

## Abstract

In the subject of tourism management and scholarship the tourists' emotional experience of a city that is visited is essential. This qualitative exploratory thesis presents a comparison between the emotional experience of tourists in touristic and non-touristic areas, based on physiological observations through skin conductance measurements. By gathering data on the skin conductance level (SCL) of respondents, potential arousing spots can be noticed within the city. The data collection is carried out in the touristic city of Krakow that attracted approximately 13 million visitors in the year 2017. A qualitative comparison of the emotional experience of respondents who are walking in a novel physical surrounding is based on the design of two different routes – an Old Town route that leads to surprising views on the main touristic highlights of the city and a route outside of the traditional touristic area. GIS mapping techniques are used to combine the skin conductance data with the GPS data, and consequently in order to show the SCL scores and fluctuations on map with the location where they occurred. These results are combined with the subjective emotional description of the respondent which are measured by traditional methodological techniques. Does there exist a potential link between the main touristic locations and heightened SCL? Or will the urban surrounding outside of the traditional tourist space generate more positive arousal leading to unexpected insights? These questions will be discussed in the present study.

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## Chapter 1: Introduction and problem in its context

"Wow!!.." An emotional reaction that we all have had once in our lives. A reaction that shows our excitement upon experiencing something surprising or extraordinary. Passionate travelers are with near certainty familiar with that feeling of excitement. Kim et al. (2010) calls this touristic phenomenon the 'wow factor'. But what kind of aspects of the novel physical surrounding generate this 'wow factor' while visiting new places?

Tourist locations, in particular in an urban setting, were perceived as areas with certain boundaries (Edensor, 2000). Edensor states that the movement of tourists within the urban setting is to a large extent staged and choreographed by travel guides, which strengthen the boundaries of the 'tourist area' within the city even more. This is being done to such extent that tourists visit sights just to reproduce the classic 'views' of famous places (Edensor, 2007). Exemplifying taking pictures only straight in front of the Taj Mahal in India, or the famous quote of Osborne (2000, p. 79) as a visitor of the Victoria Fall subjectively described the experience as follows: 'Wow, that's so postcard'. However, to what extent do people in the novel physical surrounding of a tourist destination actually enjoy being on those locations? Are the main touristic sights in fact the spots where visitors are positively aroused? Are these main touristic sights the locations where visitors experience the 'wow factor'?

To pick up on the posed questions, a significant part of urban tourism nowadays deliberately avoids the earlier by Edensor (2007) mentioned staged experiences in officially sanctioned tourist spaces (Füller & Michel, 2014). The 'new urban tourism' theory states that visitors are searching for 'alternative public spaces' and the strategy of wandering 'off the beaten track' is considered in order to find these unusual places, such as creative urban areas (Pappalepore et al., 2010; Richards, 2011). Thus, the 'new urban tourism' theory is implying that tourists' interests are changing over to the nontouristic areas and visitors are getting more enthused by walking in an undiscovered and surprising novel urban surrounding outside the touristic space. This contradiction between the tourists' experience of the traditional sanctioned tourist spaces and areas located outside of it will be pivotal in this research.

To investigate the above elaborated contradiction, research methods that help capturing the emotional experience of people should be discussed. Most methods that explore human emotions focus on quantitative or publicly available data deriving from questionnaires (Crooks & Wise, 2013; Curtis, 2012; Davis et al., 2016). Questions about the emotional-spatial experiences such as 'Please indicate, in your own words, what makes this exact spot attractive to you (Davis et al., 2016, p. 41)' are raised to participants. However, is this descriptive way of emotion measurement the best way of gathering spatio-temporal data related to human feelings?

The problem of measuring emotions while using traditional methods is the reliability of the answers of the respondent. Sturdy (2003) confirms this point stating that it is 'unknowable' whether the respondent is telling the entire truth when using traditional methods for emotion measurements. Furthermore, to what extent is the respondent aware of having a feeling? Winkielman and Berridge (2004) and Ulrich et al. (1991) demonstrate that an emotional response can easily occur in absence of consciousness. Moreover, there exists a typical time gap, named 'slippage', between the moment when emotions are raised and when they are reported. This creates subjectivity aa well as the certain loss of information between the truly experienced emotion and the way how it is described by the respondent when it is measured in a traditional manner (Narwijn et al., 2013; Rickly-Boyd, 2009; Wirtz et al., 2003).

There are other methodical ways to overcome the 'slippage' time gap, such as the near real-time method (Chhetri et al., 2004). Visitors of the Grampians National Park in Australia were asked to report their experiences at a series of specific locations along the track. These kinds of along the track measurements are often applied in tourism research (Cutler et al., 2016; Graham, 2008; Tussyadiah & Fesenmaier, 2009), but still cannot completely eliminate the subjective influence on the results of the qualitatively measured emotions.

Due to the ongoing development of technologies new methods have emerged which enable gathering data in a quantitative manner. Wilhelm and Grossman (2010) suggest gathering quantitative data on human emotions with physiological observations. There are multiple ways to perform physiological observations, among others is the so called electrodermal activity (EDA). EDA measurement techniques have the advantage that data on emotions of respondents can be gathered relatively cheaply, easily and unobtrusively and therefore increasing the possibility of performing emotion measurements over larger groups of respondents compared to the more traditional methods of qualitative interviews or surveys (Figner & Murphy, 2011; Lyken & Venables, 1971). Figner and Murphy (2011) explain the basics of EDA as the skin of a human being having electric properties which can change rapidly in a short time period. The changes of the electric properties of the skin are closely related to psychological processes. They make thus EDA a quantitative index for measuring emotional states of a human being, such as arousal (Figner & Murphy, 2011). Because of this close relation of EDA with the human skin, it is often mentioned in the same breath with skin conductance. Skin conductance is the most commonly used index for quantitative measurements of emotions in the scientific field (Braithwaite et al., 2013; Drachen et al., 2010; Figner & Murphy, 2011; Kim & Fesenmaier, 2015; Lole et al., 2011; Shoval et al., 2017; Shoval et al., 2018).

The problem of the reliability in the answers in measuring of human emotions by the usage of interviews was addressed and can partly be overcome by performing physiological observations, such as skin conductance. The word 'partly' is required to be stressed, because Figner and Murphy (2011) point out that skin conductance does not reflect one single process of emotional state of respondents, increasing the difficulty of the interpretation of the data. Nevertheless, skin conductance has already proved its value as a method in measuring emotions in outdoor environments. Hogertz (2010) used EDA measurements tools in combination with GIS software in the urban environment of Lisbon. Kim and Fesenmaier (2015) went deeper into gathering skin conductance data and can be considered to be the first scientists to research EDA in the field focused on tourism, which is also confirmed by Shoval et al. (2017; 2018). Kim and Fesenmaier (2015) performed their research with two participants in a three-days visit to the city of Philadelphia. Their qualitative study suggests that visiting an urban site for the first time might have an influence on the skin conductance level (SCL) of the participants. Analogically, Shoval et al. (2017; 2018) focused on the skin conductance level of tourists visiting a city, however, they conducted a quantitative analysis revealing interesting insights about the emotional experience of the novel environment:

Interestingly, a point of heightened emotional arousal was observed toward the southeastern end of Jaffa Street—where the Old City becomes visible. Although we cannot rule out alternative explanations, we believe that the heightened SCL in this location reflects the excitement upon viewing Jerusalem's Old City **for the first time** (Shoval et al., 2017, p. 10).

Both Kim and Fesenmaier (2015) and Shoval et al. (2017; 2018) suggest that seeing a novel physical surrounding of a tourist destination for the first time could have a measurable influence on the skin conductance level (SCL) of tourists. However, both articles did not focus on this potential link beforehand. The heightened SCL, recognized in the articles as a result, might account for the fact that people are excited when viewing a certain main touristic attraction for the first time. But what are

actually the kind of locations that cause emotional arousal for people in a new urban environment? Are these the main touristic highlights as suggested by Shoval et al. (2017)? Does there exist something like the so called 'wow factor' that causes inner body responses, such as excitement, on famous touristic spots? Or does other places that are located more out of the 'tourist space' generate more positive emotions based on skin conductance level, similar to the ideas stressed in the new urban tourism theory? No answers are found yet on those questions.

Addressing this gap, the present paper has the aim to focus on the influence of a novel physical surrounding of a touristic city on the skin conductance level of people new in that city. The novelty of this research is underscored and strengthened by the fact that no other research so far has focused on the influence of viewing an urban physical surrounding for the first time, with division into a touristic and a non-touristic area, aa well as considering the potential link with the skin conductance level of participants.

The next section will briefly discuss the research aim and the main research question together with its sub questions that derives from the above mentioned issue. Subsequently, the theoretical concepts and the methods used in this research will be elaborated. Finally, the results will be presented, followed by the conclusions chapter. At last, the discussion will focus on the process of conducting the present research i.e. decisions taken in earlier stages of the thesis and critical reviewing upon them.

## **1.1 Research objective and questions**

As described in the introduction, this research will focus on analysis of the emotional experience of the novel urban surrounding by people visiting a touristic city for the first time. The investigation is based on the emotions of participants which are quantitatively measured by means of the skin conductance. The main research question of this report is formulated as followed:

# To what extent does the novel physical surrounding of a touristic city, and in particular the main touristic sights, influence the emotional state of people new in the city, as measured by the mobile skin conductance level and qualitative description of respondents?

This is the main aim of the research and it will be divided in five sub questions. These five sub questions are listed below and will function as a guideline of chapters throughout this research.

- 1. How can skin conductance (electrodermal activity) and traditionally measured emotions be analyzed and used for research on the emotional experience of people in a novel physical surrounding?
- 2. To what extent does the novel physical surrounding of the touristic sights within the city of Krakow and places located outside of the touristic space influence the emotional state of people new in the city, measured by means of skin conductance observations and visualized and analyzed with mapping techniques using GIS?
- 3. How do people new in the city of Krakow subjectively describe their emotional experience of the novel physical surrounding of the touristic and non-touristic area, based on qualitative interviews?
- 4. To what extent do the emotion measurements through skin conductance support or contradict the gathered data on emotions gathered with qualitative interviews of people in the novel physical surrounding of the city of Krakow?

The first sub question will focus on the theoretical background of key components of this thesis, which is elaborated in chapter 2, resulting in a conceptual model and a section describing the way how the data will be analyzed based on earlier performed researches. The second question will analyze the skin

conductance data gathered in the field divided into two topics related to the area where the data was gathered, namely the inner tourist and the outer tourist area. The data will be visualized and analyzed by using GIS techniques. The fourth question focuses on the subjective description of the emotions measured with traditional techniques and will function as additional information next to the skin conductance data. This means that sub question two until four will be treated simultaneously in the results chapter instead of separate chapters. Then at last, the skin conductance level of all the respondents will be compared with their subjective experience. Special attention will be paid to the aspect of the skin conductance level on the main touristic locations in comparison to the areas out of the traditional touristic space. In the following the scope of the research will be shortly appointed.

## 1.2 The scope of the research

This section gives an overview of aspects that will not be taken into account by carrying out the experiment. Some aspects that might be relevant for this scientific field will be excluded mainly due to the time limitations, remaining open for further research. To these aspects belong among other the demographic differences between the participants. People from different age, county and cultural will take part in this research. The demographic information of each respondent will be presented at the result chapter. The difference between them, however, will not be analyzed as they are seen as one group of 'people new in the city of Krakow'. The research population will be described more detailed in the methodology section. Secondly, because of the fact that the research is qualitative the main focus will be on a small population size of nine participants. Therefore, the present study is unable to generate generalizable results for the whole population. It aims, however, at finding potential links between the novel physical surrounding of a city and the emotional response of the participants. At last, I have chosen to involve a specific kind of technology which measures the skin conductance of participants, because it is the most often applied. Besides, there are also other kinds of quantitative emotion indices or physiological observations. Thus, the results of the quantitative emotion chapter will be limited to the skin conductance level (SCL) of the participants.

