Putting Walkscapes on the Map: GIS-based Visualization for Mobile Methods in Landscape Research

Daniel Münderlein[1]

[1]University of Kassel/Germany · Muenderlein@asl.uni-kassel.de

Abstract: The idea of exploring landscapes by walking is historically and socially deeply rooted and fundamental to our modern understanding of landscapes but is often methodologically underrepresented. This paper illustrates that walking can be considered and applied as a method in landscape research. After a brief explanation of walking as a source of knowledge, a selection of mobile methods from literature is explained and their potential in landscape research is outlined. Based on these explanations, a new and innovative mobile method called a *Trigger Question Walk* is presented. This aims at combing the advantages and potential of existing methods and serves the purpose of digitally processing data from walks in a structured way to visualize results from mobile methods by using GIS. Its application is illustrated by using data from a larger empirical study, which investigates into the interrelationships between landscape, health, and well-being in the study area of a Geo-Naturepark in Germany.

Keywords: Mobile methods, walking as a research method, Walkscapes, Trigger Question Walk, strollology

1 Introduction

Walking is one of the most engaging and natural ways to encounter a landscape. The physical act of going outside and the integrated view of nature as landscape is to be seen as a turning point in the modern understanding and conceptualization of landscape (BRAAE & STEINER 2019). The term wanderlust reflects a long tradition of walking (SOLNIT 2001), so that pedestrialism is rooted in history, science, and literature (BRYSON 1998, WYLIE 2005, MACFARLANE 2007, NICHOLSON 2008, CARERI 2017). While the distanced form of viewing landscape on the one hand is to be regarded as an important basis for its aestheticization, real physical experience of landscape can enable more profound insights. *"[…] Walking offers an immersed and embodied sense of landscape – an alternative to the 'disembodied view' characteristic of scenic and picturesque landscape taste "*(MACPHERSON 2016, 427). Several scholars describe multiple layers of landscape knowledge, which were built by walking. These types of knowledge range from geomorphology (LUKAS & BRADWELL 2010) to psycho-geography (COVERLEY 2012). Thus, research interest in knowledge can only approach a comprehensive and lifeworldly description of landscape if it succeeds in complementing visual-aesthetic approaches with the physical experience both epistemologically and scientifically. Physicality must therefore be considered in the evaluation and description of landscape as a structural component (SCHUTZ & LUCKMANN 1973).

According to social-constructivism (COSGROVE 1985, BERGER & LUCKMANN 1991, COSGROVE 1998), landscapes come into being through the interactive, complex and bidirectional interplay between the observer and the observed, which also resonates within the European Landscape Convention and the according conceptualization of landscape as an area,

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as perceived by people, whose character is the result of the action and interaction of natural and/or human factors (COUNCIL OF EUROPE 2000). From a philosophical tradition of thought, wandering as a source of knowledge is based on considerations of corporeality, the moving body, its consciousness and the resulting basis of human perception. The way in which a living being can move and interact with its environment due to its nature is therefore of essential importance for the process of perception (GIBSON 1979). Maurice Merleau-Ponty developed a further approach to epistemology, which he elaborates in his *"Phenomenology of Perception"* and in which he gives a central role to the corporeality of the human being and the bodily sensing of the world (1962). He develops the idea that perception and sensuality, as the beginning of thinking of all philosophical considerations, are based on movement in space. Building on the previous explanations, it can be stated that walking, both from a historical perspective and against the background of epistemology, has numerous potentials for the study of human-space interaction, which can be operationalized in a variety of different research methods. *"Walking, in our view, holds great promise for obtaining knowledge to inform the design of complex landscapes […]"* (SCHULTZ & VAN ETTEGER 2016, 179). This paper will explain several ways, how mobile methods can contribute to knowledge building in landscape research and support applied planning and design.

2 Walking as a Research Method

The idea of evaluating spatial environments not only from a stationary perspective, but drawing on the performativity of everyday mobility, is a relatively new development in the social sciences, which is also referred to as the mobile paradigm. "Social science has largely ignored or trivialized the importance of the systematic movements of people for work and family life, for leisure and pleasure, and for politics and protest"(SHELLER & URRY 2006, 208). This goes hand in hand with a research interest and the methodological claim to take greater account of the mobility behavior of people with underlying behavioral patterns and modes of perception in scientific studies, as it has been systematically underrepresented in the past. In order to be able to meet this goal, mobile research methods are being developed and tested in different settings (BÜSCHER & URRY 2009). The conceptualization of walking and strolling as a scientific method has been pursued not only in the social sciences but also in phenomenological and explorative spatial research. In urban design, walking was used to investigate into the liveability of the urban context (APPLEYARD et al. 1981, SVARRE & GEHL 2013, SCHMIDT-HAMBURGER & ZEILE 2023), in sensing urban spaces (WUNDERLICH 2008) or in order to understand orientation in an urban environment (LYNCH 1960, 1998). Pedestrianism can also be considered as a centerpiece in the development of concepts for a walkable neighborhood or city (SPECK 2013).

Paradoxically, the idea of exploring landscape by walking is historically and socially deeply rooted and fundamental to our modern understandings of landscape (BRYSON 1998, SOLNIT 2001, MACFARLANE 2007), but in contrast is often underrepresented in scientific methodology. *"Walking has long been considered a more intimate way to engage with landscape that can offer privileged insights into both place and self"*(EVANS & JONES 2011, 850). Walking as a research method is dedicated to the study of direct and indirect social action and for gaining insights in order to understand why people display similar states of mind or behavior in specific spatial situations and thus share a section of the world. Knowledge and insights about this can essentially be gained by observing people in interaction (TURNER 1991). Walk-

ing narratives (COSTA et al. 2014, 2015), Go-Along Interviews (KUSENBACH 2003), Walking Voices (RISHBETH 2007), On-site Narratives (RISHBETH 2014), "parcours commenté" (THIBAUD 2001), wandering-method (SCHULTZ 2014, SCHULTZ & VAN ETTEGER 2016) or Continuous/stop-motion walking (SCHULTZ & VAN ETTEGER 2016, VAN ETTEGER 2016) can be considered as relatively new qualitative research methods in different variations, whose precursors are rooted in 'in situ' research on children and young people and their development (HART 1979, MOORE 1986). They were originally developed in the field of participation and inclusion research. Their application aims to develop a better understanding of how local environments are experienced and interpreted by the perceiving subject and to what extent spaces influence human action and behavior (KUSENBACH 2003, CARPIANO 2009). For this purpose, qualitative interviews, which can be semi-standardized or open-ended, are combined with participant observation and field observation (DEAN 2016). Thus, mobile methods draw on the inherent power of traditional ethnographic field studies coupled with the comprehensive explanatory potential of individual interviews (CARPIANO 2009). Against this backdrop, the German scholar Lucius Burkhard coined the term *"Strollology"*, which describes *"the science of strolling"* and carried out a wide range of walking experiments in landscapes and urban areas. Burkhard's experimental practices influenced aesthetic disciplines as well as cultural studies and paved way for a new understanding of walking as a method in research (FEZER & SCHMITZ 2012).

