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Fredrik Ullén is Professor of Cognitive Neuroscience at the Department of Neuroscience, Karolinska Institutet, since 2010. His research focuses on the neuropsychology of expertise and creativity, i.e. the various brain mechanisms that allow us to perform at a very high level within a specific field, using music as a model domain. Methodologically his team combines neuroimaging with experimental psychology and behavior genetic analyses.

He is currently heading a larger research programme, Humans Making Music that involves collaborations with the Swedish Twin Registry and other research groups both within and outside Sweden. In addition to his career as a scientist, Professor Ullén is active as a professional pianist. He has performed as a soloist in leading festivals and concert venues in most European countries, Canada, and the US. He is represented on more than 20 CD records, many of which have received outstanding critics and awards from the international press. Professor Ullén is a lifetime fellow of the Swedish Royal Academy of Music since 2007.

Music as a window to the creating brain

Neuroscientific studies of music and other art forms can have a wide range of rationales, from an intrinsic interest in the basis of aesthetic phenomena as such, to the development of clinical interventions. Here, I will emphasize a third perspective, i.e. how music can be used as a model domain to address general problems in cognitive neuroscience, using two examples from our recent work on expertise and creativity. According to the influential deliberate practice theory, expertise essentially depends on a single variable: the amount of deliberate practice an individual has accumulated. However, recent studies demonstrate that expertise can be influenced by multiple variables over and above practice at the phenotypic level and, moreover, that expert performance and its covariation with other variables, including practice itself, depend on both genetic and non-genetic influences. I will summarize this empirical literature and introduce our recently proposed model for expertise, the Multi-factorial Gene-environment Interaction Model (MGIM), which we believe can accommodate recent findings as well as provide a useful framework for future studies. Secondly, I will discuss how neuroimaging studies of musical improvisation has increased our understanding of creative cognition. Specifically, I will focus on the question of prefrontal engagement in improvisation, where studies on classically trained musicians and professional improvisers (jazz musicians) have given conflicting results.

Based on recent studies from our group, I will argue that prefrontal engagement may depend on the specific expertise of the participant for the particular creative task at hand. When task-specific expertise is high, top-down control may be reduced, in order to stimulate spontaneous free associations; when task-specific expertise is lower, such associations are less likely to produce a desirable result, and creative cognition may require higher levels of cognitive control.