## 1.3 Practical relevance

Kim and Fesenmaier (2015) emphasize in their article the importance of the knowledge how the tourist is feeling in a destination that he or she visits, which might be useful especially for tourism managers. Therefore, finding potential links between inner city locations of Krakow and the way how these particular places are emotionally perceived by people new in the city, might give new insights for instance for employees of the tourist department of the Krakow city council. For a city like Krakow that has just reached a new record of 13 million visitors in the year 2017, such knowledge might be of great importance (Radio Poland, 2017). It could be a relevant contribution to areas that are negatively experienced, which were overlooked before. The reasons for negative experience at these spots could be further investigated in the future research. At last, it could add new insights and ideas of using physiological methods such as skin conductance on bigger scale in combination with GIS for the purpose of visualization of the emotional experience of tourists in the entire touristic Old Town area and, based on that, it could help to find out where potential changes could be implemented in the urban environment.

## Chapter 2: Electrodermal activity, skin conductance and emotions

The terms, such as electrodermal activity and skin conductance, were already mentioned and briefly discussed in the introduction section of the present paper. The following section will have a focal point on detailed explanation of these notions based on what is known about these phenomena and how they can be analyzed in this research. Besides that, another key component that requires special attention is 'emotion'. Emotion is a broad term and this will account for its the definition for this research. Relating to that, links will be made between skin conductance and the possible emotional response related to that. Also the description, how traditionally measured emotions can be categorized based on previously performed researches, will be provided.

## 2.1 Terminology

## 2.1.1 Electrodermal activity

The term electrodermal activity is relatively new as it originates from galvanic skin response or GSR (Critchley, 2002). As the name galvanic skin response gives away, the term electrodermal activity is linked to the response of the skin to external stimuli or spontaneous internal events (Lykken & Venables, 1971). This response in its turn is related to the activity in the autonomic nervous system (Figner & Murphy, 2011). Sano et al. (2014) state that the autonomic nervous system is the main branch and electrodermal activity can be grouped at the sympathetic nervous system branch. Based on the response of the skin, EDA can be used to define emotions, even without the respondent being aware of it (Braithwaite et al., 2013). Due to the direct relation of EDA to skin response, the term electrodermal activity is often used interchangeably with the term skin conductance. However, electrodermal activity is the umbrella term and it includes skin conductance, skin conductance level and skin conductance response (Braithwaite et al., 2013). These terms will now be discussed in further detail.

#### 2.1.2 Skin conductance

Skin conductance means the rapid change of electrical properties in the human skin. Skin conductance is quantifiable by measuring the potential flow between two points of skin contact (Braithwaite et al., 2013). It is a multifaceted phenomenon, which does not reflect only one single psychological process. Therefore, skin conductance is used in multiple research fields (Figner & Murphy, 2011). The way how the process of skin conductance works is very complicated and is most often applied and described in researches with topics of the scientific field of psychology. Critchley (2002) describes the skin and its processes as diverse as other body processes, such as the immune system, thermoregulation, vitamin production and emotional communication. Briefly stated, the electrical property changes are caused by sweat gland activity that serves for many animals (including humans) as emotional expressions and social signals that help shaping interindividual interactions (Darwin & Prodger, 1998).

The details related to this term are to such an extent that it is not of use for the aim of this research. Therefore, the physiological processes will be neglected in this research. Previous researches have already proved that skin conductance can be used for quantitative emotion measurements (Braithwaite et al., 2013; Drachen et al., 2010; Figner & Murphy, 2011; Kim & Fesenmaier, 2015; Lole et al., 2011; Shoval et al., 2017; Shoval et al., 2018). This results in only including the skin conductance level (SCL) and skin conductance response (SCR) in the analysis.

## 2.1.3 SCL and SCR

In the present study the emotions measured in a quantitative manner will result in skin conductance level (SCL) data. SCL is the overall degree of measured arousal in microsiemens over a certain amount of time (Nagai et al., 2004). In this research it is collected five times per second (Empatica, 2017). Skin

conductance response (SCR) is a different term that derives directly from the SCL data. Because of the fact that within these different SCL levels, many peaks in skin conductance can be seen (Figner & Murphy, 2011). These peaks are often phasic phenomena and each peak represents an individual skin conductance response (SCR). They are caused by arousal. An SCR is a short fluctuation and lasts several seconds with initially a steep rise of the SCL line, a short peak, and a relatively slower return to the baseline (Figner & Murphy, 2011). Both the SCL and the SCR are included in the analysis of the gathered skin conductance data in this research.

#### 2.1.4 Emotion

Emotion is a complex term and therefore it requires demarcation. Not all kinds of emotion are included in the analysis of this research. Li et al. (2015) state that 'affect' is commonly regarded as the umbrella term that covers *emotion, mood* and *feeling*. Out of these three, *mood* is generally unrelated to any particular event or external situation (Gardner, 1985). The aim of this research is to find out whether potential links exist between a novel urban environment, so external stimuli, and the emotional experience of people new in a city. This means that the mood of a respondent will not be of worth for the results of this research and will not be included. The term *emotion* is, on the other hand, influenced by specific situations, event or even people (Li et al., 2015). To give an example, a tourist may feel annoyed or angry when walking through a crowded street or may feel happy when getting to know some of the kind locals. This type of emotion sounds interesting for the aim of this research.

Kleinginna and Kleinginna (1981) describe in their review that there exist over 100 different kinds of definitions of the term *emotion*. Although some disagreement, they state that most definitions of emotion include three main elements: the subjective experience, an expressive component and the physiological arousal. This confirms the choice for involving both quantitatively measured (physiological arousal) as well as traditionally measured (subjective experience/expressive component) emotions in this research. The way how this is done will be described in the methodology.

Emotion itself can be divided in many types of emotions. Kim and Fesenmaier (2015) state that there are two major approaches to conceptualize emotions and they are named the categorical and the dimensional approach. They listed both approaches and the emotions related to it, as can be seen in table 1. Kim and Fesenmaier (2015) state that the categorical view is a bit more simplistic division of kinds of emotion than the dimensional view. Russell (1980) adds that arousal, part of the dimensional view, is a good indicator of excitement. Most studies focused on emotion measurements by involving

Table 1: Major approaches to defining emotion

Approach	Emotion Constructs
Categorical view	Anger, contempt, disgust, distress, fear, guilt, sadness enjoyment, interest, shame, surprise
Dimensional view	Pleasure, arousal, dominance

(Kim & Fesenmaier 2015)

psychophysiological instruments, such as skin conductance, regard emotion as a dimensional construct, as shown in table 1, and see arousal as the best dimension to use as their emotional component (Gakhal & Senior, 2008; Lajante et al., 2012; Wang & Minor, 2008). Therefore, this report will define the term emotion as the fluctuations in arousal (or excitement) of respondents while walking through a novel urban environment.

#### 2.2 Conceptual model

The theoretical concepts described in this chapter and in the introduction can be visualized in a conceptual model. Pile (2010) gives an example of a conceptual model in the geographical field of study summarizing the relationship between the earlier named layers of experience in the human body, namely affect, feeling and emotion. Deriving from this, there can be stated that a conceptual model summarizes theoretical concepts and visualizes the relationships and order between them. It will therefore function as a guideline throughout the research process. The conceptual model is shown

in figure 1. In the methodology chapter the decisions are discussed how to measure the potential link between the novel urban environment and the emotional experience of the respondents.



## 2.3 Analysis design of emotions

#### 2.3.1 Analyzing quantitative emotions

The terms *skin conductance level* (SCL) and *skin conductance response* (SCR) are explained, but it is still unknown how the physiological observations should be interpreted. The way of analyzing this data is

Figure 2: SCL outcome per event outcome (Lole et al., 2012)



of great importance for the result chapter and will be explained briefly at this section. SCL can fluctuate over time. To visualize how a flow line of SCL data looks like, figure 2 is presented (Lole et al., 2012). In their article the physiological reaction to wins and losses during gambling were researched. A steep rise in the SCL (in microsiemens) can be seen in the most upper line at the moment when the respondent wins a large amount of money. Whereas a little rise is visible with intermediate and small wins. Losses are producing a low and stable SCL flow line. This figure ideally shows the difference in what Khalfa et al. (2002) calls event-

related skin conductance responses and non-specific skin conductance responses (both types of SCR). As the name gives away, event-related skin conductance responses are rapid changed emotions and can be interpreted as caused by external stimuli or a specific event. The non-specific skin conductance responses are showing a more little change, from which cannot be stated with certainty that it is caused by a specific event (Khalfa et al., 2002). The event-related skin conductance responses are named 'peaks' by Kim and Fesenmaier (2015) and this name will also be used in this thesis.

The term 'peak' in SCL is not specified enough, so the border have to be indicated between a change in SCL data belonging to a peak or a non-peak moment. Shoval et al. (2017) did a very comparable research to this thesis and they define the peak moments as followed: SCR are the number of "spikes" in skin conductance – typically changes greater than 0.5 microsiemens – that occur over a defined time interval – known as a "latency window", usually no longer than 1-3 seconds (Shoval et al., 2017, p. 5).

This definition enables the distinction between peak moments of arousal in SCL in the analysis chapter. However, what is not known about the arousal peak, is whether it is a positive or a negative feeling experienced by the respondent. As stated in the terminology section, this research will focus on the emotion of excitement (arousal). There was seen already in figure 1 that the SCL peak is high when being excited of winning a large amount of money (Lole et al., 2012). This shows that one emotion related to SCL peaks can be positive excitement. Shoval et al. (2017) state that the heightened levels of SCL on a certain place can also be caused by fear or stress. Zeile et al. (2009) adds that with a high stable SCL flow line the respondent's emotion can be classified as relaxation, and with a low stable SCL flow line the respondent can feel dissatisfaction or boredom. This information offers some insight in the potential feeling experienced by the respondent, which will be used in the analysis chapter. However, it is advised to combine the quantitatively measured data with descriptive answers of the respondents about their emotional experience of the routes in order to get reliable and valid results (Kim & Fesenmaier, 2015; Shoval et al., 2017).

Lastly, each individual tends to exhibit a unique pattern of SCL. So, for one person 10 microsiemens may be very high, as for the other it could be the average (Shoval et al., 2017). To be able to compare multiple individuals based on their SCL scores, the data needs to be aggregated. Calculating the Z-scores for all measured SCL data is a successful way of doing that (Eimontaite et al., 2013; Shoval et al., 2017). By calculating Z-scores of SCL data (or Z-SCL scores), the Z-SCL score will represent how each SCL measurement compares to the individual's mean SCL score and therefore enables the comparison of SCL data between multiple individuals in the analysis chapter.

## 2.3.2 Analyzing traditionally measured emotions

When looking at performed researches with a comparable topic to this thesis, there can be noticed that no uniform way exists of analyzing and categorizing the subjective emotional descriptions of respondents. Zeile et al. (2009) makes the classification based on relaxation and stress zones. Shoval et al. (2017) classifies certain locations within the city of Jeruzalem based on the response of respondents to questions such as 'How pleasant do you feel?'. Their research uses survey techniques and answers are ranging from 1 (low) to 7 (high) on a Likert-type scale. This qualitative exploratory research aims at finding potential links between the novel urban surrounding and the emotional experience of people, and uses semi-structured interviews for exploring that potential link rather than surveys to generate generalizable results (see the methodology chapter). This method is also successfully implemented by Kim and Fesenmaier (2015). They also researched a low number of participants, namely two, and were searching for potential explanations for the SCL pattern of their participants by using qualitative interviews. They classified the locations for every individual separately, based on the quotes in the interview with this person about those locations. This thesis will also use classification, but more specifically focused on the main topics of the interview answers divided over the touristic and non-touristic area, as will be discussed in 3.6. For every individual a map of SCL data will be made and accompanied by quotes of the subjectively described emotions of the individual measured immediately after the routes. At last, an overview of the total count of quotes related to topics of positive and negative experiences can be made. This enables a summarization of all the results of the traditionally measured emotions and can be combined with the overall results of the skin conductance data of all respondents. Chapter 3 will explain the methods applied in this research in more detail and explain the reason how choices are made regarding those methods.

