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Mapping people? – The measurement of physiological data in city areas and the potential benefit for urban planning

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1 ABSTRACT

The emergence of new technologies like GPS, mini-sensor and the ever-wider diffusion of mobile devices makes the idea of a 'smart city' become more and more realistic/concrete. Linked to this is the hope for a more livable, more efficient and greener city, which is increasingly oriented on the people's needs.

The concept of emotional city mapping, which focuses on the main subject of all planning, the human being, provides an innovative approach for the integration of people's emotions into urban planning. The goal is that test persons do not just add *subjective* impressions as suggestions to planning processes, but *objective* measurable, physiological response data, which reflects the somatic-emotional condition in the urban context.The question is: Can we objectively measure how people feel in their city?

In the projects *emomap* and *Mapping Marzahn-Hellersdorf (Mapping MH)* it was attempted to make an objective analysis of the city using geo-referenced vital data. To this end the probands – while walking through the city – wore a sensor-armband (*smartband* developed by bodymonitor.de) which measures the skin conductance. Changes of the skin conductance give indications of the actual emotional state of the probands. The acquired data shall lead to an identification of urban spaces, which are connected with emotional impulses (wellbeing, tension, relaxation), by using an objective method.

This interdisciplinary project aims at taking a new look at the city, using methods from the fields of 3D visualization, mapping and urban research, as well as areas of psychology and stress research. Operational areas where: Mannheim-downtown and Marzahn-Hellersdorf, a part of Berlin. The paper presents the results and further research questions.

2 INTRODUCTION

Looking at the conference title, which refers to the City 3.0 – smart, sustainable and integrative – the question arises how a city can be brought closer to this model. How can the planner obtain objective answers to the following questions: Where are the most livable areas areas of the city? How can I identify problem areas? How can I identify these areas with a bottom up approach, without only using my, the planners, or the involved decider's view? Is there a technique that enables the planner to follow an objective and integrative approach?

A starting point to answer these questions is the psycho-physiological mapping project. It focuses on the centerpiece of all planning, the human. The goal is that planners obtain, additionally to subjective impressions from the test persons, objective vital signals, which are an indicator for the sensation felt in a city.

The project tries to objectively analyze a city, using georeverenced vital data. The test persons were guided through the city, wearing a sensor-armband (the so called "smartband", a prototype developed by Dr. Papastefanou), which allows the ambulatory measurement of the skin conductance [cf. Papastefanou 2008].

The skin conductance is an indicator for the electrodermal activity (Greek; derma=skin), which is influenced by the perspiratory gland's activity. They are activated – next to their function in the thermal regulation of the body – in emotional situations. Emotional thoughts and experiences often go along with an increased electrical conductibility of the skin. Changes of the skin conductance reflect the activity of the autonomic nervous system (ANS) and give hints how test persons react cognitiv-emotionally to environmental impacts. This interdisciplinary project tries to take a new view at the city, using methods from the fields of three-dimensional visualization, mapping and urban research, as well as areas of psychology and stress research. Operational areas where: Mannheim downtown and Marzahn-Hellersdorf, a part of Berlin.

3 STATE OF RESEARCH

The original idea to capture and visualize emotions in an urban area, in the age of modern communication, came from the artist Christian Nold. His research work is the foundation for the art project BioMapping. Despite his innovative approach in the field of geo information data processing, the project had more of an arty and aesthetical pretension than a scientific one. Many test persons, each equipped with an indicator, walked through a city and recorded their skin resistance level. The latter was georeferenced with a GPS-logger and visualized in different so called BioMaps [Nold 2008].

This technical method is reminiscent of an automated cognitive map or, Mental Map. In his 1965 book "Image of the City", Kevin Lynch worked out the idea that humans are able to memorize paths and to recall these if needed. These mentally remembered maps contained different elements: Paths, borderlines, areas and focus points as well as landmarks. Thus, paths are the predominant aspects of a city, because they are like canals through which the spectator can move. Test persons were asked to draw their mental maps. Moreover, the test persons had to mark areas in which they had an experience of a pleasant sensation or threatening feeling [Lynch 1965]. However, critics of this technique point out that not every participant had the drawing skills needed to express adequately his exact imagination using a graphical plan.

Around 40 years later, Sorin Matei worked with mental maps and oriented his work strongly on Lynchs' works. Matei was the first to map feelings on a digital map and visualized them in an additional step as a three-dimensional VRML model. The result was a TIN model that shows well being and "fear areas" of questioned citizens of Los Angeles in a three-dimensional model [Matei ball Rockeach Qiu 2001].

Another work in this context is the project "gps-based construction risk pilot study" by JD Birdsall and E. Brühwiler [Birdsall, Brühwiler 2007]. This study researched the concept of GPS-based analysis of the personal risk. With the help of a sensor and a GPS-tracker stress data as an indicator of risk was recorded and localized automatically.

However, all these approaches based on surveys in retrospect. The new mobile devices (eg. the smartband and GPS-loggers) allow this psycho-physiological research outside the laboratory in realtime. Gathering data in the urban environment opens this methods to urban planning and architecture.The first steps in this research area were made in 2007 during the project "Ein emotionales Kiezportrait" – "An emotional city neighbourhood portrait" [Höffken, Papastefanou & Zeile 2008].

3.1 Experimental set-up

The test person wear the smartband at the non-active wrist. Additional they get a GPS-logger, which their put in their trouser pocket or a bag. Equipped with this devices the test persons walk around in the city.

