

# MASTER'S THESIS REVIEW

**Author:** Bc. Dina Chernova  
**Thesis title:** **Tactile models for older adults with vision impairments**  
**Thesis advisor:** Ing. Miroslav Macík, Ph.D.  
**Thesis oponent:** Ing. Václav Rechtberger  
**Review conducted by the Thesis Advisor:** Ing. Miroslav Macík, Ph.D.

## Assignment

The thesis assignment was to analyze the outcomes of current research on the spatial orientation of severely visually impaired with a particular focus on older adults. Design and implement a method to transform geographical models of the interior environment to (interactive) tactile models usable by visually impaired older adults. Evaluate the outcomes with participants representing the target user audience.

## Written part

**The technical manuscript is written in proper English. It has a standard structure and clearly describes the problem area as well as the developed solution. The extent of the thesis is 90 pages, followed by another 40 pages of appendices. The thesis draws from 62 cited references, including scientific papers.**

The thesis has eight main chapters. The introduction comprises from clear motivation statement as well as a statement of thesis goals. The following analysis focuses on a study of methods for creating spatial knowledge using maps (with special focus on tactile maps), related works, and previous work conducted at the Department of Computer Graphics and Interaction. **The analysis is reasonably extensive and provides good insights into the problem area. However, at specific points, I miss a more in-depth discussion of individual approaches/solutions.**

The following two chapters focus on computer vision methods for the reconstruction of 3D objects from image data (focused on buildings) and segmentation of building facades (detection of important features like doors, windows, etc.). **There is a detailed and comprehensive description of the problem background. However, I miss the analysis of more possible approaches and their pros and cons. Also, there is a lack of a proper conclusion. It is not completely clear how the discussed methods reflect in the thesis.**

In chapter 5, there is a proposal of a semi-automatic process pipeline for the creation of a 3D model of building exterior from commonly available data. The creation process comprises eight steps from data collection through the creation of the 3D model and facade maps to the transformation of the model into parts that could be manufactured using 3D printing. **The proposed solution reflects the basic requirements and limitations (e.g., data that are commonly available for public buildings). Also, proof-of-concept transformation on the example of Home Palata is shown in this chapter. A more detailed discussion of possible variants of the overall pipeline design and methods used in individual steps will be beneficial for the thesis.**

The following chapter focuses on the design and implementation of the pipeline, mainly from the user interface perspective. Two generations of prototypes of the processing pipeline user interface have been developed and evaluated for employing the User-Centred Design method. The second part of the chapter shows the proof of concept creation of physical tiles installed on the Home Palata building model. **This chapter frequently introductory and conclusion paragraphs. I miss some important details about the design decisions made for the pipeline user interface design.**

Evaluation of the proposed pipeline and its user interface is described in chapter 7. The low-fidelity prototype was evaluated using the cognitive-walkthrough methods. There were three iterations of evaluation and improvement of the low fidelity prototype. **Usability study with six participants was employed for the evaluation of the high-fidelity prototype. Both experiments were conducted well and provided valuable feedback to improve the usability of the resulting user interface.** The last chapter concludes

the thesis and provides a proposal for future work. It clearly summarises the level of achievement of the individual goals of the work.

**The thesis has the required structure and extent, and it describes the essential aspects of the developed solution well. Apart from a few stylistic details, it is written in proper English and easy to follow. The references are properly cited. However, the list of references does not contain all necessary information or is miss-formatted (i.e. [13], [23], [29], [30], [48]), moreover, the online references lack the “accessed on” attribute.**

## **Implementation**

The implementation comprises the creation of two generations of prototypes of user interface supporting process pipeline for the production of specific 3D models of buildings, including specific internal data models like facade map. Balsamic Mockups was used for the creation of the low-fidelity prototype. For the high-fidelity prototype, the SitePad tool website builder has been employed. The implementation of the high-fidelity prototype required implementation of some custom-scripts, e.g., to enable a component for 3D rotation of 3D objects of a reconstructed building model. Furthermore, part of the proof-of-concept implementation was the creation of physical 3D printed tiles that have been installed on the wooden skeleton of the model of Home Palata building.

## **Questions**

1. Interactivity can potentially improve tactile interaction, especially employing multiple modalities. Is it possible to integrate multi-modal interactivity into resulting physical objects generated using the proposed process pipeline?

## **Conclusion**

The Master's thesis of Mrs. Dina Chernova is a good example of iterative design and development as a tool for creating a tactile facade model representing a building exterior. The extent of the thesis exceeds the typical extend of theses of this type. The proposed solution consists of two generations of prototypes and will be used as a framework for the future development of a complex tool for manufacturing interactive tactile models of buildings from commonly available data. The work on the thesis was not preceded with a semestral-project focusing on the same topic. However, the candidate put a lot of effort into the project during the time given. There are some weak parts of the work - more chapters miss the proper discussion to support design decisions made. The candidate proved to be able to work on complex assignments independently.

**In conclusion, I assess the reviewed thesis with mark C (good).**

In Prague, on 25th August, 2020

Ing. Miroslav Macík, Ph.D.