Anders Dohn: Behavioral and neural correlates of absolute pitch ability

SUMMARY (ENGLISH)

Absolute pitch (AP), the rare ability to identify or produce a musical tone correctly without the aid of an external reference, has been investigated in numerous studies for more than a hundred years, yet many features of the ability remain unknown and are poorly understood. This thesis represents and conjoins three studies that investigate behavioral and neuroanatomical correlates of AP.

Study 1 focused on the pitch production ability in APs. Despite the frequently repeated claim that pitch identification and pitch production abilities do not necessarily coincide, no study has provided evidence for this which may be due to the lack of an adequate pitch production test (PPT). We created and used a novel computerized PPT and found a significant correlation between pitch identification and production abilities. Moreover, the results from the PPT revealed that the APs in general tend to undershoot when producing musical pitch, a tendency that decreases when musical activity increases. We also found that APs are less accurate when producing black key pitches compared to white key pitches. These findings suggest that AP may be partly practice-dependent and that APs may benefit from frequent contact to the fixed standard chroma to keep in tune.

In study 2 we addressed the fact that, although AP frequently is considered to reflect musical giftedness, it has also been associated with certain disabilities due to increased prevalence of AP in individuals with sensory and developmental disorders. Accordingly, we examined whether individual autistic traits are present in people with AP by quantifying subclinical levels of autism traits using the Autism-spectrum Quotient (AQ). We found a significantly higher degree of autism traits in musicians with AP (APs) than in musicians without AP (non-APs) and non-musicians, and the AQ scores were significantly correlated with pitch identification scores. However, group

differences emerged on subscales that are not part of the diagnostically crucial autism impairments, indicating that although AP is linked to autism AP is most strongly associated with personality traits that vary widely within the normal population.

In study 3, we investigated the neuroanatomical correlates of AP using structural magnetic resonance imaging (MRI) and diffusion tensor imaging (DTI) on closely matched groups of musicians with and without AP. We performed cortical thickness analysis on the whole cortex from T1-weighted images to probe for group differences in gray matter and we analyzed the fractional anisotropy (FA) and performed tractography from the DTI images to probe for group differences in white matter. We found significant increased cortical thickness in APs compared to non-APs in a number of cortical areas, including the left superior temporal gyrus, the left inferior frontal gyrus, the right supramarginal gyrus, and the right parahippocampal gyrus. Furthermore, we found increased FA in APs compared to non-APs in a cluster within the inferior fronto-occipital fasciculus, the uncinate fasciculus, and the inferior longitudinal fasciculus in the right hemisphere. The mean FA in this cluster was also found to correlate with cortical thickness in the parahippocampal gyrus. These findings suggest a link between AP and musical expertise in general. However, given the close matching of the groups on musical training and musical aptitude, these findings are not likely to derive from neuroplasticity and may therefore indicate a component of predisposition.

Taken together, these studies reveal capabilities and limitations of AP in terms of pitch production ability, maintenance of AP through musical activity, associated personality traits, and the neuroanatomical foundation of AP.