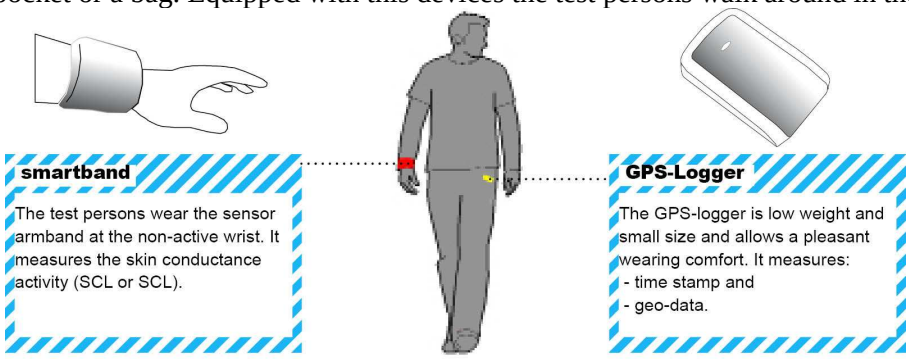

Fig. 1: Exemplary image of how a test person wares a smart band together with a GPS logger.

3.2 Technical and data bases

The usage of a GPS logger, called-Blue 747 by Transsystems, allows to record the distance traveled by the test persons. In addition to the position coordinates, the device records the corresponding time stamp (time data). Its low weight and small size allows a pleasant wearing comfort. This reduces the influence of the collected data through eg. physical exertion.

For the measurement of the skin conductance data, a prototype of the smartband was used, developed by Jorgos Papastefanou. It is a sensor armband with incorporates microprocessors, various sensors, a memory device, a battery and two electrodes. It consists of elastic material to minimize the impairment of the test

persons. The test persons wear them at the non-active wrist. The pressure gauge measures the pressure with which the two electrodes rest on the skin. A continuous flow of small electrical current through two electrodes allows to measure the skin conductance. Additional sensors could measure further data, eg. the triaxial acceleration, heartbeat rate, skin temperature and light intensity of the environment [Papastefanou 2008]. The smartband records the biodata in free adjustable rates. The record rate in the actual projects was a rate of 100 Hertz.

3.3 Data bases

Existing databases in both projects were in addition to georeferenced aerial images and a scanned raster map especially the, under the Creative Commons license available maps from OpenStreetMap [Open Street Map 2008]. Since a large community, similar to the Wikipedia encyclopedia, generates this collection of maps using GPS trackers, Open StreetMap suits perfectly for this project. In addition, data from Google Earth and Google Maps are used.

4 THE FIRST STUDY – THE STUDY PROJECT EMOMAP

In the study project emomap a group of 20 volunteers of aspiring urban planners and architects conducted several test runs in the city of Mannheim within 3 months.

4.1 Data base

Various reports and studies on the Mannheim city checked the expected results for their value for urban planning: The downtown-development-study eki.ma, which develops action models and measures for the inner city in a multi-Buttom-up approach with citizens, organizations, associations and initiatives. Thereby idea-tables generate concrete solution for six current topics [mess 2008 and eki.ma 2008]. Additionally the results of the project "feel good in public space of the inner city of Mannheim" [Berchtold Krass Neppl 2007] has been conducted. For this project, different areas in the city of Mannheim were defined for potential user groups. With the use of GIS techniques on the basis of different factors such as density, demographic distribution, green structure, shading, cultural facilities and crime rate, feel good neighborhoods for different user groups were identified. These analyses were a background to proof the results in this work.

4.2 Methodology

The groups of volunteers met in the city of Mannheim on 10 different test runs in various pre-defined areas: The Jungbusch, a high-density and social focal point; the Museum Quarter; the main shopping street, the so-called "Planken"; the castle area with the physical separation through the highway; and the boulevard area from the main station to the water tower. Each run lasted for approximately one hour. During the tours the locations where tracked with the automated GPS trackers in intervals of one second, simultaneously the values of the measured skin resistance where recorded in 1 / 10 seconds intervals. In addition, to verify and safeguard the derived measurements, perceived events where documented in writing, as well as photographically, and then localized with a Geotag. The records from the GPS data logger and the Smart Band have been synchronized temporally using the software Stata9, and then adjusted using QuantumGIS or aggregated into a whole set of data.

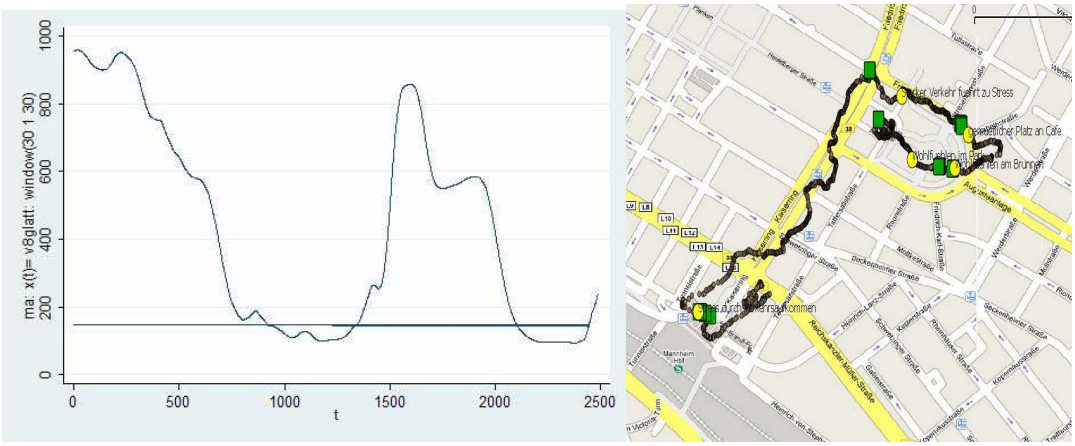

Fig. 2: Course of a skin resistance curve and positioning of the points in the city of Mannheim.