Several key themes can be identified in the literature for the application of mobile methods (DANIEL & BOSTER 1976; KUSENBACH 2003, 456; DEAN 2016; SCHULTZ & VAN ETTEGER 2016, 182; MÜNDERLEIN 2022):

- *Perception: What personal values affect experiences of social and physical space in everyday life?*
- *Evaluate scenic beauty of environments: What is considered beautiful?*
- *Evaluate human emotions in space: How do people feel in spatial settings?*
- *Social architecture: What interpersonal relationships emerge in a specific setting and how do people orient themselves within it?*
- *Social space: What patterns of interaction can be identified and how are these influenced by the spatial situation?*
- *Generating implicit knowledge: Through the process of entering the space, action-based knowledge is generated, which is not available verbally and differs from information from the application of other research methods.*
- *Reflection in action: The implicit experiences of the walk can be externalized and used as a basis for individual or group reflection processes.*

The procedure of mobile methods is that selected subjects lead researchers through a predefined area that is part of their everyday life or functions as a spatial backdrop for the corresponding everyday practice. This can be an urban environment (KUSENBACH 2003) or a landscape (DANIEL & BOSTER 1976, SCHULTZ & VAN ETTEGER 2016). Different documentation options for mobile data collection can be found in the literature. Some studies are limited to the classic production of field notes (THIBAUD 2001, KUSENBACH 2003), while in many cases sketches and photographs (SCHULTZ & VAN ETTEGER 2016, VAN ETTEGER 2016) or videos (JONES et al. 2008) are additionally created by the participants. A strong trend of digitalization can be observed in the studies, in order to deal with the abundance of data (JONES & EVANS 2012, RISHBETH 2014, COSTA et al. 2015, MÜNDERLEIN 2023, TSAI et al. 2023).

Data collection in mobile methods includes nowadays digital images, videos, voice recordings, GPS tracks and field notes and new innovative formats for aggregating and visualizing the results are under constant development, which provide new insights into mobility data.

In order to conclude this section, a selection of the advantages and potential of mobile methods is presented below. According to the literature, there are numerous advantages to using mobile methods. There is the potential of creating new spaces of possibility for investigation and disclosure of information that remains hidden in static interview settings (KUSENBACH 2003, MOLES 2008). The environment can be used directly as a basis for interview or discussion without the need for visual images of it (DANIEL & BOSTER 1976, SCOTT et al. 2009). The collaborative experience of the survey walks reduces the distance between subjects and researchers. Thus, there are opportunities to adjust and refine the research methods in a situation-sensitive way and with regard to specific social or cultural contexts (ISRAEL et al. 1998; ANDERSON 2004, RISHBETH 2014). Multisensory information is collected on responses to stimuli from physical environments (SCOTT et al. 2009), which is also due to the fact that mobile methods can be combined well with photo/video-based research methods (JONES et al. 2008). This allows for deeper and more detailed insights into individual spatial constructs (O'NEILL & HUBBARD 2010) and can be useful in making previously unheard opinions visible in planning processes (MYERS 2011).

3 Developing the Trigger Question Walk Method

Building on the considerations on walking as a source of knowledge (Section 1) and the classification of mobile research methods (Section 2), a new and innovative procedure is now presented, with the help of which, data from guided walks in study areas can be obtained, systematically evaluated according to content and spatially projected and visualized with the help of a GIS. The focus of the method presented here is on the reproducibility and traceability of application, evaluation and visualization of results in forms of maps *("walkscapes on the map"*). So far, these scientific standards have only been met to a limited extent by existing mobile methods. The *Trigger Question Walk* is part of a larger empirical study that investigates into the interrelationships between landscape, health and well-being in the study area of a Geo-Naturepark in Germany.

The application of the method serves to answer the following research questions:

- *How can the walking and hiking experience be mapped as an essential part of recreational practice?*
- *What are the components of the recreational experience?*

3.1 Selected Study Area and Case Studies

In the following paragraphs, the study area and the according case studies are being described. These have been selected because of their high potential for landscape-based restoration and their intensive use as hiking areas.

3.1.1 Study Area

The area of the Geo-Nature Park Bergstraße-Odenwald is embedded between the rivers Rhine, Main and Neckar. It is a vast landscape in the middle of Germany, covering more than

3800 km² including diverse and formally protected natural and geological highlights. The nature park plays an important role as recreational area for the Rhine-Main and Rhine-Neckar metropolitan areas due to its high natural quality and proximity to cities such as Frankfurt and Darmstadt. In terms of recreation and relaxation in natural environments, the primary focus for the Geo-Nature Park was the development of an extensive network of trails and pathways for different outdoor activities. In recent years, the development of the tourist infrastructure has been driven in particular by hiking trails, a network of trails for Nordic Walking and numerous mountain bike trails. These measures have led to an increased number of visitors from a large catchment area including other European countries. Because of this intensive recreational use of walking, the use of a mobile method is particularly promising in this study area. Two case studies have been selected for the application of the *Trigger Question Walk*.

3.1.1.1 Case Study 1

The first case study is located deeply in the hinterland of the Geo-Nature Park and is characterized by gentle topography alternating with open land and mixed forest areas (Figure 1). The hiking area is located on the border of a lowland plain and offers stunning viewpoints from the low mountain range structures to the flat plain. A boulder field in the area can be considered as a highlight for tourists. This rocky landscape is surrounded by a dense mixed deciduous forest and has been used as a source of building materials since Roman times. Nowadays, climbing on the rocks is a popular leisure activity among recreation seekers. The boulder field offers good conditions for this due to its extent and texture. Due to these natural features, the nature park administration has promoted the development of hiking and climbing trails, so that Case Study 1 serves as a starting point for long-distance hikes and day trips. For applying the *Trigger Question Walk* method, a route of 3.84 kilometers was defined, which is based on the existing hiking trails.

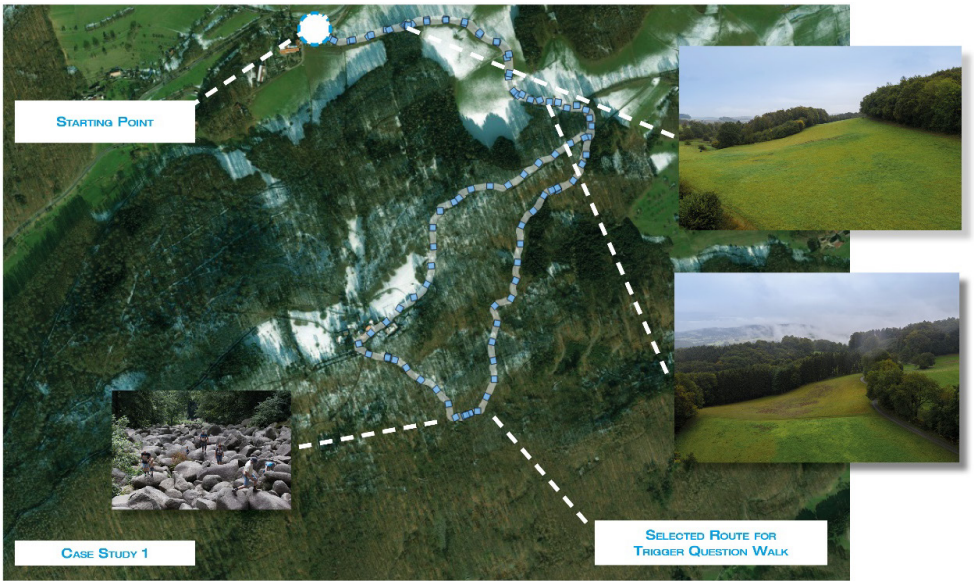

Fig. 1: Case Study 1 with selected route

3.1.1.2 Case Study 2

The second case study is located at the urban fringe and can be reached by bike, car or public transport in just a few minutes from the city center (Figure 2). It is characterized by an artificially created lake, which covers an area of approx. 3 hectares and is approx. 1.5 meters deep. The lake is supplied with fresh water by running water and was probably originally used for fish farming. Since the 1960s, the recreational infrastructure has been gradually expanded, so that today there is a mini golf course, pedal boat hire, pony rides for children and an adventure playground. A large carpark for walkers was built near to the green area, which is used by visitors of both the recreation area and a local restaurant. The restaurant is a popular stop-off point for visitors and is also used as a venue for festivities. For applying the *Trigger Question Walk*, a route of 1.8 kilometers was defined in Case Study 2, which is based on the existing hiking trails around the lake.

