Erik Marsja | Current & Planned Scientific Projects

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Previous and Current Research

In my doctoral thesis (Marsja, 2017), I investigated how irrelevant unexpected auditory and tactile stimuli have an impact on visual processing. In the first two studies of my dissertation, I used simple visual categorization tasks and these two studies identified a knowledge gap which leads to the third study: How do sudden changes in irrelevant auditory, tactile, or bimodal (both tactile and auditory) sequences affect short-term memory processes (Marsja, Marsh, Hansson, & Neely, 2020)?

The results showed that distraction of unexpected tactile stimuli is similar to distraction of unexpected auditory stimuli and that a possible difference is that the effect of unexpected tactile stimuli disappears over time (Marsja, Neely, K-Ljungberg, Under Review). Furthermore, unexpected sounds presented among repeated vibrations only capture attention if the vibration is not presented simultaneously as the sound. Omitting a repeated vibration is enough to capture attention (Marsja, Neely, K-Ljungberg, 2018). Regarding short-term memory processing, the results showed that a change in spatial location of an irrelevant sequence only disrupts short-term memory processes when the irrelevant sequence consists of both sound and vibration (Marsja, Marsh, Hansson, & Neely, 2019)

Together with international and national short-term memory researchers, I performed a series of 3 experiments with the aim of investigating what disturbs visual short-term memory (Marsh, Vachon, Sörqvist, Marsja, Röer, & K-Ljungberg, Under Revision). Specifically, is the memory for visual sequences disturbed when an irrelevant sequence of vibrations is presented simultaneously? In this study, we used vibrotactile sequences with a constant change (the sequence "jumps" between the two hands, left-right-left-right-left-right; * changing-state * sequence), and *steady-state* sequences (when all vibrations in the sequence are presented to both hands).

We found that visual short-term memory performance is more interfered by a changing-state vibrotactile sequence compared to a steady-state tactile sequence. The effect of a changing-state vibrotactile sequence is, moreover, similar to that of the changing-state sequence consisting of sound (Experiment 1); the interference between vibrotactile stimuli and short-term memory seems to affect the recall of the order of objects rather than article identity (Experiment 2), and the predictability of vibrotactile stimuli does not appear to modulate the extent of the effect (Experiment 3).

I have also studied the interaction between the auditory, visual, and tactile modalities from a more applied perspective. In a study, we aimed to determine how effective a tactile warning is during increasing levels of mental workload in a primary task. In this study, we used three simulated flight task conditions in which we varied the mental workload while we presented an "on-thigh" vibrotactile warning to human subjects. Generally, we found a decrement in overall warning response performance when task workload increased, but this tendency faded and plateaued as the level of task workload progressed. This pattern indicates that vibrotactile warning signals may offer a plausible mode for conveying information during increasing levels of primary task workload (Rosa, Marsja, & K-Ljungberg, 2020). Moreover, it was found that increasing tasks in an interface leads to increased mental workload.

More recently, I have extended my research into the field of cognitive hearing science and disability research. Together with national researchers, this research has focused on the relationship between cognitive functioning, age, and speech in noise as well as subjective aspects of speech in noise in relation to speech in noise performance. In one study, we have used multivariate statistical methods (i.e., factor analysis and multigroup structural equation modeling) to examine how cognitive functioning and age affect speech in noise performance in individuals with, and without, hearing impairment. We found that cognitive functioning and age have a similar impact whether you have a hearing impairment or not (Marsja, Stenbäck, Moradi, Danielsson, & Rönnberg, Under Revision). Similarly, we have found that high working memory capacity is related to lower scores of self-rated listening effort for informational maskers, as well as better performance in speech recognition in noise (Stenbäck, Marsja, Hällgren, Lyxell, & Larsby, Accepted). In another study, in which we used both self-reported hearing measures (i.e., a questionnaire) and performance-based behavioral measures (Stenbäck, Marsja, Ellis, & Rönnberg, Under Revision). We found no correlation between self-reported and behavioral measures of speech in noise for individuals with hearing impairment. However, this correlation was significant for individuals without hearing impairment. To examine this further, we have also applied machine learning techniques (e.g., random forest regression) to examine the most important self-reported variables for speech in noise (Stenbäck, Marsja, Danielsson, & Rönnberg, In Preparation). Finally, we are also examining how logical inference (both auditory and visually) might be related to speech in noise recognition (Stenbäck, Marsja, Danielsson, & Rönnberg, In Preparation).