## **Chapter 3: Methodology**

This section will discuss in a structured way how this research will be carried out. The structure is based on the division of methods for the quantitatively and the traditionally measured emotions. I will describe the devices used and the explanation why this is the best option, based on theory. Thereafter, the role and the importance of GIS techniques for this research will be emphasized. Then, the respondents that participate in this research will be described in further detail, including the way how they are selected. This is followed by the explanation of the choice for both routes and their visualization. In the text there will be pictures displayed, giving impressions of the appearance of both routes Furthermore, two maps are included in the appendix of how both routes run through the city of Krakow, with pictures on the spot included to strengthen the visual impression of the reader of both routes.

#### 3.1 Methods for physiological observations of emotion

## 3.1.1 The Empatica 4 wristband

In the literature section the terms electrodermal activity (EDA) and skin conductance level (SCL) is frequently mentioned. It is often seen as a plausible way of quantitatively measuring the emotional state of respondents in the scientific field (Braithwaite et al., 2013; Drachen et al., 2010; Figner & Murphy, 2011; Kim & Fesenmaier, 2015; Lole et al., 2011; Shoval et al., 2017; Shoval et al., 2018). Due to technological developments there are several devices that can measure the skin conductance of participants. Shoval et al. (2017; 2018) used the Empatica 4 wristband to carry out the research on skin conductance. This is a recent article and they underline that this device meets the requirements of detailed emotion measurements through skin conductance. Kim and Fesenmaier (2015) used for their research the Affectiva Q-sensor which is the previous version of the Empatica 4 device (AffectMedia, 2017). This confirms that the Empatica 4 wristband is the most recent and up-to-date device for skin conductance measurements. Birenboim et al. (to be published) compared the MS band and the Empatica 4 band on their suitability for EDA measurements in both lab conditions and in less controlled outdoor conditions and it resulted in a recommendation of using the Empatica 4 wristband as the most reliable device.

The Empatica 4 wristband is shown in figure 3. It measures physiological signals in real-time. It has two electrodes which measure the electrodermal activity. Furthermore, it contains a Press button and a light. The Press button can be used to turn on, off and pause the recording of the data. The light indicates whether the wristband starts up (40 seconds pulsing red color), Figure 3: The Empatica 4 wristband

starts recording (pulsing green color) or stops recording (2 seconds red color). Figner and Murphy (2011) underline that the wristband demands approximately five minutes to get used to the skin of a new participant. So, before starting the actual measurements a short test period is carried out with every respondent. The wristband will be turned off at the end of the first route and started up at the beginning of the second route. After having conducted the research with every participant, the data will be uploaded to the cloud where the data can be viewed at the web service named Empatica Connect (Empatica Connect, 2018). There is also an option available to extract the data to a csv file which can be opened with Excel.



#### 3.1.2 The GPSLogger application

To be able to know what skin conductance level was measured at what specific location, it is needed to record the precise geographical location of the respondents when walking through the city. This research will use the GPSLogger application for Android smartphone devices, which can be

Figure 4: Display of the GPSLogger application



downloaded at the Play Store (GPSLogger, 2018). At figure 4 an overview can be seen of the display of this application. It shows the exact longitude and latitude at a certain time. The interval can be manually adjusted to the preferences of the user. The interval used in this research is 1 second. This means that the application will log every second the coordinates of the geographical location at that specific time. The application is tested before it is used for the actual data gathering of this research. The data is exported after every route to a personal Google Drive in a csv format, which can be opened in Excel.

#### 3.2 Traditional method of measuring emotion

Qualitative exploratory research is chosen as the type of research for finding potential links between the influence of the novel physical surrounding on the emotional experience of people new in the city. To get to know the subjective experience of the participants the method of a semi-structured interview is used. The reason for using traditional research methods next to

the physiological measurements is mentioned by Wilhelm and Grossman (2010), who state that it requires additional contextual information to define the kind of emotion that a person experienced, regarding the physiological observations such as the skin conductance level. This means that solely skin conductance measurements are not sufficient to define the emotion related to the electrodermal arousal. Therefore, a short semi-structured interview is done directly after having walked the routes, with the goal to ask the respondents about their subjective emotional experience of both routes. Specific focus will be on the answers about experienced positive and negative surprises, causing feelings of excitement, joy, annoyance or disappointment (see Appendix 1). The questions start very broad and get more specified along the way during the interview according to the answers of the respondents. The researcher is open to ask further and deeper into specific topics that are mentioned by the participant, if it is relevant for the results of this research.

Shoval et al. (2017; 2018) tried to combine skin conductance data with traditionally measured emotions based on location- and time-triggered surveys, asking the participant to evaluate their level of joy on a Likert scale. A critic note can be made on this, because the prompting of a message to fill in a survey might has influenced the skin conductance level of the respondent during walking through the city. This is the reason why I chose to plan the interview quickly after the route and the moment that the skin conductance data gathering has ended. This to not potentially influence the skin conductance level of the respondent during the routes. Moreover, it limits as much as possible the 'slippage' time gap mentioned in the first section (Narwijn et al., 2013; Rickly-Boyd, 2009; Wirtz et al., 2003). If questions would be asked in a quantitative manner by using surveys, it would be difficult to find out what the reason was for the level of joy, such as possibly seeing a new appealing view of touristic highlights of the city. This is the second reason to use qualitative semi-structured interviews in this research. The interviews will be recorded by using a voice recorder. This enables the option to precisely transcribe and analyze the given answers. This will be performed in the result chapter where quotes will be categorized and counted according to the topic they relate on. In this way total overviews of quotes can be made individually, but also of all respondents. Besides that, the quotes will function as additional information besides the SCL maps of each respondent.

#### 3.3 The role of GIS technologies

As earlier described, GIS technologies enable the combination of GPS and skin conductance data. Both datasets can be exported to Excel in csv format, and will be combined based on the specific time of the measured skin conductance level (SCL) and the coordinates belonging to that time. The level of SCL

per individual can differ a lot. To still be able to compare the scores of all individuals, normalized Z-SCL scores will by calculated, as successfully applied in the research of Shoval et al. (2017; 2018). This makes it possible to create an average Z-SCL value of the skin conductance level (SCL) per each geographical location point. This will be visualized in individual Z-SCL maps per respondent that are made by using the AcrMap software.

Furthermore, to analyze what places in the novel physical surrounding are causing the largest fluctuations in the SCL value, thus to show the places where skin conductance responses (SCR) occurred, a change map is created for each respondent. In figure 2 of chapter 2 Lole et al. (2012) show that peaks can occur in the SCL data generated by event-related excitement. To only have an overall map of the Z-SCL scores of the respondent is therefore not sufficient to identify the main arousal spots in both routes. To overcome this potential pitfall, the change map is created which visualizes the change in percentage between the SCL value of two successive GPS location points. The maps will be designed with proportional symbols with the size of the symbols reflecting the proportion of the growth or decrease in SCL.

## 3.4 The respondents

The research population is already often mentioned in the earlier sections and it has been named 'people new to the city', which is not very precise and therefore needs some explanation. This term is used to describe tourists and international students of the city of Krakow who have not seen the city center of Krakow yet and thus are walking in a novel physical surrounding.

The acquisition of the participants is carried out by contacting the hostels as well as by addressing new exchange students by means of ESN Erasmus Group on the social platform Facebook. In the first case, participants are found by contacting the responsible people of receptions of hostels and asking them when new visitors are arriving. These visitors will be asked, if they have already visited this city in the past, and if they would like to participate. In case tourists from hostels state that they have never seen the city and its main highlights, then they are able to participate in the research. The second case of approaching potential respondents is via the ESN Erasmus Facebook group page. This group page contains a large amount of international students that stay in the city of Krakow for one or two semesters. A message is posted on this group page in order to find students that would like to walk two routes through the city for research purposes. Just as in the case with visitors from hostels the students have to be new in the city. Taking into account that the students (and tourists) who admit not to have been to Krakow before say the truth, they can be allowed to take part in the research.

Respondents are not aware of the aim of the research beforehand. Elsewise it could influence the results of both the way how the novel physical surrounding is emotionally experienced. Furthermore, respondents walk both routes alone, followed by the researcher who walks two meters behind the participants with the GPS application running. In the reports of Shoval et al. (2017; 2018) and Kim and Fesenmaier (2015) participants sometimes walked alone and in other cases together with friends. However, being accompanied by friends and having social contact along the route could maybe have an influence on the SCL. On this account it was decided to let the participants walk on their own through the city. In course of recording the participant is not allowed to talk to the researcher and any other person, and otherwise (besides informing which way to take by stating right, left or straight on). In this manner the actual influence of the novel physical surrounding can be measured. Lastly, the respondents are walking during the day within a time range of 11:00 and 17:00 with comparable weather conditions of dry days with the sun and clouds alternating each other.

## 3.5 The two routes

The routes chosen for this research are important for the aim of finding the potential link between possibly heightened SCL at main touristic locations, as suggested by Shoval et al. (2017) and Kim and Fesenmaier (2015), compared to the SCL in the route outside of the traditional touristic area. The two routes that are predefined have the following names: *The Old Town route* and *the Outside of the Old Town route*. Both routes are located in the city center of the touristic city of Krakow. The routes will now be described in further detail with references to the maps in the appendices which offer a more precise visual impression of both routes.

#### 3.5.1 The Old Town route

The Old Town route leads through the old city center of Krakow, passing by the touristic hotspots that are often mentioned as the main highlights of the city, such as the Wawel castle, Kanonicza street, St. Mary Magdalene Square and the main Market square (Kraków Sightseeing, 2017; Kraków Travel, 2017). In figure 5, pictures are shown to give an impression of the main highlights of the route.

Figure 5: Impressions of the Old Town route



This route is designed to not only pass by the main touristic highlights, but also to make a lot of turns to create surprising new views along the route. It also involves walking at specific sides of the street to strengthen the surprising effect of the first time views of the main highlights of the city. In Appendix 2 the Old Town route is visualized on the map, showing the buildings in reddish collar as buildings categorized by the cities' tourism agency as places of aesthetic importance and highlights of the city for tourists. The pictures included are taken on the spot of the route giving a precise view of how the route is visually perceived by the respondents.

## 3.5.2 The Outside of the Old Town route

This route will start at the border of the Old Town at the park named Planty. After crossing the roadway participants are lead into the street called Krupnicza. This is a very long street where only at the beginning some buildings are restored. For the biggest part of the street the buildings are bleached in a dark color and it does not offer main touristic sights. Furthermore, the street does not contain turns or surprising views and participants are walking only on one side of the street. Impressions of the route

Figure 6: Impressions of the Outside of the Old Town route







are shown in figure 6. In Appendix 3 the route is visualized on the same map of the cities' tourism agency, showing that it does not pass by any buildings selected based on their aesthetic value. Once again pictures are included that were taken on the spot. These pictures are taken at a similar time and with similar weather conditions as when the data was gathered with the respondents.

## 3.6 Analysis technique for qualitative interview data

To analyze the data gathered with the semi-structured interviews a certain coding technique has to be applied. In the coding manual for qualitative researchers of Saldaña (2015) are many kinds of techniques described how to best apply a coding technique related to the setup and aim every specific qualitative research. An example of a coding method is exploratory coding. This coding technique is best suited for reports that are novel of its kind, and where the answers of respondents are not easily predictable beforehand. An example of exploratory coding is the Vivo coding technique. This technique is mostly applied to 'prioritize and honor the participant's voice (Saldaña, 2015, p. 106).' This thesis is very exploratory of its kind and due to the fact that only a few scientific articles have elaborated on the combination of skin conductance measurements, tourism and qualitive interviews, it is advisable to prioritize the participants' answers above beforehand formulated categories deriving from scientific theory.