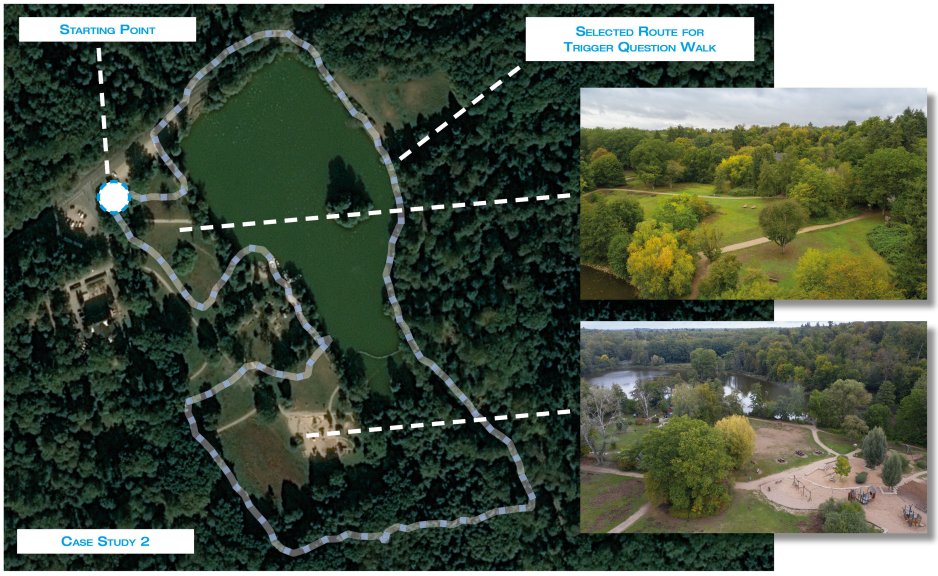

Fig. 2: Case Study 2 with selected route

3.2 Workflow of the Trigger Question Walk

In the following, the workflow of the *Trigger Question Walk* is explained. It consists of several individual work steps, which are explained in the following. These include application of the walk (3.3), the selection of routes (3.4), sampling (3.5), documentation and data collection (3.6), describing collected data (3.7), the transcription and analysis of the data (3.8), export of the interview data (3.9), processing of the recorded GPS waypoints (3.10), and the spatial projection and visualization of the results (3.11). All steps are visualized in Figure 3 and will be explained in detail in the following paragraphs.

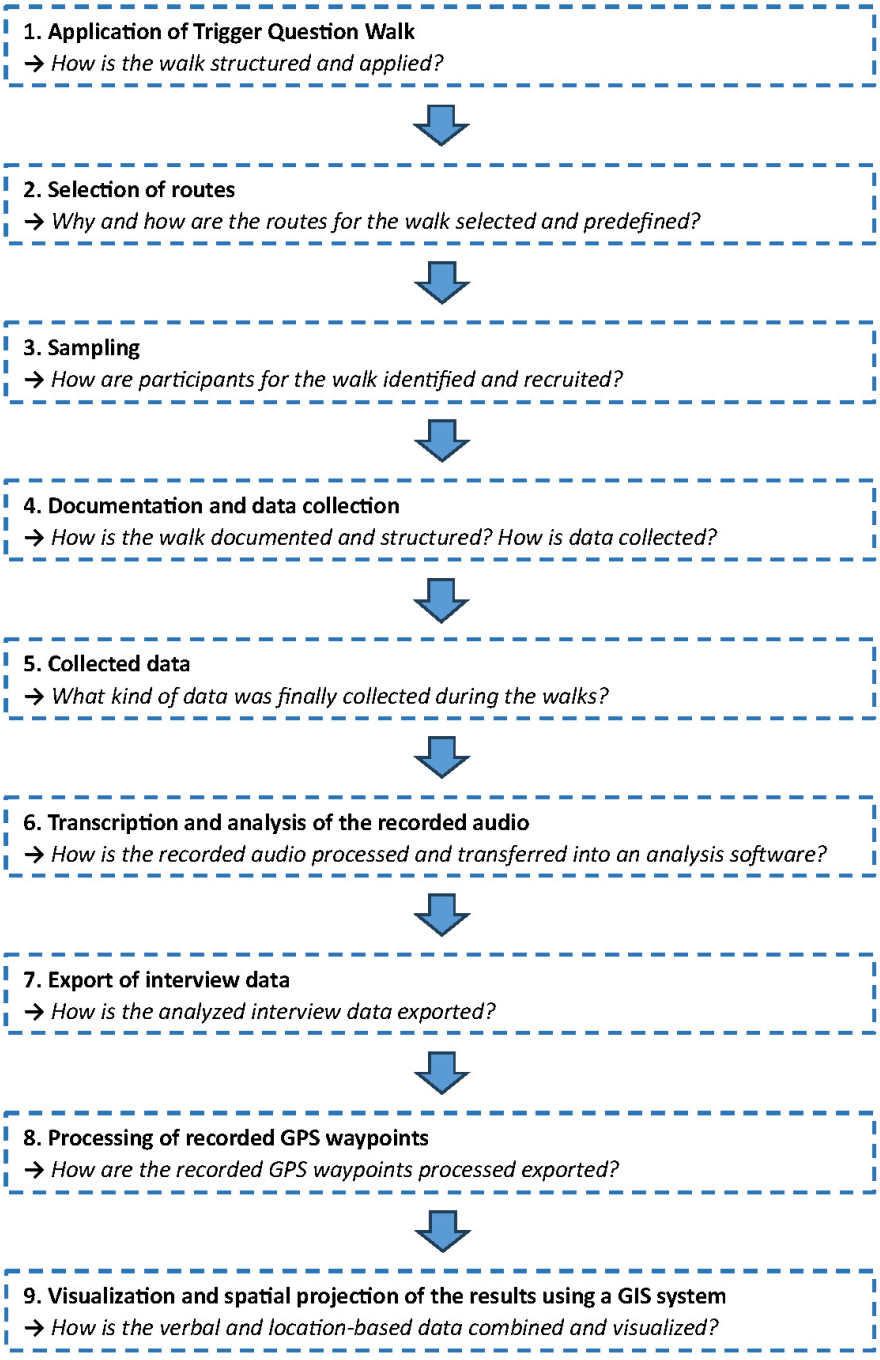

Fig. 3: Workflow of the Trigger Question Walk

3.3 Application of the Trigger Question Walk

As part of the study in the described nature park, participants move together with the research staff during the experiential walks. This communal experience of landscape should enable naturally occurring conversations between scientists and participants (JONES et al. 2008), in order to be able to evaluate the landscape experience in full authenticity and naturalness (KUSENBACH 2003, BERGERON et al. 2014). For this purpose, the explanatory potential of individual interviews is used, which presupposes conversations between scientific staff and the participants during the movement in the field. In terms of scientific replicability, it is necessary to be able to reproduce the dramaturgy of the walk, as well as its course in the study area, in a comparable form. Only in this way can data related to the study area be generated, which offer potential for a systematic analysis in terms of comparability or contrast. For this purpose, the guided walks are divided into three phases.