Planned Research: "Zoom Fatigue"

My recent research, in cognitive hearing science, has lead me to the knowledge that hearing loss affects the ability to communicate and establish and maintain social relationships. For people with hearing loss, listening can be very effortful which can lead to a person stopping using a hearing aid or choose not to participate in social events. Communication has changed radically due to COVID-19. Most measures, including working from home and the use of video calls, were intended to be provisional. However, the digitalization of working life (e.g meetings, conferences) is here to stay. Little is known about the experiences and consequences of digitization in individuals with, or without, hearing loss. Video calls can be affected by degraded sound quality and asynchronous audio and video and create an unfavorable and demanding listening situation for people with hearing loss. It is therefore both theoretically important and relevant for society to study how individuals with hearing impairment experience digitalization (i.e., video calls) and how it affects participation, both socially and professionally. I, therefore, plan to investigate how digitization, video calls in particular, of working life has affected people with hearing loss. Specifically, I aim to investigate whether listening becomes more effortful for people with hearing loss and whether this harms the individual's participation in working life. In this project, I plan two studies, one more focused on the past (i.e., during the covid pandemic) that will use self-reported measures. This study aims to get a rich understanding of how individuals with hearing loss perceive their working life when it is digitalized. Here I plan to use data-driven (e.g., machine learning methods). The second study, on the other hand, is planned to use experiments in which participants will communicate through video call software under adverse conditions (e.g., audiovisual lag). This study will use the information from the first study to narrow down the experimental conditions. In this project, I plan to collaborate across disciplines and, in the long run, hope to guide designers of interfaces (e.g., of video conferencing software). By increasing the knowledge on what affects individuals with hearing loss, new algorithms for e.g., audio compression can be developed.

In addition to the specific project on "Zoom fatigue", I also plan on working on available large databases with my previous collaborators (e.g., Dr. Stenbäck and Prof. Danielsson). For example, I plan to apply machine learning algorithms to the n200 database to entangle e.g. which clinical tools are most efficient in diagnosing hearing loss (e.g., see Dwyer, Falkai, & Koutsouleris, 2018 for an overview of machine learning methods in clinical psychology).

References

Dwyer, D. B., Falkai, P., & Koutsouleris, N. (2018). Machine Learning Approaches for Clinical Psychology and Psychiatry. Ssrn. https://doi.org/10.1146/annurev-clinpsy-032816-045037

Marsh, J. E., Vachon, F., Sörqvist, P., Marsja, E., Röer, J. P., and Ljungberg, J. K. (Manuscript in Preparation). Irrelevant vibro-tactile stimuli produce a changing-state effect: Implications for theories of interference in short-term memory.

Marsja, E., Neely, G., and Ljungberg, J. K. (2018). Investigating Deviance Distraction and the Impact of the Modality of the To-Be-Ignored Stimuli. Exp. Psychol. 65. doi:10.1027/1618-3169/a000390.

Marsja, E. (2017). Attention capture by sudden and unexpected changes: a multisensory perspective (PhD dissertation). Umeå University, Umeå. Retrieved from http://urn.kb.se/resolve?urn=urn:nbn:se:umu:diva-141852

Marsja, E., Marsh, J. E., Hansson, P., & Neely, G. (2019). Examining the Role of Spatial Changes in Bimodal and Uni-Modal To-Be-Ignored Stimuli and How They Affect Short-Term Memory Processes. Frontiers in Psychology, 10. https://doi.org/10.3389/fpsyg.2019.00299

Marsja, E., Neely, G., and Ljungberg, J. K. (Under Review). Deviance distraction in the auditory and tactile modalities after repeated exposure: differential aspects of tactile and auditory deviants.

Rosa, E., Marsja, E., & Ljungberg, J. K. (2020). Exploring Residual Capacity: The Effectiveness of a Vibrotactile Warning During Increasing Levels of Mental Workload in Simulated Flight Tasks. Aviation Psychology and Applied Human Factors, 10(1), 13–23. https://doi.org//10.1027/2192-0923/a000180

Stenbäck, V., Marsja, E., Hällgren, M., Lyxell, B., & Larsby, B. (Accepted). The contribution of age, working memory capacity and inhibitory control on speech-recognition-in-noise in young, and older adult listeners. Journal of Speech, Language, and Hearing Research.

Marsja, E., Stenbäck, V., Moradi, S., Danielsson, H., & Rönnberg, J. (Under Revision). Is Having Hearing Loss Fundamentally different? Multi-group structural equation modeling of the effect of cognitive functioning on speech identification.

Stenbäck, V., Marsja, E., Ellis, R., & Rönnberg, J. (Under Review). Relationships between objective and subjective outcome measures of speech recognition in noise.