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For a clear interpretation of the data, particular attention should be paid on the fact that a clear statement can only be made on the change of bodily tension. A decline of the skin resistance level (SRL) indicates the reduction of perspiration and with that a reduced arousal of the autonomic nervous system (ANS). Transferred to the measurements low skin resistance values indicate that the person is aroused. Through the curve progression, intensity and length of the reaction can be estimated. This type of analysis works well for a single person and can be visualized using the free online tools GPS Visualiser [Schneider 2008] for Google Earth or Google Maps two or three-dimensionally. The integration of the time signal (the so-called time stamp) makes it possible to reproduce the runs even in real time.

For the aggregation of all data on a pan-urban level, various methods have been developed: The main question is how to compare the skin conductance data with each other, because they differ from person to person (the skin of each person contains a specific skin conductance, caused by it different skin properties). This problem was resolved on the one hand by complete data visualization for a pan urban overview to see the whole amplitude of reactions and on the other with the formation of stress classes to have a solid and comparable data base.

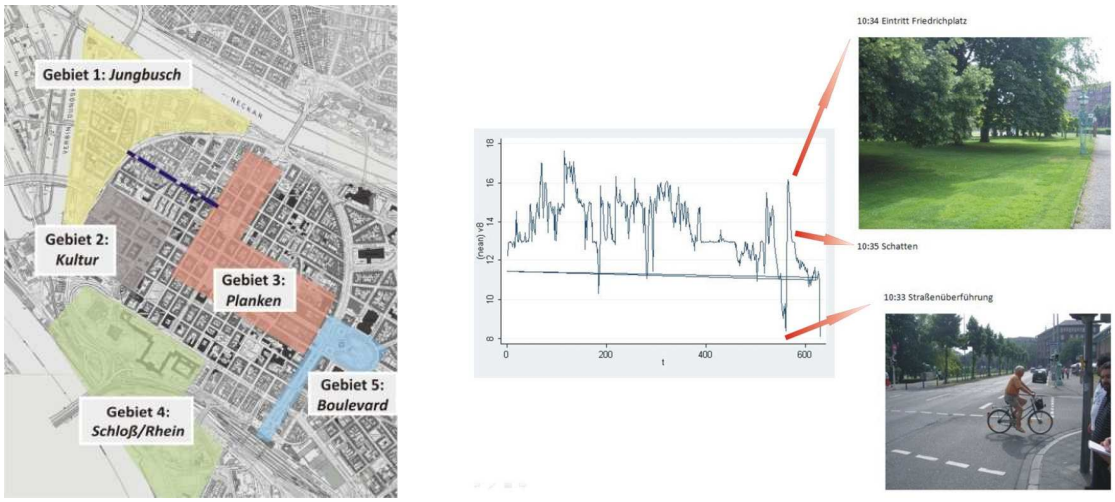


Fig. 3: Study areas marked by function and the experimental interpretation of the curve using the protocol and the images taken.

4.3 Exemplary results, presented at the district Jungbusch

A pan-urban observation was achieved by laying the measured skin resistance classes out in a grid. This grid was deliberately chosen very large to create a pan-urban map. The map serves more as a rough guide rather than a sharp statement about the feel-good areas of a city. Opposing this is the visualization of the absolute measured values within the city, which were visualized without the class formation. The large difference of the recorded absolute values is worth noting.

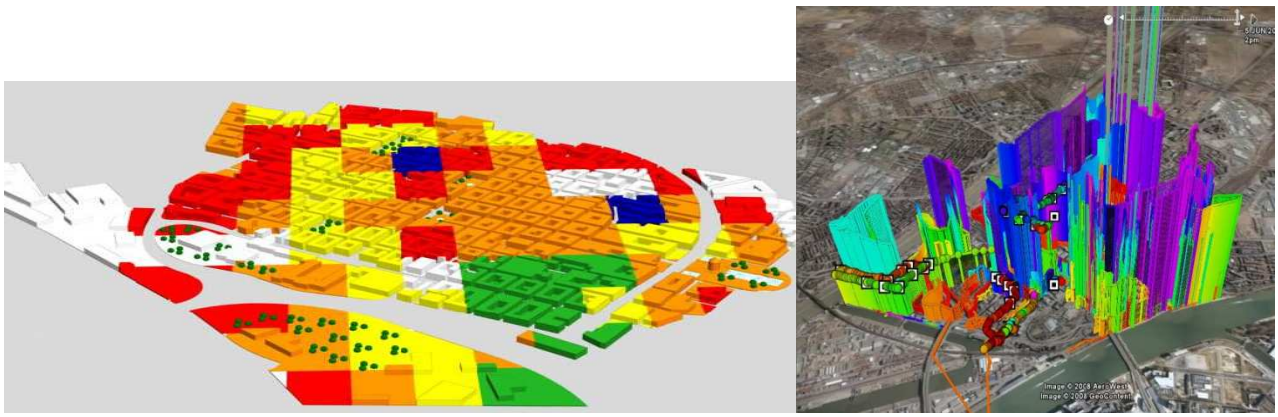


Fig. 4: Total urban aggregation of skin resistance classes in the grid and visualization of all recorded absolute values using the GPS Visualizer in Google Earth.