The first phase is the check-in phase, which serves to immerse oneself physically and mentally in the study area. It is followed by the experience phase, in which the actual landscape experience is to be described in more detail as a flow of experiences by the participants. During this experience phase, the individual impressions are to be verbalized and mentally connected to form an overall landscape experience. This process is catalyzed by the rhythm of the steps as well as the movement of the human body in space (SCHULTZ & VAN ETTEGER 2016). In order to take full advantage of the explanatory potential of the walk with the test persons and to establish a certain comparability with regard to the course of the conversation, a set of trigger questions is defined in advance for the experience phase (therefore also referred to here as *Trigger Question Walk*; see Figure 4).

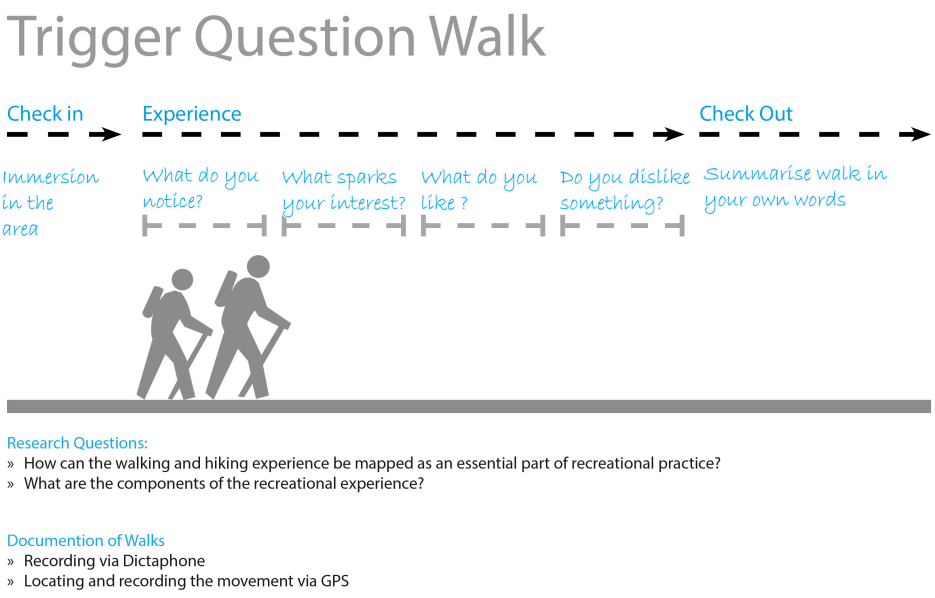

Fig. 4: Application of Trigger Question Walk

On the one hand, these have the task of directing the perception of the persons to the areas under investigation in order to understand them as a basis for conversation, and on the other hand, they are to be used to guide the conversations to be held and to produce comparable conversation content. The questions are intended to function as triggers for the uncovering of space-related emotions, to initiate research-relevant relevant statements and to reduce digressive explanations. Questions have been used throughout the walk to stimulate the discussion or to bring the focus back on the landscape. Through the use of trigger questions, the research has a reactive character, which exposes deeper levels of knowledge, but in turn, colors the perception of the participants. Thus, a certain degree of pre-influence can be assumed, which is based on the psychological phenomenon of priming. The exact extent of this influence cannot be examined due to the research design and the scope of the presented research. Other scientific works discuss this phenomenon in detail (BARGH & CHARTRAND 2014). The process of collecting individual experiences from the *Trigger Question Walk* is initiated and intensified again in the final reflection phase, when the participants are asked to summarize and reflect on the *Trigger Question Walk* in their own words shortly before returning to the starting point.

3.4 Selection of Routes

Existing mobile research methods can be differentiated with regard to the pre-selection of a possible route and the local knowledge of the participants. While natural go-alongs are based on an intuitive and free movement in the familiar living environment of the participants (KUSENBACH 2003), other studies are focusing on predefined routes (JONES et al. 2008, VAN ETTEGER 2013, 2016). The present study aims at carrying out several reproducible experiential walks with different participants, the determination of a predefined route is essential in the context of the presented research design. Against this background, the scientific staff takes an active role by intervening in the course of the *Trigger Question Walk* and guiding the participants through the study areas. The criteria for route selection must be adapted according to the purpose. For example, the following criteria can be used for the selection:

- *Uniform coverage of the qualities of the area to be studied (natural areas, land use areas, offers, etc.)*
- *Orientation towards existing recreation infrastructure such as existing pathways and recreation facilities*
- *Consideration of existing recreational behavior of visitors in the study area*

3.5 Sampling

Participants of the *Trigger Questions Walks* were mainly recruited trough the mailing list of the Nature Park management. Dates and general information about the events had been announced via email and social media and people were invited to take part. A campaign under the claim “hiking for science” was initiated, which helped to promote the walks as events. The walks had been carried out during weekends and in summer months, so locals and tourists also decided to spontaneously join the *Trigger Question Walks*, once they saw the gathering of the hikers and heard the explanations. Profiles of the participants have been recorded and have been taken into account, when analyzing the interviews.

3.6 Documentation and Data Collection

To be able to guarantee a systematic evaluation of the guided hikes, attention must be paid to the generation of a coherent data set including diverse sources of information. In order to visualize and compare the individual hiking experiences, it is necessary to collect space- and perception-related information. For this purpose, spatial data is recorded with the help of a GPS tracker, which records individual points at regular intervals, containing both spatial coordinates and information on the recording time in the form of time stamps. Furthermore, it is necessary to record spoken statements about individual perception throughout and to spatially locate generated visual material such as photos or sketches.

A digital dictaphone is used to record the interviews, which also stores the time of the beginning and end of the recording with the audio recording.

3.7 Collected Data

In total 14 *Trigger Question Walks* have been applied in two different areas of the Nature Park. In each area seven walks were carried out, with a total number of 35 participants. The duration of the walks varied according to the mobility of the individual participants. For area one there was a predetermined track of around 3,8km and the individual duration of each walk was between 60-80 minutes and included 200-250 recorded GPS Points. The track for area two was 1,8km and the duration of the walks varied between 50-70 minutes and included recorded 110-140 GPS Points. In total around 18 hours of *Trigger Question Walks* including 2500 GPS points were recorded via Dictaphone and GPS tracker. Detailed information for the collected data can be found in Table 1.

Table 1: Collected Data from the Trigger Question Walks

Nature Park Area	Number of Trigger Question Walks	Involved Participants	Duration of each Walk	Distance per Walk	Number of Recorded GPS Points per Walk
Nature Park Area 1 (Rural)	7	20	60-80 Minutes	3,84km	200-250
Nature Park Area 2 (Urban)	7	15	50-70 Minutes	1,8km	110-140
Total	**14**	**35**	**Ca. 18 hours of recorded audio**	**39,49km**	**Ca. 2500**

3.8 Transcription and Analysis of the Recorded Audio

In the first step of the analysis, the digitally recorded data from the dictation machine is imported as an audio file into a software for the evaluation of qualitative data (MAXQDA), where it is converted into a digital text form with the help of the transcription assistant. During this process, the conversations from the *Trigger Question Walks* are not only transcribed, but also time-stamped. In this way, the participants' statements can be referenced with the chronological course of the adventure walks after they have been transcribed. For example, the statement *"I especially love the change of meadows, pastures and forest here"* can be

assigned to the timeframe from 00:08:10.7 to 00:08:35.7 through the time stamp (Table 2). Evaluation strategies for mobile methods that include extensive text-based qualitative data material such as field notes or interview transcripts often evaluate them according to the grounded theory approach (KUSENBACH 2003). A central component of this is the inductive coding of individual statements as well as the iterative change between data analysis, coding and analysis, which is also referred to as permanent comparison (GLASER & STRAUSS 1998).

