SURVEY

Dear visitors to Ötztal,

This survey is part of an academic project focusing on the travel behavior of guests staying on vacation in Ötztal. The results of the survey will help provide better transportation services in tourist regions in the Alps. **Your participation is essential to achieve this goal!**

On the following pages, you will find an activity diary and a set of questions concerning you and your stay in Ötztal. On the last page, there is a filled example of the diary and below there are instructions for filling out the questionnaire. Please read them carefully.

We do care about data privacy at the University of Innsbruck – we work according to strict university standards as well as Austrian and European regulations. Your data will be used only and solely for academic work.
The survey should not take more than 20 minutes of your time.

Bartosz Bursa, MEng
Project leader
University of Innsbruck

Univ.-Prof. Dipl.-Ing. Dr. Markus Mailer
Head of department
University of Innsbruck

INSTRUCTIONS

In order to guarantee the highest quality of the data, we ask you to follow the instructions below:

1. Each family member older than 15 years should complete a separate questionnaire.
2. In the diary, **report on all activities that you carried out throughout the whole day outside of your hotel.** In other words, the activities for which you have left the accommodation, e.g. taking a walk, relaxing in a spa, visiting a museum, going for drinks or hiking in the mountains. **You will find an example of a filled diary on the last page of the questionnaire.**
3. You can choose any two days of your stay except the first and last one as these are influenced by your arrival/departure. Please fill the diary on the same day as you performed the activities – otherwise you might forget important details (e.g. exact time or location).
4. Write only one activity type in the activity box. If you have done more activities at the same location, use the next activity box and skip the trip box, which is between them.
5. If activity is a movement (e.g. cycling, hiking, skiing), write it in the activity box, not in the trip box. If you had to get to the start location of the activity (e.g. by car, bus, cable car or simply walking), write it in the trip box.
6. **Please provide the exact description and location of the activity.**
7. If you have any difficulties with filling the questionnaire, want to ask questions or give comments, please contact (in English or German):
   Bartosz Bursa
   +43 512 507-62405
   bartosz.bursa@uibk.ac.at

HOW TO ANSWER THE QUESTIONS

○ you can choose only one answer
☐ you can choose multiple answers
[ ] write your answer (in words or numbers)

SEE EXAMPLE ON THE LAST PAGE

Activity Diary EXAMPLE

Accommodation
What time did you leave your accommodation? (start time of the first trip): 8:20
If you have not left your accommodation on this day, please indicate the reason:
○ Bad weather
○ Childcare
○ Health/mood
○ Other:

Trip 1
Mode (multiple answers possible): (please indicate)
☐ Private car
☐ Rented car, car-sharing
☐ Motorcycle
○ as driver
○ as passenger
☒ Public transport
☐ Cable car
☐ Taxi, ride-sharing
☒ Bicycle / e-bike
☐ Walk
Cost (other than fuel): € 0 (Ötztal card)
Company:
☐ No one
☒ Spouse/partner
☐ Children under 6
2 Children 6-17
☐ Other household members
☐ Other known persons
Impact of weather:
☒ 1st choice transport mode as planned
○ 2nd choice (plan B) transport mode due to weather conditions

Activity 1
Start time: 9:00
End time: 12:30
Type: Mountain biking to Rofenhöfen
Start location (address/name): Vent
End location (address/name): Vent
Expenses: € 45
Company:
☐ No one
☒ Spouse/partner
☐ Children under 6
2 Children 6-17
☐ Other household members
☐ Other known persons
Impact of weather:
☒ 1st choice activity performed as planned
○ 2nd choice (plan B) activity due to weather conditions

Trip 2
Skip if both activities were at the same location
Mode (multiple answers possible): (please indicate)
☐ Private car
☐ Rented car, car-sharing
☐ Motorcycle
○ as driver
○ as passenger
☒ Public transport
☐ Cable car
☐ Taxi, ride-sharing
☒ Bicycle / e-bike
☐ Walk
Cost (other than fuel): € 0 (Ötztal card)
Company:
☐ No one
☒ Spouse/partner
☐ Children under 6
2 Children 6-17
☐ Other household members
☐ Other known persons
Impact of weather:
☒ 1st choice transport mode as planned
○ 2nd choice (plan B) transport mode due to weather conditions

About you / Your stay in Ötztal EXAMPLE

3. Your nationality: Dutch
4. Place of residence:
   Country: the Netherlands Postal code: 9171 MA
5. Which is the highest educational level you have completed?
   ○ Primary level
   ○ Secondary level (high school)
   ☒ A-levels / High school diploma
   ○ University degree (Bachelor's, Master's, PhD)
7. How many persons – including yourself – live in your household?
   2 adults
   0 children under 6
   2 children 6 – 17
8. Do you have a spouse or a partner?
   ☒ Yes, I have a spouse / partner and we share the same household
   ○ Yes, I have a spouse / partner, but we don't share the same household
   ○ No, I don't have a spouse / partner

19. Date of arrival: 08.11.2018
20. Date of departure: 15.11.2018
21. Place where you are staying:
    (name of the accommodation and village)
    Hotel Das Central, Sölden
22. Who is accompanying you during your stay in Ötztal?
    (multiple answers possible)
    ☐ No one
    ☒ Spouse/partner
    ☐ Children under 6 → How many?
    ☒ Children 6-17 → How many? 2
    ☐ Other household members → How many?
    ☐ Other known person → How many?
23. Type of your holiday:
    ☒ Organized travel (by tour operator, school, club, etc.)
    ○ Individual trip

Fig. 17 PAPI questionnaire – front and back cover