In the detailed consideration of the combined measurements taken from three participants, areas can be analyzed in which there are classified stress or relaxation zones. Along a busy main road it is obvious that

stress levels are high. When looking at the rising and falling skin resistance values, the falling values overweight. This area stands out in the entire territory of the Jungbusch through its high stress factor.

Fig. 5: Areas with low skin resistance values along a busy main road, and relaxation situation in a street with little traffic and green areas, situated in a trendy neighborhood

In close proximity to the above-mentioned area is the Jungbusch Street. Unlike in the majority of the western Jungbusch area, here a single feel-good situation can be observed. This means, the volunteers experienced bodily relaxation.

The obtained data is interpreted and supported using the concepts as mentioned above. It is notable that the analysis using GIS data has a large consistence with the data from the emomap.

When looking at the map, the main road sticks out as the first area with its high "stress levels". The reason is the heavy traffic and the associated high emissions, such as traffic noise. All this can justify the measured "stress values". In addition, it should be noted that the design of the road is not very inviting for pedestrians through the lack of street greening. In contrast to this, the Jungbusch road seems to be a feel-good area to the volunteers. An explanation for this is a vibrant urban life, that both of the investigations of the EKI.MA and the project of the University of Karlsruhe have identified. Indicators for this are the many meeting opportunities and a kind of subculture based on the many cafes, restaurants and clubs.

Although these examples are relatively clear, it becomes obvious how difficult it is to obtain universally valid statements about the feel-good value of individual areas within the city with the technique used. Many impressions do no correlate with construction and use of structure, but on the personal and direct perception of an individual (an example for this is, that a group of tests persons went around in a park area, in which they should have no stress reactions. Some of them stepped into a big dirt, and the result was, that the stress level boosted).

5 THE SECOND STUDY - THE PROJECT MAPPING MARZAHN-HELLERSDORF

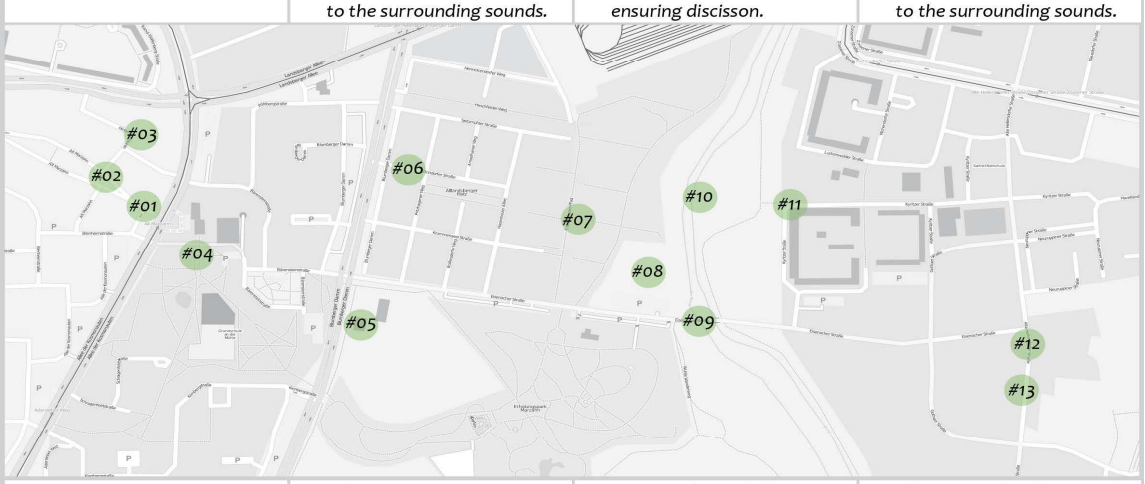
Building on these results, the experiment set-up for the walk in Marzahn-Hellersdorf omitted the aggregation of data in classes.The focus was on the analysis of individual experiences. To improve this situation-orientated analysis the skin conductance response (SCR) was gathered – instead of the skin resistance level (SRL) like in the first study. The SCR focuses on short-time reactions (phase), while the SRL and the reciprocal value skin resistance level (SRL) measure longtime changes (tonic). Only people not involved in the project were used as test persons. On the one hand, a possible unconscious influence through people's own expectations should be avoided, and on the other hand, the test person's handling of an unknown technology should be observed.

5.1 Brief description

As part of the art project surveyor K. and Humboldt surveyor - HM2 by the two artists Johann Zeitler and Klaus W. Eisenlohr three walks took place in Marzahn-Hellersdorf in October and November 2008. During these city walks, special events (such as literary readings, children's choir singing and presentations about the location) happened. For the third walk, two participants were outfit with sensor armbands and GPS loggers. The walk took less than 3 hours and led from the old village of Marzahn to the mansion in old Hellersdorf. A

common meal in the "Alten Krug" finished the tour. About 25 people participated, 13 actions took place taken during the walk (see fig. 6).