In the context of the analysis of the data of the present case study on the investigation of a recreation area, an inductive coding of the transcripts is carried out, which, however, is structured on the basis of three theoretically grounded levels of analysis (Figure 5). These go in line with social-constructivism theory, which was discussed during the introduction of this paper (COSGROVE 1985, BERGER & LUCKMANN 1991, DANIELS & COSGROVE 1993, COSGROVE 1998).

- **Interpretation:** Statements on the further interpretation of the landscape by the observers. This includes emotional evaluations, references as well as symbolic associations.
- **Experiencing and perceiving:** Due to the movement in the terrain, certain elements of the landscape are perceived and experienced in a choreographic interplay.
- **Physical-material aspects of the landscape:** People name certain parts of the landscape and mention them in the interviews.

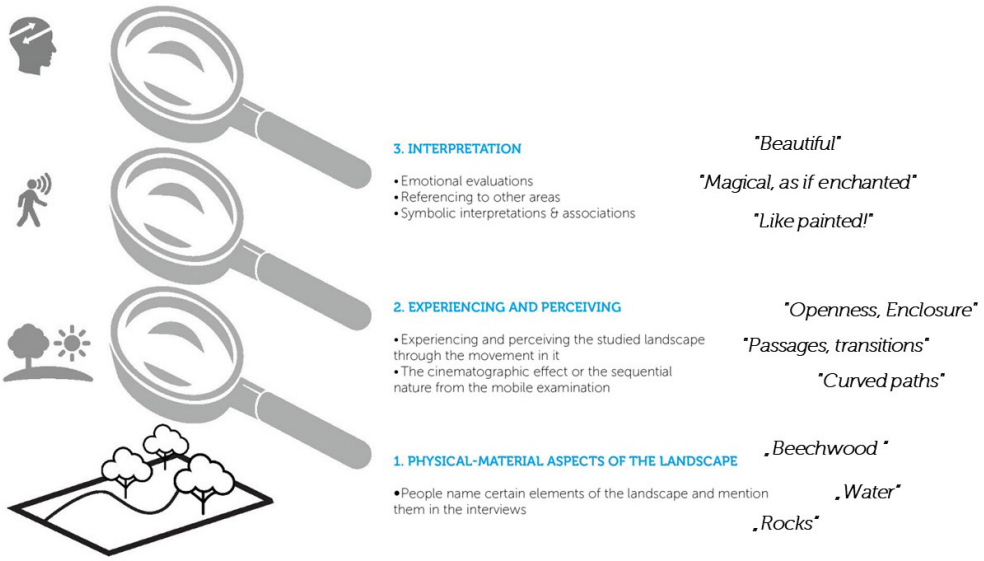

Fig. 5: Three lenses of data analysis

3.9 Export of Interview Data

With the help of the automatic export functions, the transcribed and coded interview data can be exported as an Excel table. Since time stamps are assigned to the individual text passages

during transcription in MAXQDA, the spoken statements and the assigned codes can be assigned to specific time frames. These contain the start and end time of the occurrence of the statement or the assigned code category. The duration of the time window can also be determined from this. The Excel tables are prepared in such a way that all superordinate categories, subcategories and detailed statements are chronologically assigned to the time marks in their occurrence.

This is done separately for the three layers of analysis (*physical-material, experience and perception as well as interpretation by humans*). Table 2 shows an excerpt from a correspondingly prepared Excel file.

Table 2: Processed data from the coded interviews with time stamps

Time Begin (hh:mm:SS,X)	Time End (hh:mm:SS,X)	Duration (hh:mm:SS,X	Main Category	Sub Category	Detail
00:04:50,4	00:04:50,8	00:00:00,4	Time	Course of the seasons	Autumn
00:07:35,3	00:08:03,4	00:00:28,1	Emotional Assesment	Positiv	Beautiful
00:08:34,6	00:08:35,6	00:00:01,0	Emotional Assesment	Positiv	Cozy
00:10:10,5	00:10:13,4	00:00:02,9	Emotional Assesment	Positiv	Attracting
00:12:17,1	00:12:34,1	00:00:17,0	Personal anecdotes		
00:12:34,3	00:12:40,8	00:00:06,5	Emotional Assesment	Positiv	Soft
00:12:42,8	00:12:57,2	00:00:14,4	Emotional Assesment	Positiv	Goes into the heart
00:13:15,1	00:13:17,2	00:00:02,1	Emotional Assesment	Positiv	Soft
00:13:43,7	00:13:50,4	00:00:06,7	Recognition	Typisch	
00:13:59,1	00:14:01,6	00:00:02,5	Referencing	Referencing to other areas	

3.10 Processing of Recorded GPS Waypoints

The GPS track is loaded as a GPX file from the GPS device into the GIS software and processed there so that the corresponding time of recording and the spatial coordinates are available for each individual point. The data is summarized in an ESRI shape file. The position by GPS is recorded every 10 seconds. Depending on the walking speed, this means that measurement points are recorded at intervals of 5-15 meters during the *Trigger Question Walks*. A handheld GPS tracker was used and accuracy varied through the walks. According to the information from the tracker, the accuracy of each GPS point was between 2-5 meters and decreased in the woodlands. Individual routes were checked during this stage and dead-points could be easily corrected in post-processing, as all participants followed the same track.

3.11 Visualization and Spatial Projection of the Results Using GIS

Against the background of the usability of the results for spatial planning purposes, their presentation in the form of maps or spatial visualizations is of fundamental importance. However, the central challenge in establishing the reference to place and location is the character of interview data from the application of mobile methods. Since the persons move continuously during the verbal explanations of spatial impressions or interpretations, a selective localization is not appropriate from a theoretical and methodical perspective. However, for research pragmatic reasons, the location of anchor quotes, photos or sketches and their point-by-point representation on a map (JONES et al. 2008, JONES & EVANS 2012) or in terrain sections (COSTA et al. 2014, 2015, COSTA & COLES 2018) is often used in existing studies. In order to account for the sequential nature of the spoken information while moving in space, a new and innovative approach is presented for visualization and spatial location, which consists of automatically and comprehensively linking GPS data and interview results. In order

to develop a coherent database from the processed partial data, some work steps have to be automated. For this purpose, the ArcGIS ModelBuilder is used, as it was designed for the generation of automated models and workflows. In the first step, the waypoints are connected by line segments in order to have information available for the time frames between the individual waypoints. For this purpose, data must be interpolated, since no statements can be made about the movement behavior between the individual waypoints. This means that on the basis of the available data, an accuracy of approx. 5-10 meters can be achieved for the referencing. With the help of the automatic model, all generated segments are now searched for temporal correspondences to the data in the processed Excel files so the tables of both data sources were joined. When temporally corresponding data is found, the categories from the Excel tables are integrated into the attribute table of the geodata (Figure 6). So, tables of both data sources were joined during this process. Since the georeferencing follows the created segments, this is also a temporally and spatially continuous localization, which does justice to the mobile character of the recording. The result is linear geodata, which can now be adapted to the structure of the three analysis levels. Based on the symbology, colors are assigned to all categories, which can provide information about the categorized interview data in the area of the individual segments in the spatial representation.

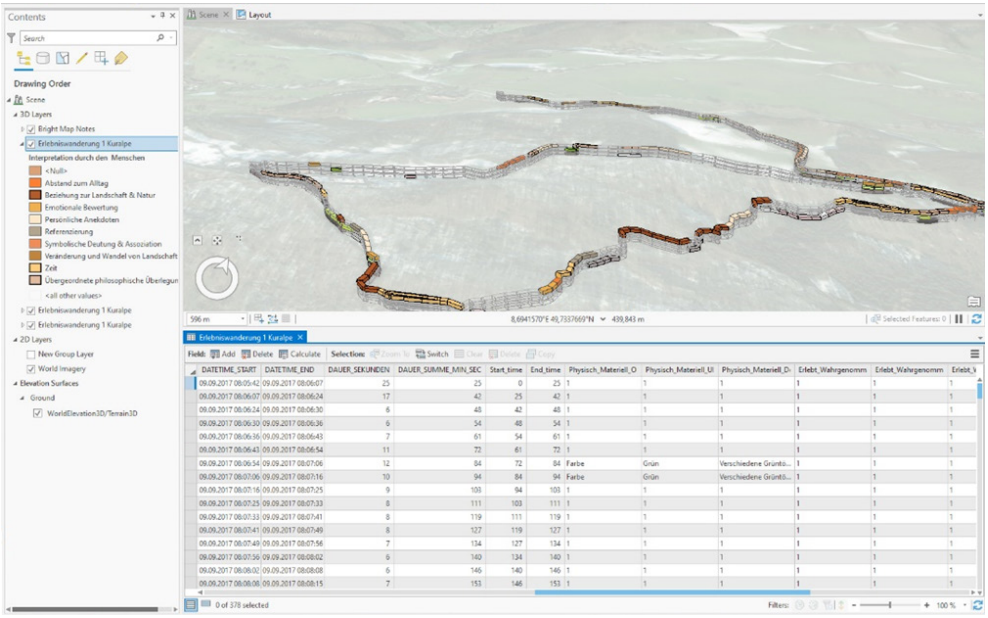

Fig. 6: Insights from the walkscapes models in GIS

4 Findings

In the following, findings from the application of the *Trigger Question Walks* in the nature park are being presented. The previously described trigger question models in the GIS used,

to visualize findings for the individual walks, but also to gain insights into the supra-individual evaluation of the landscape of the nature park through all involved participants of the study. Against this backdrop, the individual results from two selected walks of each case study are being presented in 4.1. Based on this, aggregated supra-individual results are presented in 4.2 and "positive landscape hotspots" are being identified through mapping. Additional explanations of the findings can be found in 4.3.

4.1 Findings from Individual Walks

Due to the abundance of collected data from the 14 walks in total, only findings from two selected walks can be displayed and explained in the following. Based on the GIS model, the course of the walks was digitally traced. The three levels of analysis (*interpretation, experiencing & perceiving, physical-material)* can be seen in the illustration. The individual walks are visualized as axonometry on an aerial photograph alongside the identified categories. This illustrates the frequencies of occurrence of certain categories and their distribution in the study area. The categories are also sorted by frequency in the legend of the maps. Furthermore, overlaps between the individual analysis levels can be viewed. This visualization is helpful in terms of understating the spatial distribution of statements and the interplay between the three analytical layers.

4.1.1 Case Study 1

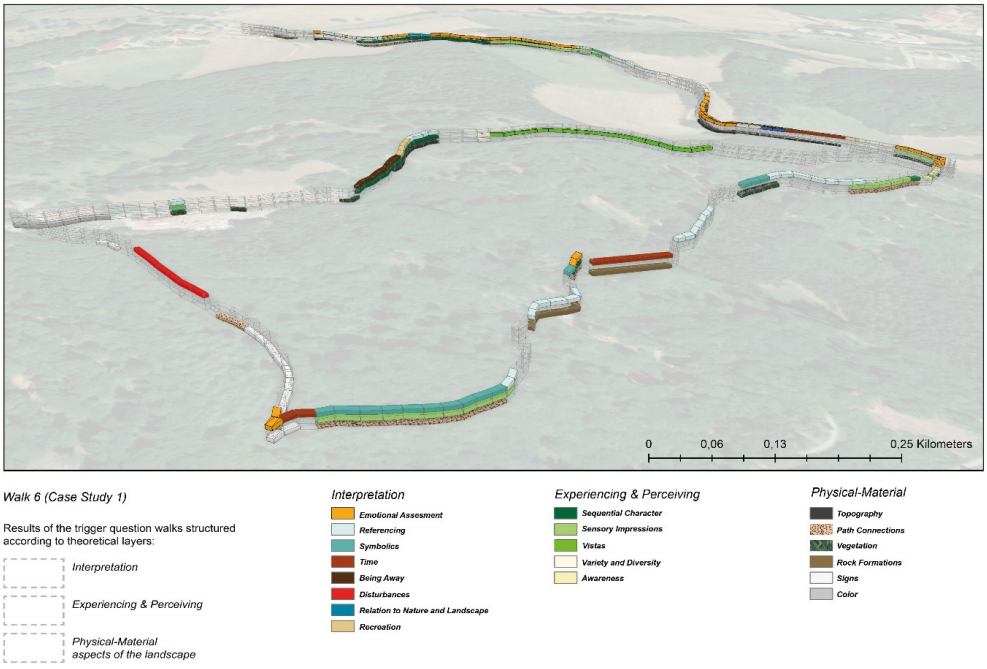

Fig. 7: GIS visualization of Trigger Question Walk 6 (Case Study 1)

Figure 7 shows the result of the *Trigger Question Walk* in Case Study 1. On closer inspection of the physical-material level, it becomes clear that it is primarily path connections, topography and the rock formations of the boulder field, which are addressed by the walkers. In terms of experiencing & perceiving mostly sensory impressions and the sequential character have been mentioned. The interpretation layer reveals, that emotional assessments and statements about referencing and symbolics had been dominant through the walks. The mapping illustrates interlinks between the three layers and spatial distribution. Strong interlinks can be observed between good path connections, sensory impressions and positive emotional assessments. Symbolic interpretations are concentrated in the area around the boulder field and positive emotional assessments can also be found in the area between forest and open land. Some comments about disturbances can be observed in an area, which is visually compromised by wind turbines.