Vivo coding can be very detailed and focused on the specific words used by the respondent. This is called the 'verbatim principle'. Another way of analyzing the data in an exploratory manner is called Vivo Themes. This can be applied when there is aimed at generating a more overall view of the qualitative results enabling comparisons of the data between different respondents. This thematical approach is 'a way of clustering sets of related themes and labeling each cluster with a thematic category of sorts (Saldaña, 2015, p. 202).' This coding technique that determines the categories on the answers of the participants in order to generate a more comparable overview between respondents is seen as the most suited and will be used in this qualitative exploratory research.

The answers of respondents are first transcribed, then thoroughly read previous to selecting which overall categories are the most relevant for the results of this research. A requirement for the categories is the relation to the novel physical surrounding of both the Old Town and the Outside of the Old Town route. The themes that are selected are the same for both routes and divided into positive and negative comments. Categories are given a different collar as 'label' during the analysis of the transcribed interviews. The division in the total amount of positive and negative comments on both routes, knowing that the interview questions were raised in an open manner (see appendix 1), presents a quick overview on the subjective emotional experience of the participants. A total count per category will be shown by using an overall table for each respondent.

## 3.7 GIS preprocessing stage

GPSLogger, as discussed in 3.1.2, is the application used for logging the coordinates while walking the two routes with the participants. This application stores first the data on a predetermined location in a personal Google Drive. Hereafter it can be extracted as a CSV file and opened in Excel. This file shows, alongside other data, the longitude and latitude, and the time when a location point is logged. The data is not logged in an equal interval, which means that first for all respondents the window average in seconds between two location points has to be manually calculated.

The Empatica 4 wristband, explained in section 3.1.1, exports the gathered data after having the device connected with the laptop whilst being logged in at the program named Empatica Manager (Empatica Manager, 2018). This program ensures that the data is extracted from the device and uploaded and stored in the web service named Empatica Connect (Empatica Connect, 2018). There it can be viewed as a flow line of skin conductance level data over time. The data can be downloaded from the web

service as a CSV file. This can be opened in Excel presenting all the collected data in one column. For every second the Empatica 4 wristband performs four measurements. First the mean and the standard deviation of the SCL scores are calculated by using the mathematical functions in Excel. This is done for each respondent separately in order to create standardized scores compared to the individual mean of every respondent. The aggregated data is named Z-SCL data. After that the manually calculated window average in seconds per GPS point is copied from the GPS data file and pasted in the Z-SCL file. Both datasets could be combined based on the time when the data collection started. Thereafter, for each GPS location point the average of Z-SCL scores is calculated according to the window average in seconds between two GPS point. This is done by using the 'average' function in Excel. The Z-SCL average per window average in seconds is then combined with the longitude and latitude of that location point. At last, the CSV file is converted into a XLS file in order to import the dataset into ArcMap.

## **Chapter 4: Results**

This chapter will present the results with a view to every respondent, in each case as an individual map based on their skin conductance level (SCL) throughout the two routes. Every map will be discussed individually according to their SCL pattern and the location where this SCL occurred. The average level of the SCL data is different for each individual. Therefore, the standardized scores are presented and divided into six equal interval classes. In this way it is possible to show for each individual where the higher and lower amounts of SCL occur in comparison with their individual mean.

Firstly, overall maps will be presented showing the standardized Z-SCL values throughout the routes. They will be analyzed in generally basing on their pattern. The maps contain icons to guide the reader and to help understanding what the locations are where certain levels of skin conductance are measured. It is worth pointing out that the reader can always look back at the appendices 2 and 3 where the routes are more explicitly visualized with the help of pictures taken on the spot.

Afterwards the change map will be presented. The change map illustrates the shift of SCL (not the standardized scores) in percentage between two different GPS location points. The locations that caused the largest change of SCL in percentage will be accentuated and shown on real pictures taken on the spot, in order to give the reader a better visual impression of the location. Additionally the subjective emotional experience measured in the semi-structured interview will provide further information alongside the SCL data, leading to potential reasons for the pattern of each individual. This will be done by quoting the relevant answers of the respondents. The total amount of quotes will also be presented in a table, divided in positive and negative statements on topics related to both routes. After all, the results of each individual will be briefly summarized.

After having discussed all the respondents individually, an overall summary of the results will be made. Analyzing and finding out which areas generated the largest change in SCL, there will be an attempt to answer the following questions. Are the main touristic highlights of the city the places which are creating arousal, or do people experience the Outside of the Old Town route as more positive? And what areas within those routes are particularly eye-catching according to the skin conductance level? Regarding the quotations of the respondents, there will be created an additional table which with respect to the subjective description of each participant. It will present the total amount of responses on the related topics, the information about each area of the routes with the total amount of quotes of respondents on the related topics, showing which areas of the routes were subjective experienced as the most positive overall. Will the results confirm or contradict to the SCL patterns of both routes? Are the results in line with expectations based on the articles of Kim and Fesenmaier (2015) and Shoval et al. (2017), or do they show different and surprising new insights? All these questions will be discussed and answered, but first there will be started with the individual analysis.

Lastly, an important note before starting with the analysis of the SCL patterns of the respondents. Until now only two scientific articles have tried to combine tourism, outdoor skin conductance measurements and GIS techniques (Kim and Fesenmaier 2015; Shoval et al., 2017). Due to the fact that the development of applying this method is still in the initial phase, the results are discussed in a descriptive manner, in imitation of the two pioneer articles. Mathematical analyses of the SCL patterns cannot be expected of this study.

## 4.1 Respondent 1; Dutch, 24 years, employed, man

An error occurred while conducting the research with the first respondent. Although the GPS application had been tested before, it only logged 18 location points throughout the first and the second route. The reason for it might be the fact that the phone was given to the respondent to make the measurements as precise as possible. When the screen of the phone turned black it also changed

the interval of measuring the location points. To guarantee the quality of the results of this research, the data of this respondent are left out of the analysis. From the second respondent on, the phone with the GPS application stayed in the hand of the researcher who walked two meters behind the respondent. This procedure was applied in order to assure the proper work of the device throughout the entire route.

## 4.2 Respondent 2; Dutch, 61 years old, employed, man

Figure 7: Overall Z-SCL score map of respondent 2 with legend for icons included



Figure 7 visualizes the Z-SCL scores of respondent 2. This will be the only map that has explicitly mentioned what all symbols mean that are used in the map. Also there will be for the last time stressed that the first route starts at the most southern point on the map and ends on the Market Square in the North The second route starts at the city park named Planty and follows its way westwards to where the a modern university building is located. The icon number 1 is shown on the map in order to indicate that the street northwards named Kanonicza is one of the main touristic highlights and exactly at the half of that street where the icon number 1 is located, there the unexpected view on another main

touristic sight, namely the Maria Magdalena square, becomes visible (for picture look to appendix 2 photo number 5).

As already stated, the goal of this research is to find out whether there exist a potential link between the main touristic highlights within the city and the SCL of the respondent on those locations. Surprisingly, the pattern of this respondent shows throughout the whole first route a low aggregated SCL score. This means that passing by all the main touristic highlights did not generate any form of arousal to this respondent and actually caused the lowest level of skin conductance compared to its individual average. In the second route the level rises after having crossed the traffic junction and at the end of the second route this respondent experienced the highest level of arousal. This was in the area of the university. The change map will now present where the biggest fluctuations were in percentage of SCL between two geographical location points.



Figure 8: SCL change map of respondent 2 with visual impressions included



As can be seen in figure 8, the main spot where the SCL grew the fastest was at the Planty park at picture number 2. Also at the end of Bracka street, which is the last street leading to the Market Square, a large rise of SCL can be seen (see visual impression number 1). Picture number three is the university building at the end of the second route. There the biggest fluctuations in SCL (see the alternating growth and decrease in SCL) were located. Also is this the spot with the highest overall Z-SCL for respondent number 2, as can be seen in the first map. Perhaps the results of the interview can give a better insight in this SCL pattern.

The interview quotes can help understanding how this respondent perceived both routes and where this person enjoyed it or felt a feeling of annoyance. The following quote can be potentially the reason why this person enjoyed the second route more:

"At the first one there was a lot of traffic crossing and from the square until here (the end of the second route) we had a quite passive road. In a more calm area, where not that much traffic was present."

This gives potentially the reason why this person has a higher SCL in the second route, because it gave a feeling of relaxation. However, regarding the novel physical surrounding, this person states that the first route was more attractive because of the older classic buildings. Also this person states the following:

"(..) the nicest were really those stairs (towards the Wawel castle). There I would still like to go once."

This person admits that the entrance to the castle was very attractive, however it did not give this person a large rise in SCL as can be seen in both maps. After that it looked all satisfying for this person and mentions 'it looked all a bit the same with the same shops'. As seen in the maps not leading to any difference in SCL. The next quote can be the reason why this person also perceived the second route as more positively surprising:

"I expected it all to be a bit older, a bit less developed, but I was actually surprised with all the shops and the traffic through the city. I didn't expect that it would be like this. I expected old trams and old buses, but that all was better than I expected."

At last, this person stated that nothing disappointed him throughout the route, which means that the lower level of SCL in the first route is not per se a bad feeling. This person enjoyed it but it didn't get any feeling of arousal. The overall count of quotes in the interview divided per route shows that this person was very positive about the urban building structure in the first route, such as the statement about the stairs towards the castle. There are only a few negative statements, which are already mentioned in the discussion above.

Respondent 2		
Positive comments on topics	Sum of the first route	Sum of the second route
Urban building structure	4	1
Public on the spot (by foot and car)	0	1
Retail on the spot	0	(
Others	2	
Negative comments on topics	Sum of the first route	Sum of the second route
Urban building structure	0	(
Public on the spot (by foot and car)	1	(
Retail on the spot	1	1
Others	0	(

Table 2: Total count of comments per topic of respondent 2

#### 4.3 Respondent 3; Romanian, 21 years old, student, woman

Figure 9: Overall Z-SCL score map of respondent 3



The Z-SCL map of respondent 3 is a bit less precise due to some outliers of the GPS application. However, it does not give any problem when looking at the pattern of the SCL data. It shows a negative value at the beginning, which starts to rise after seeing Maria Magdalena square. In the short street northwards in the middle of the first route (Grodzka Street) the Z-SCL value rises even further. This stays on a comparable level towards the end of the first route. The second route caused in the beginning a high Z-SCL, with the Planty park, Theater Bagatela and the beginning of the long street westwards named Krupnicza as the physical surrounding. As the second route continued the SCL decreases gradually, with the lowest level at Theater Grotestka (theater located close to the end of the second route), which had undergone restoration work during that time causing, also causing noise pollution.

Figure 10: SCL change map of respondent 3





The change map shows that the SCL grows the most at the Planty park, see picture number 2. This is not an arousing point, because no big fluctuations are seen there, but the high level of SCL shows that the respondents is feeling comfortable around that spot while surrounded by the park. Picture number 1 shows the restaurants where the largest fluctuations can be noticed. After having passed by that point the SCL starts to rise a few times in a row. At the end of one large positive change can be noticed at the spot where the university becomes visible. Now the interview answers will be discussed.

The following quote could clarify the low SCL at the beginning of the first route:

"It was a little bit strange, because I was walking and I don't know what I see."

