

From Neurons to Behavior

Citation for published version (APA):

Zulfiqar, I. (2021). *From Neurons to Behavior: Investigating Auditory Information Processing across Multiple Scales*. [Doctoral Thesis, Maastricht University]. Maastricht University. <https://doi.org/10.26481/dis.20210609iz>

Document status and date:

Published: 01/01/2021

DOI:

[10.26481/dis.20210609iz](https://doi.org/10.26481/dis.20210609iz)

Document Version:

Publisher's PDF, also known as Version of record

Please check the document version of this publication:

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- The final published version features the final layout of the paper including the volume, issue and page numbers.

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Impact Statement

The ability to hear and interpret the sounds around us is not only necessary for survival but also enriches our life with interpersonal communication. In this thesis, we used computational and experimental methods to enhance our understanding of how the human brain processes sounds, and showed how the two approaches reinforce each other. We presented a computational model of the auditory cortex and used it to generate insight into the cortical processes that may underlie a range of experimental observations. The model predictions were used to generate hypotheses on auditory cortical processing as well, which can be tested in future experiments. However, the model is a simplification of a complex system and needs to evolve to better represent the auditory cortex. An avenue for the model to grow was explored by studying multisensory processing, and specifically the effects of visual input on auditory processing. Multisensory processing is important because our environment is full of information from different senses. This multisensory information guides our perception and behavior. In a behavioral study, we found an influence of what we see on what we hear, but not vice versa. We then explored the regions of the brain involved in the process. In the future, we plan to use this data to extend and improve the model of information processing in the auditory cortex. This can help elucidate the brain processes that underlie multisensory processing. As quite a few psychiatric and neurodevelopmental disorders, including schizophrenia and autism, are characterized by abnormalities in multisensory processing, this extended model may in the future also be used to characterize the neuronal sources of multisensory processing deficits.