4.1.2 Case Study 2

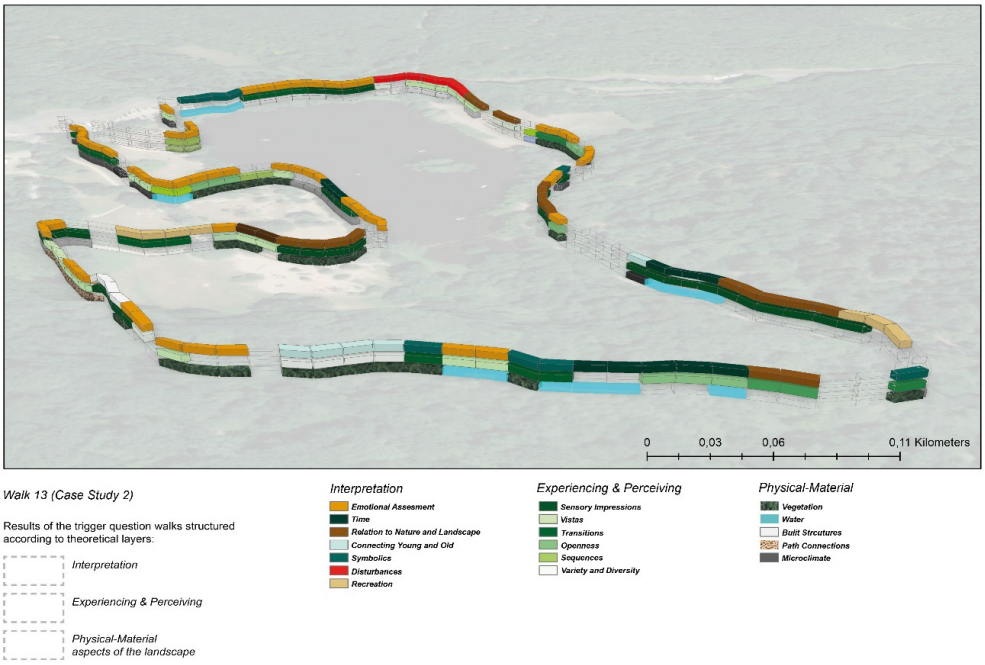

Fig. 8: GIS visualization of Trigger Question Walk 13 (Case Study 2)

Figure 8 visualizes the result of the *Trigger Question Walk* in Case Study 2. The statements from the physical-material layer are mostly referring to water, vegetation, built structures and path connections. In the category of experiencing & perceiving mostly sensory impressions and vistas but also transitions, awareness, sequences and openness are mentioned. In terms of interpretation, it becomes apparent, that emotional assessments are the dominating category. But also several statements about time (seasons of the year), relation to nature and landscape as well as connections between young and old can be observed. Through the mapping approach it becomes apparent, that most positive statements were made nearby the lake

and with open visual contact to the water. Disturbances can only be observed alongside a close road. Transitions between forest and the open park as well as vegetation in general seems to be connected to interpretive statements about the human relation to nature and landscape and other symbolic meanings.

4.2 Supra-Individual Findings from All Walks

Based on the individual results from different *Trigger Question Walks*, a supra-individual evaluation of the aggregated findings is carried out. This follows the phenomenological character of mobile methods explained in detail in section 2 and aims at revealing commonalities between individual landscape experiences. Social constructivist theories could also offer different evaluations strategies, which focus on demographic or cultural differences. This is outside of the scope of the presented research and subject for future research. In order to reveal communalities, statements on positive emotional interpretations of both case studies were extracted from all data sets of the individual *Trigger Question Walks*. This process of finding commonalities in the individual walks is explained in Figure 9.

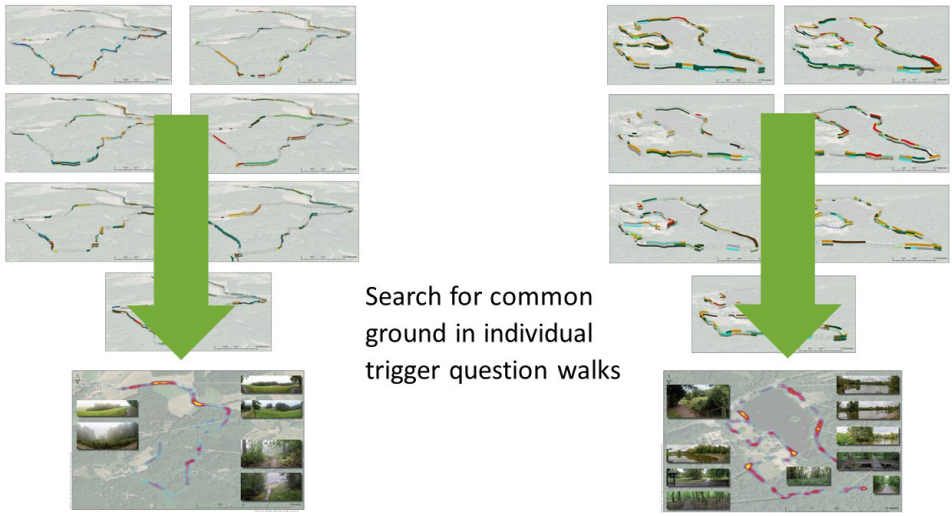

Fig. 9: Searching for commonalities in individual Trigger Question Walks

For the visualization of the results, the visual style of heat maps is used, which has already proven itself in comparable studies for the representation of human emotions in space (DÖRRZAPF & KOVÁCS-GYŐRI et al. 2019, DÖRRZAPF & ZEILE et al. 2019). Two resulting maps are presented, which reflect the emotional mapping approach for each of the two study areas. Each resulting map (Figure 9 & 10) visualizes the spatial distribution of around 200-250 statements on positive landscape experience based on seven *Trigger Question Walks*. The aim is not to absolutely quantify the number of statements in each hotspot. This step serves the purpose of aggregating data from the individual walks (4.1) in order to visually obtain spatial commonalities. To increase the intuitive readability of the representation, explanatory panoramic images were assigned to the identified hotspots to illustrate the respective spatial situations in plan graphics.

4.2.1 Case Study 1

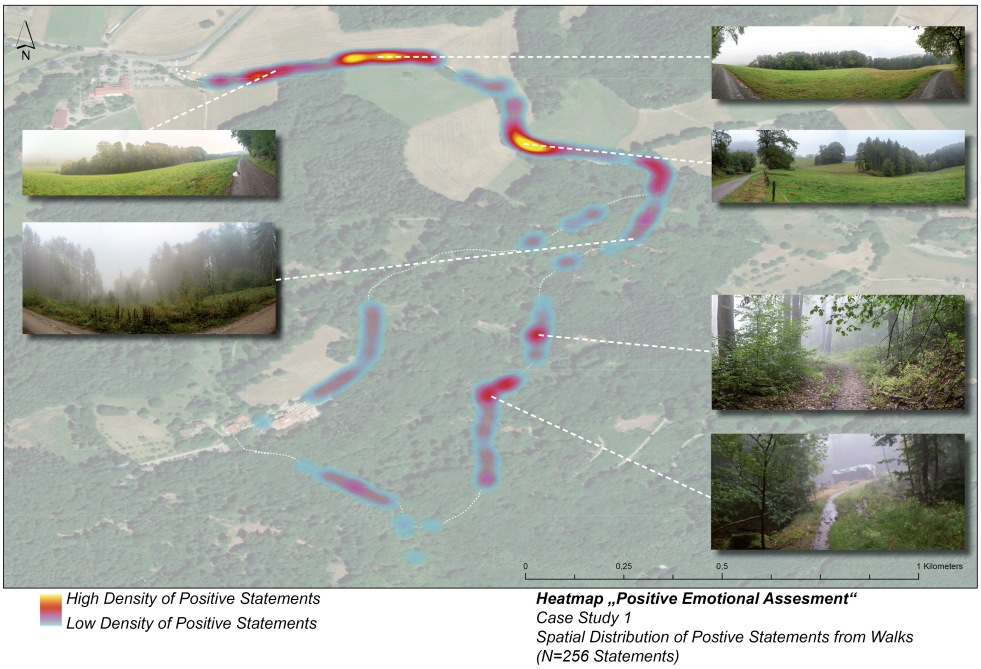

Fig. 10: Heat Map displaying positive emotional assessments of case study 1

The resulting heat map (Figure 10) for case study 1 identifies several “positive hotspots” in the landscape. The open vistas during the beginning and end of the hikes evoke strong positive emotions. Furthermore, the transitions between openness and narrow pathways are assessed in a positive way by the participants. The area around the boulder field seems to trigger symbolic associations and not only positive emotions. The heatmap also reveals transit areas, without positive emotional interpretations.