The respondent had a feeling of disappointment when passing by the main touristic highlights of the city, because this person did not know where the buildings were used for which were seen. However, this respondent still states that because of the Wawel castle and other highlights the first route was

more interesting. The next quote shows that Theater Bagatela at the beginning of the second route interested this person, but the rest of that route was not so appealing:

"Second one I only remember the theater in the beginning. (...) A lot of buildings under construction which were not interesting I guess and the University at the end of this path (second route). So I think the first one is better."

This is once again confirmed in the following quote:

"Many buildings here remind me of Prague and Dresden as well, these once are maybe a bit smaller I don't know. And that was mainly in the first route. In the second there was nothing to see. Just two or three buildings I guess."

This respondent then finally states that there wasn't really a feeling of annoyance, but the second route was less interesting to walk:

"I wasn't annoyed, but in the second there were many buildings under construction so it is not nice to walk. That was for me less interesting. (...) But not really moments of annoyance."

The main building under construction was Theater Groteska, which generated a lot of noise, which can be seen as a negative influence on the emotional state of the respondent, as visible in the overall Z-SCL map. After all there can be stated that this respondent enjoyed the first route more than the second based on the subjective description, although the Old Town route was still a bit disappointing because it was unknown to this person what she was passing by, and therefore likely to create the low arousal in SCL measurement in the first route. The overall table of the quotes in the interview show that the urban building structure in the first route was subjectively liked much more than the second route (see the high sum of the negative comments), and this confirms the pattern of SCL in both routes.

Respondent 3		
Positive comments on topics	Sum of the first route	Sum of the second route
Urban building structure	3	1
Public on the spot (by foot and car)	0	0
Retail on the spot	0	0
Others	0	0
Negative comments on topics	Sum of the first route	Sum of the second route
Urban building structure	0	3
Public on the spot (by foot and car)	0	0
Retail on the spot	0	0
Others	2	2

Table 3: Total count of comments per topic of respondent 3

#### 4.4 Respondent 4; German, 24 years old, student, woman

Figure 11: Overall Z-SCL score map of respondent 4



This respondent starts with a negative SCL on the street next to Wawel castle. At Kanonicza (the first street northwards) it started to rise already a bit and since Grodzka street (the middle street northwards) the Z-SCL scores turn into positive arousal. This level remained similar towards the Main Square. At the second route at the Planty park and Theater Bagatela this person experienced the highest arousal throughout the route. After the beginning of the long street Krupnicza it goes rapidly down to a negative level, which only shows a little rise still around the University at the end of the second route.

Figure 12: SCL change map of respondent 4



At the Z-SCL map there were higher values in the first route compared to the second. This value went very gradually up during the first route, as can be seen in the change map of respondent 4. The largest fluctuations and positive rises in value are when the Wawel castle becomes visible, location number 1 at the map and the picture shown for a visual impression of the spot. The largest positive change in SCL is once again located at the Planty park in the beginning of the second route. What can also once again be stated is that this park is not a spot of arousal, because of the lack of fluctuations. More it is a location of relaxation and joy. After crossing the street the SCL steeply goes down as can also be seen with the amount of orange points indicating that at each new GPS location has an SCL value of 5 to 19,9 percent less compared to the GPS location before that. On picture number 3 the physical surrounding of that place can be seen.

The quotes in the interview with this respondent confirm the pattern of SCL data shown in both maps:

"The first route was nicer because there were more sites and the second route was really really boring, to be honest." (Why boring?) "Nothing to see, or nothing that I found really interesting. It was straight the whole time. I was thinking why am I walking here."

This person enjoyed the first route, but it took some time before this person also reached positive Z-SCL scores within the Old Town route. The following quote could be the reason why the overall Z-SCL level gradually grew at Kanonicza street (the first street northwards), although it was still negative compared to the average level:

"In the first route there was a lot of stuff to see, like ah this is nice and that is nice. I really liked the route or street that started after the castle."

Also it is good to mention that very specific things can cause positive surprises which could have influence on the feeling of the respondent:

"(...) At one place I saw a sign of a muffin and I was oh muffin, muffin. And that maybe happened in other places as well when I saw something. (Where was that?) The muffin sign? Uhm, maybe it was in the second route but I am really not sure. I cannot say that really."

This was after the route checked and there is a muffin store at Bracka street (the last street towards the Main Square), where indeed a high Z-SCL pattern is shown, but besides a small rise in SCL not many fluctuations are visible at that spot. The last statement by this respondent is to confirm that both routes were not annoying, but at the second one this respondent found it a bit boring:

"In the second route I was thinking can we not walk somewhere else instead of all the way straight haha. It was not really like bad or something" (Not annoying also?) "No why should I be annoyed, there was nothing really bad."

There can be stated that this person based on both the interview as well as the SCL data enjoyed the Old Town route more. Also there can be seen in the change map that at all locations when the main touristic highlights become visible there are green dots meaning that the SCL of this respondent grew quickly when seeing for instance Wawel castle, Maria Magdalena square and the Main square. The Planty Park and the beginning of Krupnicza street has the highest Z-SCL values, as the rest of the second route is experienced in a bit more negative way. Underneath at the table is a quick overview shown of the quotes during the interview, which is very obviously showing that nothing in the second route was mentioned in a positive way and all topics score positive in the first route.

Respondent 4		
Positive comments on topics	Sum of the first route	Sum of the second route
Urban building structure	3	(
Public on the spot (by foot and car)	1	
Retail on the spot	1	
Others	2	
Negative comments on topics	Sum of the first route	Sum of the second route
Urban building structure	0	
Public on the spot (by foot and car)	0	
Retail on the spot	0	(
Others	0	

Table 4: Total count of comments per topic of respondent 4

#### 4.5 Respondent 5; Romanian, 21 years old, student, woman

Figure 13: Overall Z-SCL score map of respondent 5



This respondent had the highest Z-SCL score at the start of the route at Stradomska street. This remained on a positive height until Maria Magdalena square. After that it starts to decrease with one spot in dark red on Grodzka street (short street northwards in the middle of the first route). At the place where the trams are passing by it started to rise a bit to after that get lower when entering the last street Bracka. The two classes are alternating and at arrival at the main square the SCL decreased again. The second route was in the very beginning still at positive level, but soon declined to a lower negative level followed by the most negative values from the middle until the end of Krupnicza street.

Figure 14: SCL change map of respondent 5

1



The change map shows some very specific locations which caused huge fluctuation in SCL. The location with the most changes in percent is shown at picture number 1. This is Grodzka street, one of the main streets in the Old Town with large amounts of tourists. The reason for the large fluctuations in SCL can very obviously be found in the interview and will be later discussed. Picture number two is the square with the church neighboring the traffic junction with trams. There the value of SCL was changing a lot, but the Z-SCL scores were not on a positive level. Picture number 3 shows the end of the second route with Theater Groteska which is under reconstruction. This was by far the area with the lowest Z-SCL values and on the location of the theater further decreases in SCL can be noted. For this respondent the interview has a very clear explanation for some of those places of fluctuations in SCL.

The respondent states the following as her subjective experience of the routes:

"It was actually really nice. I haven't seen these places before. They really made me feel like a tourist. I liked a lot the first route with the Wawel castle, and also the small streets after that."

Especially the first part can be seen as emotionally arousing for this respondent, and indeed the highest Z-SCL values in the overall map can be found in the area where Wawel castle is visible. The next quote shows how this person perceived the second route:

"Also this one (the second route) which had a kind of mix of buildings and a little bit chaotic maybe, but the previous one was more organized based on architecture."

She defines the second route as chaotic and therefore maybe generating lower SCL. A personal factor that had a big influence on the SCL in the Old Town route, where earlier was referred to (picture 1), is mentioned in the following statement:

"I didn't like seeing the horses. We passed by two times I think. In the middle of the first route."

There can indeed be seen a huge negative fluctuation on Grodzka street where seeing the horses maybe came as a surprise. Horses are used in Krakow to walk with carriages to show the city to tourists. It also could clarify the lower level of Z-SCL by entering the Main Square, where many horses also used to stand and walk. This can be confirmed later on in the interview:

"Yeah, the horses ('were my annoyance'). Twice in the first route (On Grodzka and on the square). No other moments annoyed me, just the horses. Overall it was a positive experience. I felt like a tourist. The only negative thing were the horses that were working basically, exploited in my opinion."

The reason why close before the large negative change on Grodzka street also a positive change can be seen, can be explained by the following quote:

"And also when a person handed a flyer to me (on Grodzka street). I just was amused, not really happy also. I mean it was not a negative feeling, but I was just amused somehow. I don't know why, but it usually is the feeling because these people are so funny when they hand in the stuff."

Another comment not related to the novel physical surrounding was the following:

"This one the second route, I saw something that interested me in terms of food. In the first route I didn't really see anything that interested me. The vegetarian restaurants I liked, because I am a vegetarian."

The vegetarian restaurants are located at one-third of the second route at the Food icon in the Z-SCL map. There the SCL did not increase, but it is also not yet on its lowest level. Besides all these comments that are not related to the urban surrounding, this person was very much interested in the structure and appearance of the buildings. The respondent stated that in the following ways:

"I looked at the structures of the buildings, and I tried to understand how old or new they are."

And;

"When I saw people restoring the buildings I was comparing it to in my home country, when something gets started it barely gets done. So now I can see in a few months if they finished it. I like to compare."

## And the last one;

"I looked also for communist remains but those are probably in other parts of the city. So I think the buildings that were built were from before the communistic era and the new ones also after the 90's."

Especially the last two quotes are related to the second route where more buildings were being restored and also where it would also have been more likely to expect buildings from the communistic era. This shows that the person's focus was fixed for a big extent on the novel urban physical surrounding. Maybe this person expected to see some communistic remains especially in the second route and it was to some extent disappointing that there was none. After all there can be stated that for this person it can be seen that the first route indeed caused a higher SCL, but that it was negatively influenced by personal factors, like seeing the horses working. At the main touristic highlights indeed the highest level of skin conductance can be found, but those were not the locations with the highest positive arousal. Table 5 shows a quite equal division of positive quotes in both routes, however there can be seen that the category of negative 'others' was very important for the first route, which were all quotes related to seeing the horses being used to carry tourists around.

Table 5: Total count of comments per topic of respondent 5

Respondent 5		
Positive comments on topics	Sum of the first route	Sum of the second route
Urban building structure	4	3
Public on the spot (by foot and car)	0	0
Retail on the spot	0	1
Others	3	2
Negative comments on topics	Sum of the first route	Sum of the second route
Urban building structure	0	1
Public on the spot (by foot and car)	0	1
Retail on the spot	0	0
Others	4	0

#### 4.6 Respondent 6; Japanese, 20 years old, student, woman

Figure 15: Overall Z-SCL score map of respondent 6



This respondent had the highest Z-SCL values both at the start of the first and the start of the second route. With the first route the map shows that especially when the castle becomes visible and during walking next to the castle the Z-SCL is on the highest level. At the crossing to Kanonicza street (first street northwards) it quickly decreases and it becomes at the lowest point since the touristic main highlight the Maria Magdalena square. When turning to Grodzka street and walking next to the tram stop the Z-SCL keeps being on the lowest level. Rising a little bit again on last street before the Main square and not increasing when seeing the Main Square. The second route shows a high level from the start of the Planty park, then lowers a bit but still remains high around the crossing to Theater Bagatela. At the beginning of Krupnicza street it once again reaches the highest level and remains high until the middle of the second route. At the last it slowly decreases to a negative level at the end of the second route.

Figure 16: SCL change map of respondent 6



This change map shows very few places with big fluctuations throughout the entire research. For some reason this respondent had the largest negative change at the start of Kanonicza street, see picture 1, which is often mentioned as one of the most attractive streets for tourists. The largest positive change is located in the Planty park where the Z-SCL map also showed the highest values. Also a location where positive arousal is visible, and where the highest level of Z-SCL are located, is the start of Krupnicza street (picture 3). There can be stated that this person did not have any positive arousal within the entire touristic Old Town route.