#01 Start - short introduction and presentation of involved persons.	#03 Explanation of the history of the old windmill and children's choir singing,	#05 Guided tour in a sports hall of a boxing club.	#07 Recitation of poems of the community of authors „Fensterblick".
#02 Welcoming by town council Stephan Richter.	#04 Listening experience - two minutes of silence, listening to the surrounding sounds.	#06 Lecture about the history of the market hall and ensuring discisson.	# 8 Listening experience - two minutes of silence, listening to the surrounding sounds.



#09 Listening experience - two minutes of silence, listening to the surrounding sounds.	#10 Listening experience - two minutes of silence, listening to the surrounding sounds.	#11 Lecture about the history of the district and the urban development strategies.	#12 Closing words of tour guide Klaus Eisenlohr.
#13 Common meal in the mansion „Alter Krug".			

Fig. 6: Overview about the 13actions, which took place during the third walk in Marzahn-Hellersdorf (Berlin).

The two test persons were selected out of the received applications to the project partner urbanophil.net - network for urban culture. The volunteers were instructed in the technology (the sensor-armband' function and GPS logger) before the walk.Perceiving a special situation they should notice it with a Geotag (placemark) and a brief quote (in writing). Local data and the time stamps (viaGPS logger) and SCR data s (via sensor-armband) was synchronized using Stata 9 and imported in Google Earth via MKZ-files generated from GPS Visualizer 3D. The two test persons did the assignment of the citations to the placemark and the positioning of the actions manually.

5.2 Evaluation

5.2.1 Placemarks – subjective opinion

Proband 1 has placed 15 placemarks, of which only 10 were of significance for the evaluation. Four other placemarks were removed, after consultation with the test person – they were repeated marks, caused by usability problems. In these cases, always the first measurement was evaluated (# 7 - # 9).

Fig. 7: Track and evaluated placemarks (#1 - #9) by proband one.

Proband two marked eight placemarks. In addition, the first two marks at the starting point were combined (# 0 - Start). The other placemarks were set without duplications.

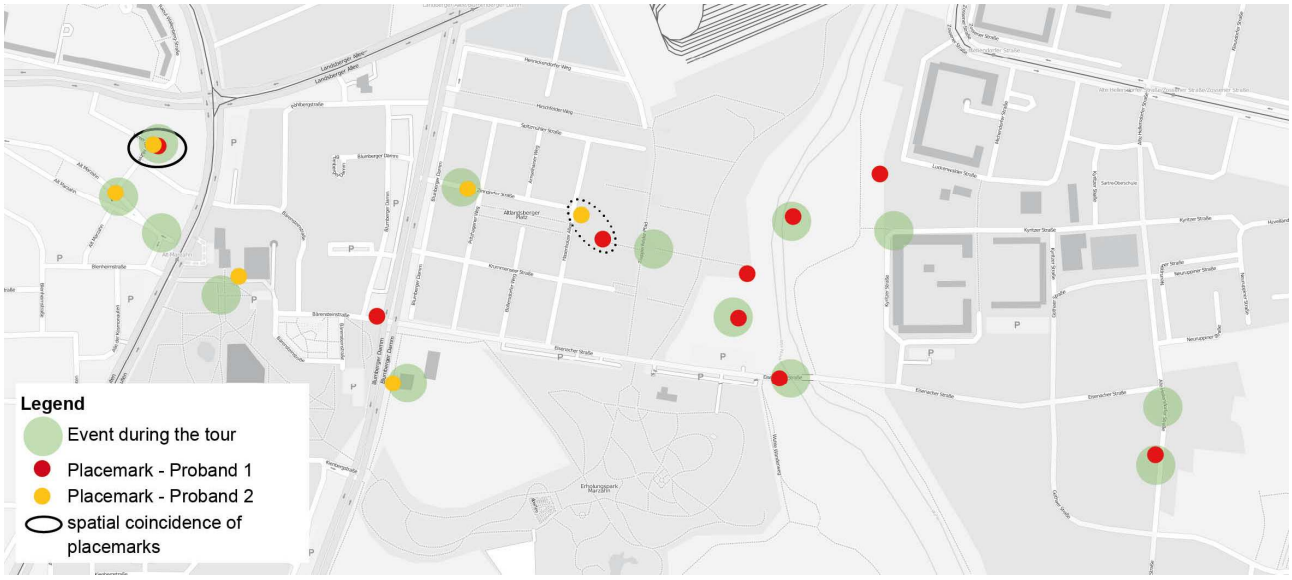


Fig. 8: Comparison of the 13 actions and the evaluated placemarks of both probands.

In combination with the citations given, it shows that 9 out of a total of 15 placemarks (both subjects together) refer to the actions carried out during the walk; 2 were due to local peculiarities of the built environment; 1 because of the special landscape and 2 because there kites hovering in the area, while 1 placemark remained without details.

