

## **Tone Language Translates To Perfect Pitch: Mandarin Speakers More Likely To Acquire Rare Musical Ability**

*Science Daily* — Could it be that cellist Yo-Yo Ma owes his perfect musical pitch to his Chinese parents? While we may never know the definitive answer, new research from the University of California, San Diego has found a strong link between speaking a tone language - such as Mandarin - and having perfect pitch, the ability once thought to be the rare province of super-talented musicians.

The first large-scale, direct-test study to be conducted on perfect pitch, led by psychology professor Diana Deutsch of UC San Diego, has found that native tone language speakers are almost nine times more likely to have the ability. Results will be presented Nov. 17 at the meeting of the Acoustical Society of America in San Diego.

Perfect, or absolute, pitch is the ability to name or produce a musical note of particular pitch without the benefit of a reference note. The visual equivalent is calling a red apple "red." While most people do this effortlessly, without, for example, having to compare a red to a green apple, perfect pitch is extremely rare in the U.S. and Europe, with an estimated prevalence in the general population of less than one in 10,000.

Tone languages - Mandarin and Vietnamese, among many others - are those in which words take on entirely different meanings depending on the tones in which they are enunciated. In Mandarin, for example, the word "ma" means "mother" when spoken in the first tone, "hemp" when spoken in the second tone, "horse" in the third and a reproach in the fourth. (Tone is not to be confused with shades of meaning imparted by intonation; saying something sarcastically, for instance, or rising at the end of a sentence to indicate a question.)

Deutsch and her co-authors measured the prevalence of perfect pitch by means of a direct, on-site test in two populations of music students: a group of 88 first-year students enrolled at the prestigious Central Conservatory of Music in Beijing, China, all of whom spoke Mandarin, and a group of 115 first-years at the Eastman School of Music in Rochester, New York, none of whom spoke a tone language. The test consisted of 36 piano notes spanning a three-octave range, generated by a Kurzweil synthesizer. To minimize the use of relative pitch (a much more common ability where listeners rely on reference notes for help), all intervals between successive tones were larger than an octave. Perfect pitch was defined as a score of 85 percent correct.

"We found a very clear difference between the two populations," Deutsch said. "In

Mandarin speakers, perfect pitch appears to be not rare, but rather a readily acquired ability." "We also found a striking effect of age of onset of musical training," she said. In both groups, the earlier an individual began music lessons, the more likely he or she was to have perfect pitch. But the incidence was substantially higher in the Chinese Mandarin speakers of the Central Conservatory.

For students who had begun musical training between ages 4 and 5, approximately 60 percent of the Chinese speakers tested as having perfect pitch, while only about 14 percent of the U.S. nontone language speakers did. For those who had begun training between 6 and 7, approximately 55 percent of the Chinese and 6 percent of the U.S. met the criterion. And for those beginning between 8 and 9, the figures were 42 percent of the Chinese and zero of the U.S. group.

The discrepancies were greater when the researchers allowed for semitone errors (that is, giving the subjects credit for a note missed by a half-note, or answering "C" for "C sharp"): Fully 74 percent of the Chinese students had perfect pitch if they had started musical training between ages 4 and 5. There were no differences depending on gender, in either group or any subgroup, Deutsch noted. Also, all those who were asked to participate, did, thereby eliminating the self-selection bias which plagues survey studies.

The study results, Deutsch said, "are very like what you would expect if you were dealing with a speech-related system. Tone appears to be analogous to vowel quality and other linguistic features acquired during infancy."

"The findings support the notion that babies can acquire perfect pitch as part of learning a language, which can later generalize to musical tones," Deutsch said.

"Indeed, the results for acquisition of absolute pitch in tone and nontone language speakers reflect a very similar picture, in terms of timeframe, to the critical periods inferred by linguists for acquiring first and second languages."

In other words, Deutsch suggests, perfect musical pitch functions much like a second language to tone speakers: If you're fluent in Mandarin, learning the tones of Cantonese - and perfect pitch - will be much easier than if you're an English speaker. The study follows up on one Deutsch led in 1999, which found that native speakers of Vietnamese and Mandarin exhibited a "remarkably precise and stable form of absolute pitch in enunciating words," leading Deutsch to hypothesize then that pitch was an extra-musical ability.

Deutsch's coauthors on the present study are: Trevor Henthorn, also of UCSD; Elizabeth Marvin, professor of music theory, Eastman School of Music; and Hongshuai Xu, graduate student, College of Music, Capital Normal University in Beijing.

The study, with graphic figures of the results and sound files of the test, is available at <http://www.aip.org/148th/deutsch.html>.

A top authority on musical perception, Deutsch is the editor of "The Psychology of

Music" (2nd edition 1999) and is the founding president of the Society for Music Perception and Cognition. Her past research has explored the way we hold musical information in memory and how we relate the sounds of music and speech to each other. Deutsch has discovered a number of musical illusions and paradoxes, including the tritone paradox, which established that different cultural groups often perceive identical notes of music differently.

*Note: This story has been adapted from a news release issued by University Of California San Diego*