

# Congenital amusia in dizygotic twins: A case study

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## Introduction

Congenital amusia is a neurodevelopmental disorder that has a negative influence on pitch and rhythm perception (Peretz et al., 2002; Stewart, 2008). Amusics face lifelong impairments in the musical domain (Stewart, 2008). Recent studies (Patel et al., 2008; Liu et al., 2010) have also shown that amusics have deficits in the perception of linguistic pitch (intonation) as well and that the disorder can no longer be seen as domain-specific to music.

We report the first documented case of congenital amusia in dizygotic twins. They grew up together in the same household and attended school as well as their undergraduate program in linguistics together. One twin, NN, was diagnosed as amusic using the Montreal Battery of Evaluation of Amusia (MBEA) (Peretz et al. 2003) and a detailed questionnaire, while the other, JN, was diagnosed as non-amusic. We conducted a large battery of tests to assess the behavioral differences of the twins that emerged despite the same environment.

## Method

We assessed their hearing and intelligence using standardized tasks. Besides the MBEA and a questionnaire about educational, musical and demographic background, we also conducted the Gold-MSI (Müllensiefen et al. 2014) to assess musical abilities. To assess auditory memory and processing abilities, we conducted a pitch detection and direction discrimination task (Williamson & Stewart 2010) and also a pitch memory task (Schaal et al 2015). To assess language perception, we conducted an intonation perception task (Hamann et al. 2012) and a vowel perception task.

## Results

Both twins had normal hearing and above average intellectual abilities. Both twins had an identical pitch detection threshold of 0.135 semitones, while their pitch direction threshold differed significantly. Surprisingly, they also had an identical, low pitch memory span of 3.5 tones. While their performance on the intonation and vowel task differed significantly with the amusic twin performing worse.

## Conclusions

The finding that both twins have a comparable pitch detection threshold, while their pitch direction threshold differs is in line with previous findings (Williamson & Stewart 2010). It is surprising however that both exhibit a comparably low (amusic) pitch memory span in comparison to normal controls (Schaal et al. 2015), which might be interpreted as an indication for a certain hereditarity of pitch memory, as has been proposed for pitch processing (Drayna et al. 2001). While the everyday communication of the amusic twin seems to be unimpaired, her intonation and vowel perception are impaired in comparison to her twin, as was to be expected based on previous studies (e.g. Liu et al. 2010; Hamann et al. 2012).

This twin case study highlights that congenital amusia is not due to insufficient exposure to music in childhood. The exposure to music of the twin pair was as comparable as it can be for two individuals.