The first quote of the interview shows how this person defines the difference between both routes:

"The first route is like the main sightseeing I think, cause there you have the castle and the church I think. I saw it in the first route. And the second one is more experienced. Like more for the people that

live in Krakow I think. So I think the first route is more the main sightseeing for the tourists and the second is more to join the living in Krakow."

It could be a potential reason for the fact that Z-SCL values are much higher in the second route than in the first. That the respondents like seeing the real living of the people of Krakow instead of the main touristic sights. The interview then shows some contradicting result compared to the SCL data:

"Ah the most I liked, which really expressed my heart is, I think it is a church on the right side (Maria Magdalena square) on the first (route) that has many statues of the God in front. And when I walked through the street than suddenly it appeared at the right side and wow."

This is the main aim where this research is focused on, finding whether this 'wow factor' exists at the main touristic view sights and causing an inner body emotional response of skin conductance arousal. However, this feeling is only perceived and described in a subjective manner while it does not create a rise in SCL. Instead, the Z-SCL map shows at the Maria Magdalena square a lower SCL than the average of this individual. But, besides the fact that it did not create a steep rise in SCL, the lower level of SCL after that moment in the first route can still be explained by the following quote:

"When I walked through the street I wanted to go into some buildings. That's what I wanted."

Some other comment that is not related to the novel physical surrounding, but still is very much of influence to the results is mentioned in the quote below:

"They have a lot of ice cream shops haha. Even though it is very cold in the winter. But I love ice creams. I also like coffee and cakes and take some time and enjoy the afternoon."

This can be the potential reason for the high level in the beginning of Krupnicza street (at picture number 3) where among others Starbucks coffee, but also two ice cream shops with an obvious sign on the wall are located. Furthermore, the person states that the restoring of buildings in the second route was a bit disappointing, which is mainly at the end of Krupnicza street with especially Theater Groteska, and where also a decrease in overall Z-SCL can be noticed. Summarizing, there can be stated that the results of the interview and the SCL data are partly contradicting. Although this person stated that visiting the buildings was what this person wanted, the first route still gave surprising beautiful views. This however did not generate a higher SCL or positive arousal. Also by viewing the Main Square for the first time, the Z-SCL remained lower than the individual average. The shops and food bars in the beginning of the second route seems to have had more influence on the SCL than the novel physical surrounding of the main touristic highlights. The overall results of the interview shown in table 6 confirm that both the first and the second route are perceived in a positive way, but with some negative remarks. The fact that this respondent did not experience the second route in a negative way is both visible in the traditionally measured results, as well as in the skin conductance measurements.

Respondent 6		
Positive comments on topics	Sum of the first route	Sum of the second route
Urban building structure	4	3
Public on the spot (by foot and car)	0	0
Retail on the spot	0	3
Others	2	2
Negative comments on topics	Sum of the first route	Sum of the second route
Urban building structure	0	1
Public on the spot (by foot and car)	2	2
Retail on the spot	0	0
Others	2	1

Table 6: Total count of comments per topic of respondent 6

#### 4.7 Respondent 7; Macedonian, 22 years old, student, woman

Figure 17: Overall Z-SCL score map of respondent 7



Throughout nearly the entire first route the Z-SCL scores are very low. Only at the middle of Bracka street at the end of the first route it starts to increase slightly. This remains until Main Square on the same level. By passing by the often named attractive sights for tourists, such as Wawel castle, Kanonicza, Maria Magdalena square and Grodzka the SCL stays on its lowest level. At the Planty park it starts to rise to a positive value and since the beginning until the end of Krupnicza street this person experienced a high level of positive SCL arousal.

Figure 18: SCL change map of respondent 7





The change map of respondent number 7 shows some surprising insights compared to the earlier presented Z-SCL map. With three positive changes of more than 20% of the SCL level, the main touristic highlight the Maria Magdalena square was causing positive arousal (picture 1). This although the Z-SCL level compared to the individual average is still at the lowest class at this spot. At the location of picture number 2 this person is very likely to have experienced another kind of emotion related to large changes in SCL, namely stress. In the introduction there is underlined that skin conductance fluctuations does not only reflect upon one single emotional reaction. The quotes of the interview will explain why the different form of emotional response is expected for this participant. Picture number 2 is the location where a lot of people are waiting for the tram and where cars come passing by regularly. The Planty park caused once again the largest rise in SCL. At location number 3 a very large negative change has taken place. This although the Z-SCL remained after that moment very high compared to the first route. Perhaps the interview could shed some new light on this SCL pattern.

This person subjectively explains what the nicest places were of both routes and what her opinion was about the difference between both:

"Well the first route was nicer, because I think we walked in the part with the history one. Like everything was old. And we walked through some kind of castle and stuff it was really nice. But the second one, was like more I don't know, more commercial. Lot of people, not so much interesting stuff to see and things like this."

This subjective result is very contradicting to the results found in the SCL data. Maybe other quotes can give more insights into why the second routes had such a high SCL value compared to the average of the individual. The following quote states that something was actually interesting for this person at the second route: Figure 19: Mural art museum

"In the second route I think I saw a museum of mural art. At the end also the university. And in the first route it was some kind of church, or no no no it was a theater, that was really nice. It was at the beginning of the first route on the right (so the church at Maria Magdalena square)."(...) "And there was also a museum at the second route, some kind of street art. And I read it was a kind of mural art museum and I wanted to go over there too. It was before the university a bit at the middle of the route."



At Kanonicza street indeed some high growth in SCL in percent can be found. Furthermore, at the mural art museum in the middle of the second route there the highest Z-SCL values located and also a little positive growth in SCL can be seen in the change map at that spot. The next quote shows that this person would prefer the first route above the second, although the second was also interesting:

"The overall experience was a positive one, because it was walking through the old city. Because as I know Krakow is known for its beauty and it wasn't touched by the war. It was really nice. Walking next to the castle and the other old streets. And even the second route was nice. Because it was everywhere. The Jagiellonian University everywhere in the city. But first one I liked more.'

The following comment is showing a personal factor in combination with the public on the spot which was very negatively experienced, likely to have created a stress response in the SCL data on the location of picture number 2 and 3 in the map:

"(...) negative for me was. I don't really like crowds. It was at one moment, I think it was around the main square, it was like lots of people and I don't really like this kind."(...) "Also lots of people were like bumping at me"(...)(Next to the trams in the first route?) "yeah, yeah there. There was a little tram station. Also at the second route three or four people and I was like okeee."

Both routes are mentioned as being busy, and two main fluctuation spots are likely to have caused stress responses in the SCL data. Possibly the second route overall was more relieving for this respondent compared to the first one with the main touristic highlights, given her high Z-SCL scores in the second route. Then the last quote which also shows the potential reason why the subjective answers are partly contradicting to the standardized SCL pattern:

"The route is for me not so important. It is more the weather first, then the person with who you are, then the route."

So to summarize, this person enjoyed quite much the whole route, but is more likely to have got influenced by external factors other than the urban surrounding of the route. The second route was also described subjectively as a nice one for this respondent, although the preference still would go to

the first route. The surprising result is only that this person had a negative Z-SCL value around all the places of the first route which were named as visually appealing. The total count of quotes related to positive and negative topics in table 7 show indeed that the urban physical surrounding was more positively described in the first route, but for both routes count that public on the spot was a very negative factor.

Respondent 7		
Positive comments on topics	Sum of the first route	Sum of the second route
Urban building structure	8	4
Public on the spot (by foot and car)	2	0
Retail on the spot	0	1
Others	4	4
Negative comments on topics	Sum of the first route	Sum of the second route
Urban building structure	0	1
Public on the spot (by foot and car)	3	3
Retail on the spot	0	0
Others	1	0

Table 7: Total count of comments per topic of respondent 7

#### 4.7 Respondent 8; French, 25 years old, employed, man

Figure 20: Overall Z-SCL score map of respondent 8



This map shows the biggest errors in GPS data of all respondents. This is mostly at the first route and the reason for it is inexplicable. The pattern throughout both routes can still be analyzed despite these outliers. At the start until halfway of the first route at Grodzka street a low Z-SCL can be found. This remains then on the same level until reaching the Main square. There a rise in Z-SCL data can be seen

to a more positive level. The highest levels are clustered around Planty park and next to Theater Bagatela. Then after the start of Krupnicza it starts to decline which since the half of the second route starts to get on the lowest level again. This remains until the end of the route.



Figure 21: SCL change map of respondent 8

This respondent had throughout both routes a very stable SCL line. The change map does not show a lot of fluctuations, except from at the Planty park. There are also the high Z-SCL values located, but instead of that it is only a relaxation zone, this area also caused huge positive arousal shown by first having the largest positive change in percentage followed by the largest negative one, which implies a very steep positive peak moment in the SCL data. Besides that also entering the Main square gave a response in SCL, although it is not higher than 20% of the value of the previous GPS location. In the interview can be found why these places caused arousal.

1

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The first comment that compares both routes directly comes with an explanation that suits to the SCL pattern:

"Well, the first one we saw the castle, we saw the main square, so way more historical buildings and the more touristic places, rather than the other one, which was like a random route in the city." (...) "I wouldn't say that it (the second route) was not attractive, because where we started it was really nice. Not a particular place to see as a tourist."

Indeed the cluster of the highest level of skin conductance is around Planty park and Theater Bagatela, which are perceived as attractive because these are not particular places for tourists. The following personal factor increased the feeling of joy on certain places:

"Each time when there were musicians. I liked that. The violins in front of the church with the statues (Maria Magdalena square). The guy with the guitar in the beginning of the second route (Planty park). It is like you can see a place and hear it as well."

At this day two violin players were present at two locations, the Planty park and the Maria Magdalena square. This person even stood still at the Planty park to listen to the music for a few seconds, which means this person really enjoyed that area as can be noticed from both the Z-SCL data as well as the change map which shows the largest arousal on that spot. However, next to Maria Magdalena square the SCL data did not show a rise and remained on the lowest level compared to the average of the individual. The other moment with a rise in SCL data is at the moment when Market square becomes visible. It is subjectively described below:

"When we arrived on the Main square. It is such a small city and then with the old lady in front of us. She was a bit slow haha and it makes you walk slower. So when you arrive at the Main square and you have all this beauty, it came like a bang in my face. It is huge with the market and the different buildings."

This is the second time that the intentional aim of this research is mentioned by the respondent. However, compared to respondent 6, this person also experienced a positive SCL response caused by the excitement of the respondent. The public was in the opinion of this respondent also different between both routes:

"The second route felt just like less touristic, more with local people. Polish people with families walking in the streets. The people. Also the school at the left. So, it looked way less touristic than the first one."

The school that this respondent mentioned is located close to the end of the second route, it can be seen that this did not increase the SCL. Both routes are described to be neither annoying nor unpleasant. At last, this person categorizes the things that would have had the biggest influence on the way how this person felt in the city:

"The musicians made me really feel the best. It just highlights the place and makes you appreciate things. Then the weather I liked. Well actually, no the architecture of the buildings and so on I would see as more important on my feeling, and above still the musicians. I wouldn't have had the same experience without music."

This means that the novel physical surrounding is for this person on quite a high place. However, based on the Z-SCL scores only the Main square cause a rise in SCL and at other main touristic highlights there were actually the lowest level of Z-SCL scores located. The violin player as well as the Planty park are perceived as very arousing in both the SCL data and the interview. In table 8 the total interview results

are shown and deriving from that there can be stated that actually both routes had nearly only positive aspects which mere mostly related to the urban building structure or the topic 'others' often referring to the positive influence of the musicians.

