

I. IDENTIFICATION DATA

Thesis title:	Examining the Interrelation and Perceptual Influence of Head-Related Transfer Functions Distance Metrics
Author's name:	Natálie Brožová
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Circuit Theory
Thesis reviewer:	Ing. Tereza Tykalová, Ph.D.
Reviewer's department:	Department of Circuit Theory, Faculty of Electrical Engineering, Czech Technical University in Prague

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment <i>How demanding was the assigned project?</i>	challenging
The aim of the study was to analyse the interaction and mutual information between different objective distance metrics for Head-Related Transfer Functions comparison, using tools such as correlation analysis or factor analysis. Given metrics were further reduce to a smaller set of measures suitable for a listening experiment and covering both spatial and spectral aspects. The listening experiment was designed, implemented in MATLAB and performed by a small set of 19 listeners to examine just noticeable differences and give first insights into various perceptual attributes.	

Fulfilment of assignment <i>How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.</i>	fulfilled
All aims assigned were fulfilled.	

Activity and independence when creating final thesis <i>Assess whether the student had a positive approach, whether the time limits were met, whether the conception was regularly consulted and whether the student was well prepared for the consultations. Assess the student's ability to work independently.</i>	A - excellent.
The student's attitude to the thesis solution was responsible. The student continuously consulted the project development and particular results.	

Technical level <i>Is the thesis technically sound? How well did the student employ expertise in his/her field of study? Does the student explain clearly what he/she has done?</i>	A - excellent.
The student was able to employ expertise gained from the study properly and implement the standard methods previously published in the literature.	

Formal level and language level, scope of thesis <i>Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?</i>	B - very good.
The thesis is well written and organized, with logical separation into chapters and subchapters. The methods are technically sound. The statistical design is correct. The results are well presented with an appropriate number of figures and tables. Typographic standards such as using of abbreviations are maintained. The level of English is satisfactory. However, in my opinion, the interpretation of the result and future work should be discussed in more detail.	

Selection of sources, citation correctness**A - excellent.**

Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?

The state-of-the-art literature seems to be presented in a sufficient range. The student's contribution to the field is clearly stated. The references section is written to meet the expected standards.

Additional commentary and evaluation (optional)

Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.

Please see the review performed by the main student's supervisor Shaima'a Doma attached at the end of this report.

III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

Suggestions for questions:

- 1) How did the listener's age and gender influence the results of the listening experiment?
- 2) How was the intra-rater variability of listeners evaluated?

To summarize, I consider the thesis to be of an appropriate quality with the potential for future extension and publication in some international journals.

The grade that I award for the thesis is **A - excellent**.

Date: **23.8.2021**

Signature:

I. IDENTIFICATION DATA

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Author's name:	Brožová Natálie
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Circuit Theory
Thesis reviewer:	Shaima'a Doma, M.Sc.
Reviewer's department:	Institute and Chair for Hearing Technology and Acoustics (IHTA), RWTH Aachen University, Germany

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	challenging
<i>How demanding was the assigned project?</i>	
<p>The topic required proper understanding and application of different approaches and theories. This included data analysis, current methods in binaural technology (HRTF individualization), psychoacoustics and listening experiment design, as well as deriving complex interactions between these different fields. The work further required MATLAB programming skills, building upon and extending previous work done at our institute. The topic proposal left room for different levels of complexity, depending on the student's experience and interest. That is why I did not select the option "extraordinarily challenging". However, Ms. Brožová worked on the topic on a quite complex level and with deep understanding.</p>	

Fulfilment of assignment	fulfilled
<i>How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.</i>	
<p>The performed work covered the points listed in the assignment. The analysis of mutual information performed between different metrics was extended to include three approaches, which was not mandatory but gave another perspective to the choice of the subset of metrics. The listening experiment was not only designed, but also implemented in MATLAB and a pre-study was conducted with test participants from our institute.</p>	

Activity and independence when creating final thesis	A - excellent.
<i>Assess whether the student had a positive approach, whether the time limits were met, whether the conception was regularly consulted and whether the student was well prepared for the consultations. Assess the student's ability to work independently.</i>	
<p>Ms. Brožová worked eagerly on her topic, following the time schedule she had prepared at the start of the project and adjusted after a consultation. In regular meetings, she usually contributed with own ideas and presented the current state of her project and preliminary results. Following the suggestions she received in the consultations, she independently researched the theoretical background and looked for existent helper functions in MATLAB to perform the required tasks.</p>	

Technical level	A - excellent.
<i>Is the thesis technically sound? How well did the student employ expertise in his/her field of study? Does the student explain clearly what he/she has done?</i>	
<p>Ms. Brožová built upon and extended previous work in the field using valid methods of analysis, which she had partly encountered in her studies, and making use of her previously acquired MATLAB programming skills. The train of thought is properly explained in the thesis.</p>	

Formal level and language level, scope of thesis**B - very good.**

Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?

The thesis is written in comprehensive English and formally correct. Suggestions for correction were properly integrated. The content was organized in a logical order, as far as it allowed. Discussions ensued on the optimal order of the results, given that the results of the first part of the thesis (interrelation analysis) were the basis for methodology of the second part (listening experiment). However, this was - in my opinion - properly handled with referencing the corresponding sections.

Selection of sources, citation correctness**A - excellent.**

Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?

The topic is clearly separated from previous work. Relevant sources were cited.

Additional commentary and evaluation (optional)

Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.

This work contributes to a project funded by the German research foundation (DFG), aiming at deriving a multidimensional metric that predicts audible differences in HRTF sets. The prepared code, the acquired subjective data as well as the fruitful brainstorming sessions (which lead to the presented results) are a useful building block for further work on the project. Further statistical analysis on the data, as well as follow-up listening experiments will be necessary to derive application-relevant conclusions, however, these additional steps were not meant to be part of the present thesis.

III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

Suggestions for questions:

- A follow-up listening experiment could examine more prominent audible differences to see how the distance metrics scale with perception. Would you use a similar approach to choose stimuli as done for the JND experiment?
- Out of the five distance metrics used as input to the interrelation analysis, JND values were derived only for the three least redundant metrics. Would you include the two remaining metrics in creating the JND model based on the acquired listening test data?
- In future work, the monaural metrics (calculated for only one ear respectively) should be extended to binaural metrics (taking into account changes occurring at both ears). How do you expect a suitable weighting function for the left and right ear data to look like?

In overall, I consider the present work to be of very good quality and am happy to have had the opportunity to supervise Ms. Brožová in the past months.

The grade that I award for the thesis is **A - excellent**.

Date: **16.8.2021**

Signature:

