

Assessment of the Dissertation thesis by Ing. arch. Ladislava Fialka Sobková:
“MOBILE-BASED SENSING – SMARTPHONE APPLICATION FOR LONG-TERM URBAN
LIFESTYLE AND MOBILITY SENSING”

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The theme of dissertation thesis

Theme of the dissertation is very broad and multifaceted. The thesis cover multiple phenomena of data collection technology, mobility behavior of people and health benefits of physical activity. However, it is not clear, when the phenomena constitute the object of the study and when it is considered as a means of the study of other phenomena. That confusion slightly devalue otherwise ambitious thesis.

The themes of the thesis are at the spotlight of research agendas of many research and academic institutions as well as they are considered actual by policy makers and public.

Goals of the thesis and hypothesis

The goals of the dissertation is stated ambiguously. The aim of the work, as stated on page 4, is to „prove the usability of the mobility data made available by smartphone applications for data-supported decisions in the field of urban development. “ This goal is expected to be attained by three steps: 1) data acquisition via self-designed smartphone application „UrbanFit“, 2) data interpretation in different urban contexts, 3) case study of urban mobility and its factors.

The fact the the above three steps are not directly related to each other is the main cause of the confusion: the case study is not based on data form smartphone application UrbanFit and therefore does not serve the declared purpose. Consequently, one of the goals of the thesis, which is to „prove the usability of the mobility data made available by smartphone applications“, could not be accomplished. The goals and research steps should be therefore restated to make at the start clear that the individual steps relate to each other. In typical research the following steps are expected: research question → review → hypothesis → data collection → experiment/test → falsification of hypothesis → discussion → conclusion.

In the following chapter 2.5 „History of work, gradually achieved results“(page 9) the reasons of confusion are partly explained: development of the smartphone application UrbanFit proved too expensive for the author. The author therefore supplement the missing data with the synthetic data on mobility of population from a „model of multimodal mobility in Prague“, which was created by the team led by RNDr. Michal Čertický, Ph.D. The author is using the data for the model to analyze the mobility pattern of habitants.

Hypothesis (chapter 2.2.) are stated very broadly in a sense that smartphones can monitor the mobility of people and they are capable to produce indicators of urban life and lifestyles, data cumulated in longer period can serve further research in many fields related to urban planning, design and

development. I consider these statements to be assumptions or perhaps the motives of the thesis rather than operationalized hypothesis. For being the scientific hypothesis, the statements are neither grounded on the propositions of any existing scientific theory nor they are related to any specifically situated problem. The hypotheses are not stated on the level of specificity to serve the theory building and further research, they are not clearly stated in a way that would allow their falsification.

I assume that the ultimate goal of the work is to analyze the pedestrian activity of Prague population to assess the preconditions for its health. Assuming this to be the main goal of the theses I judge the theses fulfilled its goal.

Scientific quality from methodological viewpoint

In the chapter 3: „State of the art“, the author on 29 pages presents the overview of potential use of data-collection technology for study of human activities in public space. The thesis refers to the methodology proposed by Jan Gehl. The thesis provides review of technical details, how the tracking of human movement in public space originally proposed the Jan Gehl could be automated via smart phone technology.

In the second part of the chapter the author provides the evidence of the health, economic and social benefits of physical activity in public space and possible ways the urban design and urban planning can promote the physical activity of inhabitants. It provides technical details on using the smartphones for automatic recognition of location and movement of people. The evidence is based on substantial amount of reviewed publications and provides an interesting overview. However, the purpose of the overview and clear linkage to the goals of the thesis is not clear. The results of the review are not used for validation and interpretation of the results of the thesis.

In the chapter 4 the thesis presents the concept of the smartphone application UrbanFit. The proposal of user interface and data to be collected seems to be clear and appropriate for the data collection with respect to the purpose of the thesis. However, the application was not programmed and applied for data collection and therefore the concept of the application could not be proved to be right one.