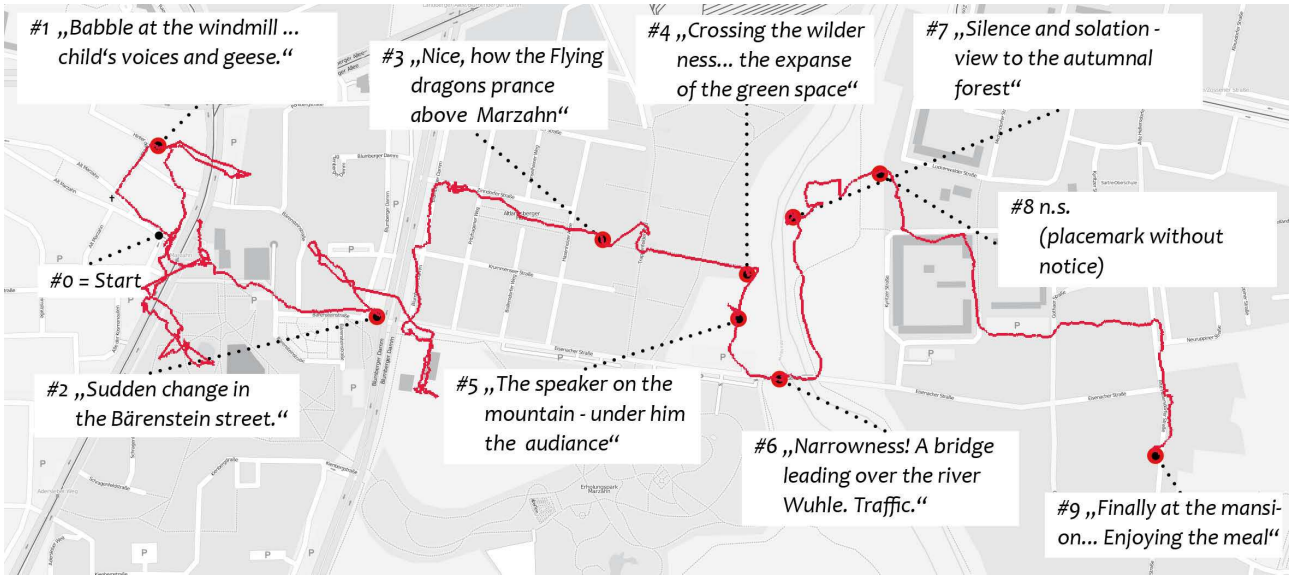


Fig. 9: The distance travelled by proband one with placemarks and related citations.

5.2.2 Skin conduction response data

Figure 9 shows test person 1s' skin conduction chronologically. A higher and denser amplitude indicates a more intense attention-response. The results show that the subjective judgements (green) differ from his unconscious-emotional reactions (orange). Therefore, the locations or situations, which he subjectively marked as interesting, differ from those that involuntarily aroused his attention. A clear correlation between auto-emotional and subjective verdict could only be detected in two cases.

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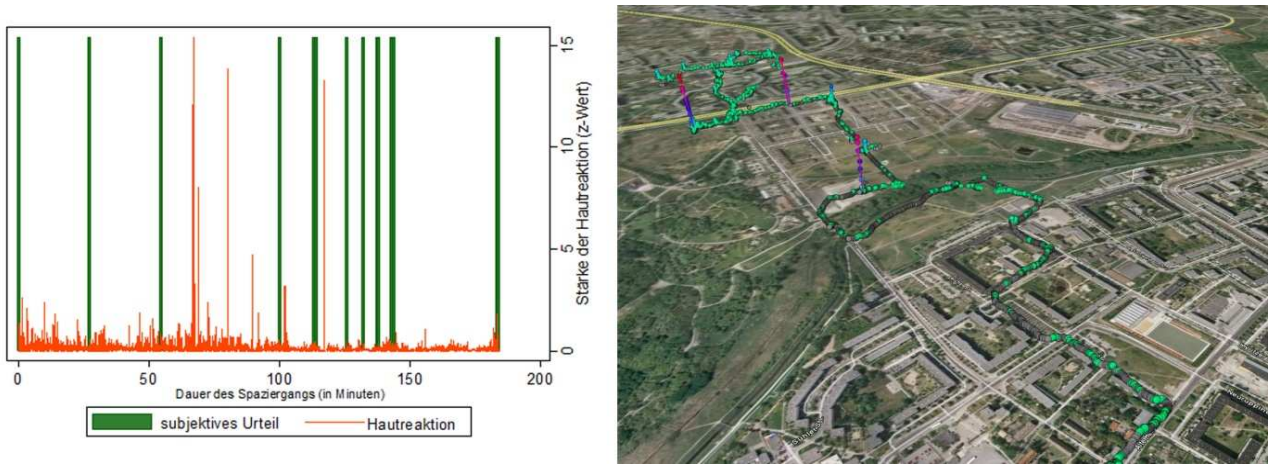

Fig 10: Diagram of the evaluation of the placemarks (green), skin conduction response (orange) and the localized representation of the skin reaction values of test person one (right).

In this respect, proband 2 differs significantly.[1] Comparing his subjectively set placemarks (orange) with the automatical emotional reactions (green curve) shows that subjective opinion and involuntary attention reaction are chronologically closely related. The automatic inner reaction of proband 2 is relatively consistent with his deliberate decision.