Respondent 8		
Positive comments on topics	Sum of the first route	Sum of the second route
Urban building structure	4	4
Public on the spot (by foot and car)	2	1
Retail on the spot	0	0
Others	3	4
Negative comments on topics	Sum of the first route	Sum of the second route
Urban building structure	0	0
Public on the spot (by foot and car)	1	0
Retail on the spot	0	0
Others	0	0

Table 8: Total count of comments per topic of respondent 8

#### 4.8 Respondent 9; Algerian, 24 years old, student, man

Figure 22: Overall Z-SCL score map of respondent 9



At the start of the first route, this person has a low Z-SCL score. At the Maria Magdalena square it changes and quickly increases to a level close to the average of this individual. This level stayed the same during Grodzka street (street in the middle towards the north) and until Main Square. At the square it shows also two dots that are higher, but it is not at the exact moment when the Market square becomes visible. The second route starts with one negative value and then rises to a very high level at Planty park. When passing by Theater Bagatela and in the beginning of Krupnicza this person

experienced the highest level of Z-SCL scores. Until the middle of the road it becomes a bit lower but it still a high Z-SCL. From the middle until the end of Krupnicza this person once again reaches its own highest level in SCL.



Figure 23: SCL change map of respondent 9

The change map of this respondents shows clusters of positive growth around the main touristic highlights of Kanonicza street and Maria Magdalena square (pictures 1 and 2). Also at the Main square a rise can be spotted in SCL. However, there must not be forgotten that on most of those touristic locations in the Old Town route this respondent still had negative Z-SCL scores. Furthermore, the largest rise and arousal is located at the beginning of the second route at Planty park. Since that point the SCL is not very much fluctuating and remains on a very high level compared to its own average, as seen in the Z-SCL map.

In the results of the interview this person indicates that both routes were a positive surprise and this person enjoyed it a lot.

"The first route I didn't know anything, it was so beautiful. Such a beautiful buildings from centuries ago. And for the second it was pretty interesting and actually it was awesome because we passed by the university where I am going to study."

The fact that this person is also so enthusiastic about the second route is clearly visible in the Z-SCL results. This person even states in the following comments that the second route was maybe even more interesting and appealing than the first one:

"The first route was so touristic. It was like, where you can see also a lot of people. Places where they can sell a lot of things, like souvenirs and so on. And the second one was more like a student road. Where you can go for a good coffee and something like this. It was amazing, it was awesome."

## And;

"In the second route I saw also the fitness club, at the end, and Starbucks coffee I saw a bit at the beginning of the second route. That is famous and really a good point. And in the second I saw a kebab shop, at the beginning also. I like a good kebab."

This person was mostly by personal interests in food and coffee appealed by the second route. The areas that are named are indeed the places where the highest level of skin conductance can be found. The kebab place is located next to Theater Bagatela (at the start of the second route) and the Starbucks coffee is also at the beginning of the second route. However, it did not generate large fluctuations in SCL. The next comment shows that the first route was also perceived in a very positive way:

"In the beginning of the first route this old building, it was so attractive and this statue with this old man with some kind of church. Some little square (Maria Magdalena square). I got attracted to that. I wanted to also make a picture there and from the castle."

The Maria Magdalena square indeed created a steep rise in SCL as can be seen in the change map. So for this person it was both subjectively as well as with the SCL an arousing sight. This person was, based on the comment, quite much fixed on the novel urban surrounding:

"Also at the beginning of the second route I saw something so attractive. A building with some things on the wall. Some sort of painting, no not really, but a kind of architecture (it is at the side of Theater Bagatela). We crossed the road and there it was."

At the Planty park the steepest rise in SCL can be found. This park was indeed described by this person as a surprise:

"The building in the center and the garden where we pass by. I mean the park. So the second route in the beginning. I mean everything was Polish. It was so surprising."

This respondent is the first who describes the park as surprising in a positive sense. This although many respondents have very high Z-SCL scores when surrounded by the park. At last, this person lists a few things that were important for the way how the route was perceived, with the following things as result:

"The weather was amazing, when it is like this you can enjoy your time and you can enjoy the things you see. Haha yeah and with the kebab. I am a bit hungry. After this interview I will go there haha. But I really enjoyed the whole trip. The combination between the weather and the walking was just nice." Overall, this person enjoyed very much both routes as described in the interview. However, based on the SCL data the second route was perceived in a more positive way than the first one. This is actually also stated in the interview, that this person was very positively surprised about everything that was seen at the second route and this could have been the reason for the positive SCL pattern throughout the entire second route. The SCL grew steeply at Maria Magdalena square and also the Main Square where the first time view of the the touristic main sights could potentially be the reason for the growth of SCL. However the viewing the Wawel castle for the first time was not causing any growth in SCL and there the Z-scores were the lowest. Table 9 shows that most positive aspect about the first route was the urban building structure and for the second route the retail on the spot, such as the kebab and the coffee shop. At last, this person stated the following:

"Well actually for me, like for strangers here, you will see people looking at you in a different way. You know what I mean."(...) "And then I think we are humans, we are the same haha. But actually I can deal with this."

This person laughed away this topic and stressed a few times that it does not matter for him or for his feeling, and indeed it did not generate a lower Z-SCL, because this was stated mainly about people in the second route where entire route has high Z-SCL values.

Respondent 9		
Positive comments on topics	Sum of the first route	Sum of the second route
Urban building structure	7	3
Public on the spot (by foot and car)	0	0
Retail on the spot	0	4
Others	4	5
Negative comments on topics	Sum of the first route	Sum of the second route
Urban building structure	0	0
Public on the spot (by foot and car)	1	2
Retail on the spot	0	0
Others	0	1

Table 9: Total count of comments per topic of respondent 9

#### 4.9 Overall view on the results

The main aim was researching whether a potential link exists between seeing a main touristic highlight for the first time and the skin conductance level and response of the respondent that is new in that city. Or can other areas being identified as positively experienced, which were not in line with the expectations? Especially based on the Z-SCL scores, so the standardized SCL values compared to the average of the individual, there can be stated that in most cases the potential link between the seeing the novel physical surrounding of touristic sights and the high SCL, is not found. Three people (respondent number 6, 8 and 9) expressed themselves subjectively as having experienced a so called 'wow' feeling when looking for the first time at surprising sights of the main touristic highlights of the city of Krakow. Two of them also experienced a rise in SCL, where respondent number 6 experienced a contracting decrease in SCL on the subjectively described main touristic spots. Only respondent number 9 is seen with having a growth in percentage of more than 20% at those surprising touristic views. What must be taken into account is that for all the three respondent quite low Z-SCL scores can be find at those spots, meaning that other areas were experienced in a more positive way.

The spot with the most convincing cluster of positive Z-SCL scores is the Planty park at the beginning of the second route. Many times the largest rise in SCL is located there and it is also often the place of huge positive fluctuations meaning that it was an arousing area to walk. The area with the lowest positive fluctuations is from the middle of the second route towards the end. Several times high Z-SCL

scores can be found there, stating that this person was relaxed or satisfied, but it never is the location with high fluctuations in SCL.

Surprisingly respondent number 4 and 5 are the only once that have the highest Z-SCL scores mainly concentrated in the first route. All the other respondents have more positive Z-SCL scores in the Outside of the Old Town route. The overall pattern of the Z-SCL of all respondents is that it starts very low, then gradually grows during the first route, when starting the second route it reaches the highest level around the Planty park and the beginning of Krupnicza street, and then at last gradually decreases again towards the end of the second route.

The most contradicting result is that in all cases, except from respondent number 9, the first route was subjectively described as more positive than the second one. This can also be seen in table 10. Due to the fact that questions were openly asked, the respondent was free to name the positive and negative aspects of both routes in his or her opinion. As can be seen, the urban building structure is most often named as the main positive aspect in the Old Town route. There is even no respondent which named the urban building structure in the first route as negative. At the second route the 'retail on the spot' scores much higher than in the first route. This means, based on these subjective answers, that no one was interested in the restaurants that are mainly located at the first route. Instead, the food, coffee or ice shops in the beginning of the second route are often mentioned as a positive aspect of that route. At those points high Z-SCL scores can also be found. The public on the spot was very equally subjectively experienced, meaning that there is not a big difference seen between the emotional experience of the Old Town route where a lot of tourists are walking and the second route where more the local Polish people are walking. At last, the 'others' category shows that personal factors clearly had its influence on the results, such as the negative experience of respondent number 5 of seeing the horses with carriages used for tourism, and respondent number 8 subjectively stated that the areas where violin players were located was the most important for his emotional experience.

Total sum of comments of all respondents		
Positive comments on topics	Sum of the first route	Sum of the second route
Urban building structure	37	19
Public on the spot (by foot and car)	5	3
Retail on the spot	1	9
Others	20	20
Negative comments on topics	Sum of the first route	Sum of the second route
Urban building structure	0	8
Public on the spot (by foot and car)	8	8
Retail on the spot	1	1

Table 10: Total count of comments per topic of all

Perhaps a potential explanation for these surprising results of SCL data can be found in the literature? Some people referred to the second route that it was less touristic and it shows more the living of the people of Krakow. This could possibly have been a reason for the higher Z-SCL scores on the second route, compared to the first. Respondents all subjectively describe the first route as more positive, but are unaware of the fact that they were more relaxed and enjoyed during the second route (especially at the beginning), based on their Z-SCL scores. This subjective unawareness is mostly visible on the fact that only one respondent named specifically the park as positively surprising and a point of joy, while it nearly counts for all respondents as the most significant area of relaxation. In the scientific literature a positive explanation can be found, which is often named 'New Urban Tourism" (Feifer, 1985; Füller & Michel, 2014; Pappalepore et al., 2010; Richards, 2011). This theory states that nowadays more and more tourists are enjoying going 'off the track'. So instead of visiting the main touristic highlights,

visitors of a city are searching for unusual and unknown places that are not familiar to the mainstream tourist. Once is stated in the interview of respondent number 8 that the beginning of the second route was very appealing, because it is not an usual spot to see as a tourist. This qualitative exploratory research will not find generalizable answers to the reason why the second route was more positively experienced based on SCL data, but the results of this research could function as an incentive for further investigation on such areas outside of the tourist area and the potential link with the skin conductance level of tourists. Perhaps these areas are more often enjoyed by tourist without them being aware of it.

#### **Chapter 5: Conclusion**

This thesis has the aim to research the influence of the novel physical urban surrounding on the emotional experience of respondents, measured in both a traditional way as well as through physiological observations. The potential link, on which the main focus is put, is the first-time view of the main touristic highlights of the city of Krakow and the physiological arousal on those places. This physiological arousal is measured through skin conductance. Using a GPS application the skin conductance level (SCL) data can be combined with the location where the level of arousal occurred by using GIS mapping techniques. The respondents are unknown with the city of Krakow and its main highlights. They walk alone and do not talk with anyone. This procedure guarantees that only the novel physical surrounding has impact on the SCL data. Immediately after the routes an interview is held with the respondent to be able to combine the quantitatively measured data with the subjective description on how the routes are emotionally experienced.

The expectation is that seeing main touristic highlights will cause high scores of SCL, as well as large positive fluctuations meaning that an area would generate arousal, as suggested by Shoval et al. (2017) and Kim and Fesenmaier (2015). To find out whether touristic highlights potentially generate higher levels of skin conductance, two predefined routes are designed. The Old Town route passes by the main touristic highlights of the city and is planned in such way that the main highlights come as a surprise to the participants, increasing the so called 'wow factor' (Kim et al., 2010). The second route is outside of the touristic Old Town. It is a straight route with no buildings mentioned by tourist agencies as esthetically appealing. The respondents are not aware of the goal of the research. The expectation is that the first route creates a higher level of skin conductance overall and a rise on moments when touristic highlights become visible for the first time.