The chapter 5 presents possible utilization of data, that were supposed to be produced by application UrbanFit. The author presents various characteristics of urban environment, which impact on physical activity of inhabitants could be examined by “would-be application” UrbanFit. The propositions are only hypothetical as no data on physical activity or data on urban environments are available at this stage of the research.

The chapter 6 „Case study“ documents the pedestrian movement of the population of the city of Prague with the aim to report the current health status of Prague population. For that purpose, the data from agent-based simulation model of multimodal mobility in Prague is used. Data represents the mobility of Prague population in the year 2017 based on sample of 90 thousand Prague residents. However, the height and weight – the two population characteristics indispensable for the calculation of Body Mass Index (BMI) are not covered by data. Data is restricted to the work trips and only persons of the age 21 to 65 were included. The reasons of age restriction is not revealed by the author.

The author compares the statistics of the subsamples based on income, marital status, gender, and highest reached education degree. Physical activity (PA, i.e., pedestrian movement) is higher in the high-income group. However, the higher education is related to lower PA. This result is unexpected as the income is typically correlated with education degree. The author does not provide any explanation or validation of this interesting result, for example by using the findings of the research projects reviewed in chapter 3.

In chapter 7 „Discussion“ the author is going back to the data collection via smartphones and discuss the pros and cons of this form of data collection. In my opinion it is a) redundant as this topic was discussed already in the chapter 4 and b) useless as no real data were created by the “would-be-application” UrbanFit.

The second part of the chapter discusses the limits of data used of case study: the lack of data verification and data update. The last part of the chapter discusses possible alternative mobility data collections.

Chapter 8 briefly concludes the previous chapters.

Conclusion: the methodology of the work is confusing which is caused by diversity of topics and not clearly stated goals. The methodology consists of several partial and not directly related research activities: review of data-collection technology, Public Places Studies, health issues related to physical activity, mobility behavior studies. Part of the presented methods are not used for empirical research (i.e. UrbanFit application), part of presented reviews are not used for final result validation and interpretation. In spite of redundancy, some important information is missing, especially information on agent-based simulation model of multimodal mobility in Prague and the way the data on synthetic population were generated or collected.

Formal quality of theses

The theses is written in English. Chapters of the theses differ in language quality, but overall quality is very good. The references to literature are provided in standard way.

Principal scientific contribution

Dissertation presents the conceptual design of the smartphone application UrbanFit with the aim to collect data and reports on daily routes of users and related caloric expenditure. The application was not programmed due to high costs of programming and therefore it is not possible to assess the quality of proposed application based on quality of data collected.

The second part of the theses presents an analysis of mobility behavior of Prague population and population of Central Bohemian Region. The analysis is focusing on active mobility, i.e. walking and further narrowing analysis to work trips and to age of agents between 21 and 65 years. Those a priori restrictions decrease internal as well as external validity of results.

The analysis provides following results:

- Average walking activity of Prague residents (3106 m) and comparison with recommended walking activity according to WHO (47%).
- Percentage of Prague inhabitants, who fulfill the WHO recommendation.
- Relation between age, gender, income, marital status, education degree and walking activity.

In general, this type of results would be useful for policies such as Sustainable Urban Mobility Plans (SUMP). However, the validation and interpretation of results is missing, for example the results could be compared with data from other, comparable cities. Also, it would be very useful to present examples of policies that use such data.

The results of the thesis prove that the author is competent for performing scientific research by using the quantitative methods. From scientific point of view the approaches based on disaggregated synthetic population is very innovative, however, the thesis does provide only very little details on this method.

Conclusion

The thesis demonstrates very extensive and ambitious work of the Ph.D. candidate and in general it proves the author is prepared for future scientific carrier. The initial aim of the thesis – design the data-collection tool and to use the collected data for analysis of the factors influencing the active movement and health impacts of population – was innovative, interesting and ambitious and was only partially fulfilled. The most innovative part of the thesis is the application of the synthetic population in the study of mobility behaviour of Prague population. The thesis does not use the opportunity to present this innovative methodology in bigger detail.

Despite the comments presented in the assessment I consider the thesis to be of sufficient quality and I recommend the thesis to defense.

V Praze, 18.4.2022

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