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Nina Kraus and Individual Differences in Auditory Processing

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It was in the late 1990s when I first encountered Nina's work.[1–3] I was studying auditory processing in dyslexia in Merav Ahissar's lab at the Hebrew University of Jerusalem. Our findings of large individual differences in basic auditory skills like frequency discrimination were met with skepticism. At the time, individual differences in sensation and perception were typically attributed to error – sampling error, measurement error, or "outliers." To the extent they were acknowledged, individual differences in auditory processing were used to diagnose auditory pathologies (e.g., with ABR tests). Nina's work on the links between auditory neurophysiology, performance in psychoacoustic tasks, and language skills were unique and exciting. It hinted at how individual differences in language and learning could be related to auditory perception and neurophysiology and how these could be studied non-invasively in human listeners.

Further, although I was unaware of it at the time, Nina was already developing more sensitive tools to study individual differences in the neural processing of speech (then termed "speech-ABR").[4] A few years later, when looking for a postdoctoral position, I met Nina in person for the first time. She was able to put me at ease immediately, even though I was stressed after a few sleepless nights dreading the interview. Then she challenged me to explain my research in non-technical terms and its impact in the ‘real world,’ something she continued to do ever since. It was my first experience of Nina’s effective mentoring style.

But it was really in 2004 when I finally made it to Evanston. I had planned to focus on auditory learning, but Nina managed to convince me to join the speech-ABR project. I had to first learn the ins and outs of ERPs, a rather painful process. I had no prior experience with the technique and did not realize how many “subjective” decisions were involved in collecting and analyzing “objective” measures. Specifically, the way peak latencies (e.g., of wave V) were determined at the time seemed arbitrary. Had it not been for Nina’s patience and good humor, I would have probably quit before I even started. The fact that both Nina and Trent Nicol (her long-time lab manager) were incredibly consistent and reliable in their labeling and taught me that there was real data to uncover under all this noise. This would have never happened without Nina’s graceful mentoring.

My main project in Nina’s lab thus involved children with language-based learning disabilities and the speech sound [da]. We found that children with abnormal neural timing originating from sub-cortical areas (speech-ABR) also had less robust cortical processing of acoustic changes (MMN) and more impaired language and literacy than children with no timing deficits.[5] Later on, we established links between individual differences in the neural processing of speech sounds and reading-related skills.[6] Together, these and other works from Nina’s lab served to establish the idea that indices of auditory processing can serve as biomarkers for literacy even though the underlying mechanisms remain elusive.[7,8]

In the years since, Nina and her crew continued to develop the measurement and analysis tools that now allow a nuanced analysis of the fidelity, integrity, and plasticity of sound encoding in the brain (the EEG-FFR).[9] These tools are based on evoked responses to speech sounds at the individual level and therefore can be used to study the behavioral relevance of different aspects of neural processing of speech sounds. Using this methodological and analytical framework, Nina’s work touched on many areas, from the more traditional listening in noise, through language and reading development and the neuroscience of music all the way to autism and sports. Therefore, Nina’s work not only helps us scientists deal with individual differences, but it also touches on the lives of so many human listeners, neurotypical and atypical alike.

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