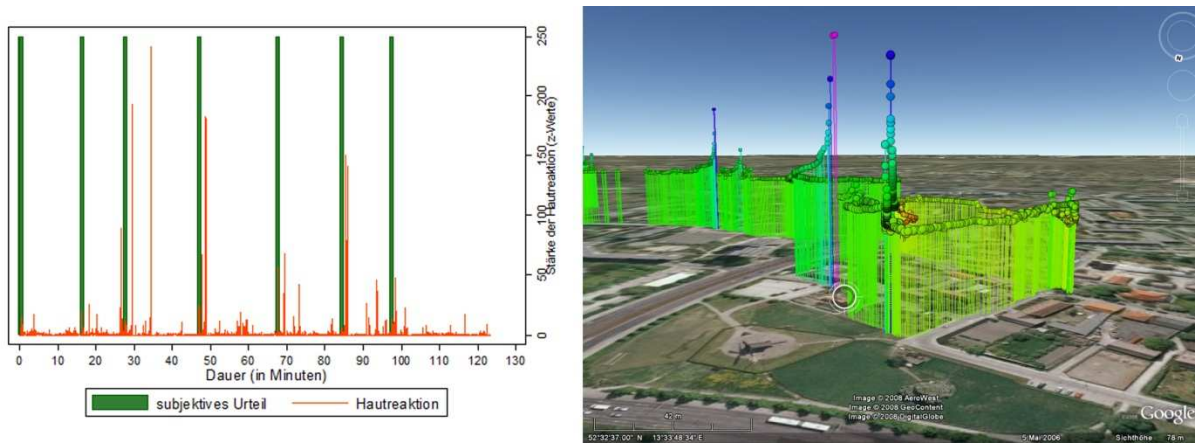

Fig.11: Diagram of evaluation of the placemarks (green), skin reaction (orange) and the localized representation of the skin reaction values of test person 2 (right).

5.2.3 Comparing SCR-data and the events

Comparing the amplitudes of the SCR values with the events taken place around proband 2, it appears that in all cases a change in the skin reaction has occurred, which deviates from the average. These changes may occur several times, within the same event, some of them lasted several minutes. Thus, a correlation between the events and the SCR-data can be identified.

5.3 First results

In the project *Mapping Marzahn-Hellersdorf* two walks of city tour participants have been analyzed. By the method of a comparative walk, the data of two volunteers could be compared under similar conditions.

It is possible to get further information about places and activities that aroused the interest of the participants – according to their own opinion. The frequent setting of placemarks during ongoing activities suggests that the idea of the tour, to create special moments in contrary to everyday life in this urban area, was achieved. The selection of a walk filled with special attraction proved difficulties to pursue the question of the impact of the urban area on the perception of a person. The attractions dominated the walks. Conversely, the (built) environment triggers such decisions to a much lesser extent. A walk along the same path, without action taking place, could shed light on other events and places that arouse the attention of the subjects in this case.

[1] Proband 2 was suffering from a tendon sheath inflammation and therefore had to put off the smartband after 2 hours. Consequently the data is only available for 2 hours.

The gathered data illustrates how different the probands reacted to a (relatively) similar urban environment. It also shows that subjective judgment – that is the conscious evaluation of a place or a situation – not necessarily has to match with the autonomous physiological response. So places / situations could be identified, that triggered unconscious reactions by the test person, without leading to conscious responses. To be able to analyze these changes of the skin reaction better, future walks should be logged more detailed. This could be achieved for example with audio recordings.

The results of the walks indicate a connection between the events and changes of the skin conduction response. However, it has to be explored in how far various interferences, such as breaks at the individual actions, affect the data.

In addition, the significance of the changes of the skin reaction sometimes proved difficult, since the changes were too small to be interpreted as a clear reaction. In order to get clearer results, scaling test (benchmarking) should be made in advance of the walks.

Additional quantitative (like pulse, temperature) and qualitative data (questionnaires, audio-recordings) get helps to get more information about the emotional reactions and would improve the interpretation of the biodata

In terms of usability, the repeated use of the geotagger, shows that the probands had difficulties in dealing with the GPS loggers. This was confirmed in an interview. To prevent usability problems in future surveys, a manual with graphic illustrations could be handed out during the introduction.

6 FINDINGS AND RECOMMENDATION FOR FUTURE PROJECTS

Caused by the innovative character of the research project, the first projects were designed as explorativ studies. During the data collection, the following errors and problems have emerged:

- The Smart Band did not provide consistent data due to power outages and bad contacts. In addition, there is no time logger integrated in the recording function of the device, so that on the one hand, it is not possible to say how long the measurement interrupted and on the other hand, the measurements needed to be logged very accurately by hand. For convenience, this would be a useful development.
- The design of the sensor-armband should be improved: it slips too easily. The material urges perspiring and thus influences the measurement results.
- The measurements of GPS loggers are very inaccurate due to the shading of the GPS signal in narrow streets. With the use of the newer version of the MTK chipset in the logger it could be possible to solve this problem partly.For better accuracy, the test persons should carry the logger with a lot of "sky view" (in the backpack instead of in the pocket). Furthemore, the subjcts should select a high tracking interval and they have to watch out to hold the device horizontally [Haase2008].
- For better and more scientifically correct interpretation of the data, it would have been preferable not to examine the entire city as a whole, but to get more records that are comparable and to improve the ways for interpretation of the results entirely. In some areas, only one set of data could be obtained; for the evaluation a kind of reference walk at the beginning of the project would have been useful.
- The test persons wrote a protocol to interpret the measured values and took pictures on special places and events. This additional work put some participants under pressure, so the obtained data did not only result from the environmental influences but also eventually from a personal distortion. A better method of logging would be voice recording with a Dictaphone; the environment could be recorded with a running video camera.

As part of the data processing, the following points of criticism arouse:

- Because of wrong GPS values and the erasure of these data in the GIS-system to get a comprehensively data set, partly important pieces of skin resistance information from the smart band gets lost.
- In some sets of data measurement errors in form of absolute peaks occurred, these were outliers and smoothed for better understandability. While this is a helpful procedure, important data is lost.