However, the results of the eight respondents are very contradicting to the expectations. The second route is in most cases causing the highest level of skin conductance compared to the average level of the individual. Consequentially, there can be concluded that there is no potential link between the main touristic highlights and the SCL on those places. The touristic highlights of the first route are often named as appealing in the interviews, but it does not potentially generate an inner body reaction, such as arousal. Instead, the highest level of SCL can often be found at the Planty park and the start of the long street of the Outside of the Old Town route. This park is only named by one participant as a positive surprise in the interview, but it is apparently experienced by many as a satisfying place to walk. The influence of places that offer food or coffee also seems to be high, as respondents often mentioned these spots in the interviews. In the majority of the results there can be found a high SCL at those locations. Worth particular mention is also the fact that those locations were mainly located at the beginning of the second route. The last part of the second route is often leading to a decrease in SCL and is also described as boring in the interviews. This is likely to happen due to restoration work on many buildings and the fact that the street is only straight.

At last, there can be concluded that the potential link between seeing the main touristic highlights for the first time and the rise in skin conductance level is not found, as was suggested by Shoval et al. (2017) and Kim and Fesenmaier (2015). However, it should be taken into account that this research is very explorative of its kind. The conclusions made in this thesis are not generalizable. Meanwhile, there is possibly a reason for this surprising high SCL at the area outside of the traditional touristic space. Scientific articles are referring to a new kind of tourism that is gaining popularity, namely 'New Urban Tourism' (Feifer, 1985; Füller & Michel, 2014; Pappalepore et al., 2010; Richards, 2011). Tourists are nowadays enjoying the areas that are less known to the mainstream tourist public. Ideas for a further research would be whether this potential link between areas outside of the traditional tourist space and heightened levels of SCL also exist in other touristic cities. Also more attention could be put on the

difference between the skin conductance level within green areas, which was in this research the hotspot of the high SCL scores, and the inner city areas. Is the green area indeed potentially causing arousal or relaxation based on SCL measurements, as comparable to what is found in this research, and as expected by Hull and Harvey (1989) who state that park areas increase arousal? These potential ideas remain however open for the further future research.

## **Chapter 6: Discussion**

In the discussion several topics will be elaborated, mainly focused on the methodology in combination with the reliability and validity of the results of this research. Also other aspects where I could not have any influence on will be stressed as potentially having caused impact on the results.

To start in a general manner, the methodology of this research involves a very specific kind of technology. The technology of physiological measurement through skin conductance is not my main field of study. Therefore, I had to completely rely on other researchers that had already tested these kind of technologies in outdoor activities. Also the way how to use the technology was learnt by reading how pioneers on this topic applied this technology. The advice to start with every respondent with a few test minutes to let the wristband get used to the skin of the respondent was always carried out, which has led to an increase in reliability of the results of this research. The Empatica 4 wristband is the most up-to-date device to measure skin conductance, as was explained in the methodology. This ensures that with no other device the SCL results would have been more reliable than how they are now. This also increases the validity of the results, which means that the change that the skin conductance results would be exactly reproduced when carried out in the same manner, will be higher with the Empatica 4 wristband than with any other device.

The fact that I was reliant on technology had mostly influence on the reliability of the results due to the choice of the GPS application. Although having it tested multiple times beforehand, still problems occurred with the first respondent. During the testing phase the GPS application logged also coordinates when the phone was on stand-by modus. Due to that knowledge I wanted to make the measurements as precise as possible, and I gave the phone to the respondent and asked him or her to keep it in his or her pocket. Then after the first route I noticed that only 11 GPS points were logged. I stated after the first route was ended that the respondent could better keep the phone in his or her hands. But also during the second route only 7 GPS locations were logged. To retain the quality of the results I have decided to leave that respondent out of the research. After that I ensured that with the other respondents the GPS application remained logging coordinates by holding it in my own hand.

The GPS application also had influence in another way on the validity of the results. With some respondents huge outliers can be found, while others have coordinates that are located close to perfect in both routes on the map. The reason for that is inexplicable. If this research would be once again carried out with the same GPS application it is very likely that not exactly the same GPS locations will be logged. Also it can be that there exists a better or more precise application, which could lead to an increase in reliability of the results. However, this application was mainly chosen due to its convenience in usage, such as logging both the time, the longitude and the latitude, but also being able to export it to excel in CSV format so that it could be combined with the SCL data.

I could have had a negative influence on the validity of the results, because I had to manually aggregate all the scores and calculate the average of Z-SCL for a window average in seconds. This all was done with the help of the mathematical functions in Excel. However, because I still have carried it out myself it could have been that an error has occurred somewhere in the data. But, the SCL pattern on the maps were always checked and compared to the SCL flow line visible on the web service of Empatica Connect. The SCL pattern on the map always looked exactly how the flow line was presented at the web service.

Because of the fact that I have chosen to connect the data of skin conductance with GPS location points it can be that large peaks in SCL are not visible. This because for every GPS location I had to calculate the average Z-SCL value for the window average of approximately 6 seconds. It can be that peaks in SCL happen within less seconds than that window average. To increase the reliability of the results I

decided to include for every respondent a change map of SCL in percentage. With this map it became possible to highlight the areas in the routes with the largest fluctuations which is a sign of arousal.

One of the most important aspects of discussion is the difficulty of interpreting the skin conductivity data in relation with the answers of the qualitative interviews. In many cases the answers of the respondent clearly reflect the pattern of SCL and arousal spots of the respondent. However, there are cases when contradicting results can be found. The reason for that is partly shown in the results of this report, showing that at the green park space the highest Z-SCL values cluster, but surprisingly with only one person mentioning it as a positive experience in the interview. This indicates the unawareness of respondents about their experienced emotions. In the introduction there is written that skin conductivity measurements have big advantages, because gathering the data is relatively cheap, easy and unobtrusive. However, it is also stressed that the disadvantage of applying this method is that skin conductance data does not reflect only one emotional response. This leads to problems when the interview answers give no potential reason for certain hotspots of SCL fluctuations within the routes. Without any qualitative explanation there can be stated that these areas in the route are either caused by feelings of arousal, fear or stress, which is not meaningful to the results of this thesis. It remains the biggest disadvantage when applying this kind of method in your research and it is far from easy to overcome that problem. Therefore, the conclusion can be drawn that measuring emotions through skin conductance is, until now, never a full objective method of emotion measurement.

Deriving from the interviews there can be stated that personal factors have a big influence on the outcome of the SCL data. It shows that the experience of a novel physical surrounding is for every person different, related to their varying personal interests. It is still unclear what to depict from the environmental factors, because the importance of it differs a lot per each individual. Performing a GIS based analysis involving these kind of environmental factors is therefore hindered. Using an environmental factor such as a busy tram stop in your analysis does not need to state that all respondent reacted on that spot specifically to that environmental factor, exemplifying respondent 5 being surprised to see horses with carriages being exploited for tourism very near to the spot of the tram stop leading to a negative SCL fluctuation. This makes it harder to use a GIS model to analyze such factors and to come to overall valid conclusions for all respondents. This is the reason why so much attention is paid to the respondent separately and why the overall view of the results is somewhat limited. This to avoid subjectively chosen invalid generalizations of results for all respondents.

The outcome of this thesis might be steered by the population that took part in it. Mainly people of an age between 20 and 25 years old took part. Besides that, most of them are still students. I gave a potential explanation for the overall high Z-SCL scores in the second route as likely be triggered by ideas pivotal in the 'new urban tourism' theory. However, it is more likely that the younger generation is more interested in areas located outside of traditional touristic space, which for example can be perceived as creative. However, the one older person that took part in this research had also high Z-SCL scores at the second route, contradicting to my above described idea. However, it is still likely that the age of the respondent have had an impact on the outcome of the thesis.

I have read before starting with the measurements that talking to a person could have influence on the SCL data measurements. So for example, when a person would start laughing, because a joke is told, a response would be seen in the SCL data. This is not the influence that I wanted to measure. Other articles did not take this effect into account and they let their respondents walk with other people and friends. I think that the reliability of the results increased because of my choice to only tell the way by saying right, left or straight on, and for the rest letting the respondent walk alone. In this way only the novel physical surrounding could have impact on the SCL data. Moreover, I think the reliability of the results increased by my choice to not tell the respondent beforehand what the aim was of the research. By doing so the respondent was walking unaware through a novel physical surrounding, instead of knowing that I am measuring how they react on touristic and non-touristic sights.

Lastly, I would like to mention a few elements that had influence on the validity of the results without me being able to avoid it. To start with is the fact that the research was done outdoors. I tried to collect all the data in approximately 2 weeks. Still the weather conditions are never totally the same. I tried to only do the research with half sunny or full sunny weather. I twice had to cancel the plan to do the data collection because it started raining. But still if the research would be reproduced it would be very likely that the weather conditions are not similar to the conditions during this research. Also there was an influence of the public on the spot, which is never totally the same. Once there are a lot of cars or trams passing by at traffic transitions, the other time it is relatively calm. The same counts for the very specific difference that on one day a violin player is present at some location and another day he or she is not. Also at some days the horses with carriages passed by and at other days not. Furthermore, the time when the data is collected was tried to be at similar time ranges, so not in the early morning or in the late afternoon/evening. However, it is never collected on exactly the same moment of the day. All these aspects decrease the chance that performing this research once again would lead to exactly the same results.

#### **Chapter 7: Recommendations for further research**

The outcome of this thesis triggers exploration of the potential links that are found. This first potential link clearly coming forward is the green space and the influence of it on the skin conductance level on respondents. In this research there was focused on people new in the city, which may have caused a surprising positive emotional response when seeing a park for the first time. However, it can be further investigated whether parks in general create higher SCL scores compared to urban built-up areas. It is advised to perform similar kind of analyses on a large population size and in a quantitative manner. This would not require GIS analysis techniques. Moreover, there is addressed in the discussion that the age of the respondents might have had influence on the results, because of the openness of the younger generation to explore areas outside of the traditional touristic center. This potential link of heightened SCL in areas located in more unknown parts of the city and the age of tourists that participated can also function as a topic for further research. Furthermore, the scientific articles that until now involved skin conductance measurements in tourism are very descriptive of its kind. Research that would analyze the skin conductance data statistically instead of descriptively in the field of tourism could be a welcome addition to the until now found results on the topic. Another idea more closely related to the methodological set up of this research is investigating whether a same kind of pattern of SCL would be the outcome if the Old Town route and the Outside of the Old Town route would be walked in reversed sequence. It does not need to be exactly the same routes in the city of Krakow. The importance is whether a first route outside of the touristic area followed by a route within the tourist space would lead to similar or contradicting results as presented in this research, e.g. higher SCL scores outside the touristic area.

At last a recommendation related to GIS techniques involved in mapping and analyzing skin conductance data. As was encountered in this thesis GIS model based analysis is, and is likely to remain, very difficult in interpreting the skin conductance data. This is due to the difference in personal interests leading to a big variance on the perception of environmental factors. However, skin conductance data that is gathered with a focus on the location where it is collected, whatever the reason for it might be, is advised to apply GIS mapping techniques to combine GPS location data with SCL data to be able to present it on map. Without applying GIS, this also counted for this research, gathered data on skin conductance would never be able to be used in location-oriented analysis. This is the main power of GIS, turning meaninglessly stored data with a locational component into informative and analyzable results visualized on maps.

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# Appendices

## **Appendix 1: Interview questions**

- 1. Can you describe your overall experience of the routes?
- 2. What is in your opinion the difference between the first and the second route?
- 3. Can you name a few things that you have seen and that you still remember? Describe the locations.
- 4. Have you experienced positive surprises during the routes, such as joy and excitement? Explain where, what and why.
- 5. Have you experienced negative surprises during the routes, such as annoyance or disappointment? Explain where, what and why.
- 6. What had, in your opinion, the largest influence on the way how you felt during this research? Could be anything. Describe.

Appendix 2: The Old Town route on a tourist agency map with pictures on the spot included



Appendix 3: The Outside of the Old Town route on a tourist agency map with pictures on the spot included