4.2.2 Case Study 2

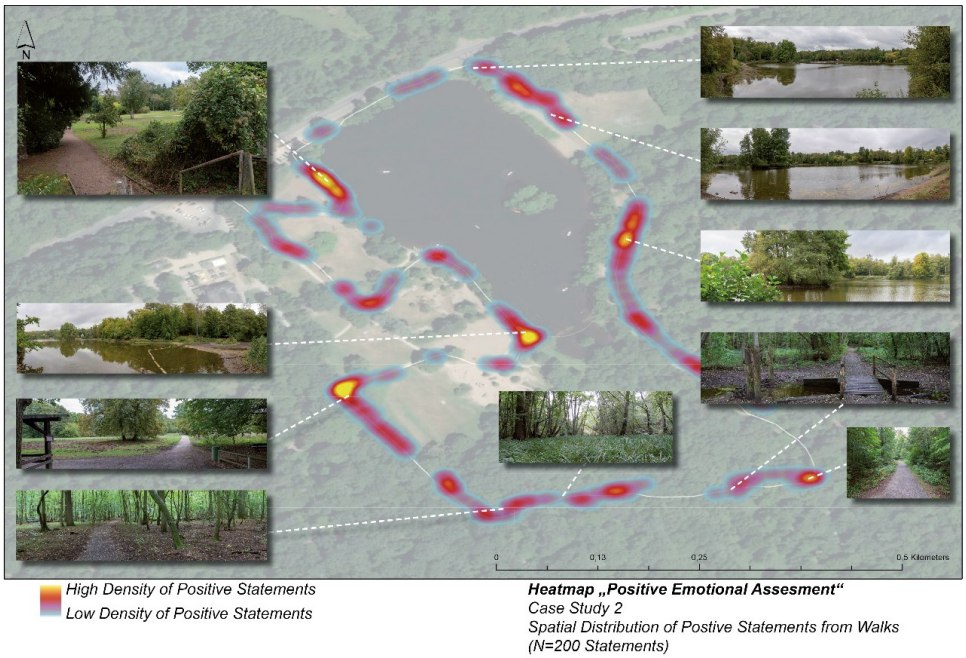

Fig. 11: Heat Map displaying positive emotional assessments of case study 2

The resulting heat map (Figure 11) for case study 2 reveals “positive hotspots” in the park area. The open vistas and viewpoints nearby the water are associated with strong positive emotions. The transition areas between the open park area and the surrounding woodland trigger positive responses. In general people seem to relate to the change between maintained and natural parts of the study area. Several features like bridges and small pathways are also evaluated positively. The road in the northern part of the park is clearly a transit area, with little emotional triggers.

4.3 Explanations of the Findings

The first thing which becomes apparent is that times, categories and ideas of landscape experience grounded in participant perspectives reveal a richness of landscape and can be seen as an opportunity to supplement and enrich current landscape evaluation strategies. In addition to the operationalization of classical visual sensory impressions, the *Trigger Question Walks* were able to generate multisensory information on the experience and perception of landscape. In this way, individual spatial constructs could be revealed and visually presented on several levels. Mobile methods provide detailed insights into individual and supra-individual landscape constructs. Fine notions of the landscape experience could be revealed and evaluated by looking at interview data through the three analytical lenses. This highlighted how physical-material elements of the landscape are assigned with personal meaning and subject to symbolic interpretations including aspects such as emotional value attributions,

metaphorical interpretations, associations and mentally produced references. Positive emotional assessments had been the dominating coding category throughout the analysis of all walks. Furthermore, it was possible to obtain in-depth information on the interpretation of the study areas by the interviewees. In addition to this, the *Trigger Question Walk* was in particular useful for understanding landscape experience and perception through movement, which is otherwise not accessible in its dynamics and the experienced context of spatial sequences. The way certain landscape features would align during the walk seems to be very important for the visitors. Transitions in these perceived spatial choreographies can feel "hard and abrupt" or "soft and fluid", which shapes and affects the according restorative experience. Some people also described these transitions as guiding themes and emphasized during the checkout phase, that they mainly remember the feeling of these sections but not the single details of the landscape. Open vistas, contact to water, the boulder field, forest edges or atmospheric spaces were regarded as highlights and contributed to the overall positive experience. Other parts of park, which were used for transit only seem to be without deeper restorative qualities. These findings go in line with the picturesque garden tradition and the design of interesting spatial choreographies is clearly documented in the English and French renaissance and baroque gardens. Mobile methods could be an inspiring way to evaluate the quality of these garden design principles.

Although landscape perception must be considered as something subjective, positive statements during the *Trigger Question Walks* were not gradually spread across the areas of the case study, but clear hotspots can be identified. The presented heat maps are suitable for identifying hot spots or transit areas and can be used directly for spatial planning. They act as a link between individual and supra-individual results and seem to be a promising way of depicting human emotions in space. Although the homogenous group of participants can be regarded as a limitation in this regard. Most participants were familiar with the case studies and visit the Nature Park on a regular basis for recreational purpose. Involving people from other cultural backgrounds with different motivations could affect the results. Testing for cultural preferences might reveal different notions of the idea of landscape as well as patterns of landscape perception. Carrying out *Trigger Question Walks* with a more diverse group of participants could be an important source of knowledge for inclusive landscape planning and design.

There was no detailed terrain data included in this presented research, as the focus was on mapping the perception of the individual subject. Linking the presented walkscapes approach with comprehensive terrain models and established formats like a viewshed analysis could unlock even more spatial potentials for evaluating the interplay between physical features and perceived qualities of the landscape.

In summary the *Trigger Questions Walks* were in particular helpful for understanding the interlinks between physical-material and symbolic-interpretative qualities of the landscape while making the perspective of walking person tangible and shedding light on experienced spatial choreographies. The GIS mapping made it possible to depict these interlinks in the according spatial settings and revealed individual findings as well as supra-individual communalities.

5 Conclusion

Although walking is already a well theorized and approved phenomenological research method, there is still a lot of room for innovative analysis approaches and visualizations of the according data. Since mobile methods were adopted by different academic disciplines as well as in artistic practice, there is a wide range of expectations regarding the outcome and potential academic standards of the findings. The presented research illustrates that a relatively simple application of walking as a research method in combination with digital documentation in form of voice and GPS recordings results in an abundance of data, which calls for a comprehensive and efficient evaluation strategy. The proposed GIS based and automated workflow is capable of processing and linking location and text-based data, after interviews have been transcribed and coded. The created maps emphasize that experiential and perception-based mapping approaches result in new and uncommon visual styles, which are based on hotspots and fragments instead of exhaustive area coverage. Accepting an experiential approach and its unconventional outcomes might change the nature of existing landscape assessment approaches from a procedure in which observers perform on a landscape to an activity carried out by engaging with landscape. Walking might lead us to questioning our familiar surroundings on a profound level and might provide us with a new trajectory and beat for all of our landscape-based reflection and research practices.

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