The interpretation of the datasets leads to following questions:

- The interpretation of the data was only done by the measurements of the skin conductance. Additional data such as skin temperature and pulse should be added. This data could possibly improve the interpretation of the situation, whether a situation is relaxing or stressful. Therefore, a consultation of specialists from other fields would make sense.
- Depending on the patient and their personal skin resistance, small or large amplitudes of the measurements can be recorded. To compare all the data, different skin resistance classes had to be established. Whether these data indicated a genuine comparability should be judged by a specialist.
- It must also be further explored whether the results can really be used to investigate urban factors. During the walks it was noticed that personal impressions, for example a long line in front of an ATM, or stepping into dirt, triggered very violent reactions, and are not directly related to the urban environment. These "personal extreme events" can only be reduced in the urban area by increaseing the number of measurements.

Particularly for the improvement of survey methodology and the technical development the project brought important insights, which are going to be introduced in further research, in addition to the results of the first project:

- A further reduction of the investigated factors is desirable. The investigation should therefore no longer be exploratory open, but focused on some specific aspects for a continually reduction of the complexity of the influence factors. This could include the investigation of the relationship between stress and the surrounding density of people and traffic.
- As the evaluation of written comments and subsequent interviews was helpful for evaluating the skin reaction values and their first interpretation, further studies should try to add more qualitative sets of data. These can be audio or video recordings, written records of the walks exact to the minute and subsequent reference interviews.
- The method of comparative walk proved to be beneficial to illustrate the various sensations of the subjects and to identify commonalities. In further walks, this methodology should be used predominantly. Group walks could take place, as well as repeated visits (eg, at different times).
- The challenge for the further investigations is now to illustrate these exact causes and contexts accurately. This refers particularly to the influence of the built environment, which could only be little examined in this experiment.

Although many questions remain open, the first improvements to the survey methodology can be made and further defined specific research questions can be raised.

In the topic of the visualisation of the results, another method should be tested: The urbans density analysis. In anology to the works of Berchtold Krass [Berchtod Krass 2009], the classified stress areas have to set in an urban relation measure. With these density maps, it is easy to develop a height map for a 3dimensional triangulation to develop the a “real” threedimensional emomap of a city.

7 POTENTIAL BENEFITS FOR URBAN PLANNING

After carrying out the two projects, some potential applications for urban planning or urban design crystallize;

- The method offers the possiblity to analyse unconscious emotional reactions, eg. stress caused by density of people and traffic. This could be done in examination of the research field of crowding-theories [Richter 2004]. Results could be interesting for traffic planning and urban design.
- The comparison of data – eg. analysing stress, leisure etc. – before and after building projects, could give hints for a human orientated planning.
- Furthermore the analysis of the unconscious decisions, eg. the choice of paths, give hints for the better design of urban spaces and orientation-systems.
- The measuring of subjective impressions could clarify and validate survey results; for example surveys to the field of subjective sense of security in urban areas.

- Emotional "well being hotspots" are very interesting for city marketing strategies. Many advertising companies are very interested to position their advertise bills on spots where people feel well, because they hope that the potential customer has a better attitude for the product (concerning privacy aspects, the use of this data is only allowed approval of the test persons).
- Checking the ways of walk and the corresponding feeling on these ways is very interesting for tourist destinations. With the results of the examination, tourist managers can improve their signposting of special tourist routes even in small, unclear historic city centers (These results could be intersting for local merchants too, but in this case, there are many conflicts with the use of personal data and data privacy acts).
- Proofing municipal bicycle lanes and the reduction of potential danger spots if pedestrians or cars encounter the bike route could be very helpful.
- In the discussion of barrier-free cities, the objective examination of a accessible urban design for handicapped people could make good progress.
- Last but not least, the accessibility of the environment is an interesting discussion point for parents with strollers. At a municipal meeting, this was in a discussion the main interesting point for the audience. A large group of young parents would take part in another emomap test run, that they have a database and a result map to have a firm base for argumentation.

The authors believe that the research of daily life situations and new ways of analysing "invisible"-emotional data offers many potentials to analyse, understand and design the urban environment. This will help to develop a city, which is oriented on the needs and interests of its inhabitants – the smart city.

8 MORE RESEARCH NEEDS

In addition to the better interpretation of the obtained vital data by consulting doctors and sensor technicians it is of principal interest how urban development methods progress under the influence of the GeoWeb and mobile computing development. The goal must be to address the potential for change in the urban and regional planning repertoire of methods, due to the formation of Geowebs on the Internet and mobile computing systems (Mobile Computing). The research interest in these two technical developments lies in their interaction. The question is, how and to what extent the new geo-orientated information and communication platforms, which are currently developing online, lead to significant changes in the scientific planning methods. In the central focus of interest are especially mobile communications, recording- and computer- systems (smart devices). The research project offers first clues. These questions are going to be explored at the Department cpe with aid from the Deutsche Forschungsgemeinschaft (DFG) in the next few years. Another research project is planned at the TU Berlin in cooperation with TU Kaiserslautern, bodymonitor and the data carrier BitCarrier. Focusing on a city neighbourhood area in Barcelona, the impacts and results of former researchs will expand with the topics of better visualisation of the collected data, crowding research like the works of Anna Husemann [Husemann 2005] and measuring the human and traffic density.

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