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## Study Links Perfect Pitch to Tonal Language

### Audio

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By JAMES GLANZ

**M**ost native speakers of languages that use tones to convey meaning may have a form of perfect pitch, according to new research. The results may suggest that many or even most babies are born with perfect pitch but lose it if they do not learn a tonal language or undergo early musical training.

Most people find it easy to perceive and sing musical tones relative to each other, a skill called relative pitch, but perfect pitch -- the ability to identify any note by name or to sing a given note without hearing a reference note beforehand -- is much less common. Perfect pitch turns up in no more than one person out of 10,000 in Western countries, according to some estimates.

The languages studied in the new research were Vietnamese and Mandarin Chinese, two major languages in which different rising and falling tones can impart different meanings to the same combination of vowels and consonants. For example, the Mandarin word "ma" can mean mother, hemp, reproach or horse depending on whether the spoken tone is flat, rising, falling, or falling and then rising.

While the differences in meaning are conveyed largely by relative rather than absolute tones, the researchers, led by Dr. Diana Deutsch, a psychologist at the University of California in San Diego, found that speakers retained an absolute tonal standard.

In the study, which Dr. Deutsch described yesterday at a meeting of the Acoustical Society of America, the researchers recorded Vietnamese and Mandarin speakers as they read lists of words that covered a wide range of tones, and then repeated the exercise days later. A computer analysis of the recordings showed that individual speakers uttered the same words at the same absolute pitches to within fractions of a semitone -- the musical step from one key on a piano to the next.

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"It really sounds as though the person is sitting there immediately repeating the sound," Dr. Deutsch said. "Which is really, to my mind, amazing."

While the new findings have surprised many scientists, some said that more research needs to be done to show that the ability displayed by Vietnamese and Mandarin speakers is identical to perfect pitch as it is understood in music.

"It is still possible that the subjects may not actually see or realize a connection between tone as they use it in language, and pitch as a musical concept," said Dr. Donald Hall, a physicist at California State University in Sacramento who studies musical acoustics and is a church organist with perfect pitch.

Other research has shown that the prevalence of perfect pitch is higher in Japan, where the language is not tonal, but where many young children receive Suzuki music training. Perfect pitch is also more common among professional musicians, but studies so far have not established whether the talent arises from youthful practice or led the musicians to their vocation in the first place.

Still, some scientists said the new findings suggest that most babies are born with perfect pitch but retain it only by learning a tonal language or undergoing some sort of early musical training.

"There could be a much higher incidence of absolute-pitch musicians out there if all of us were exposed to music much earlier," said Dr. Gottfried Schlaug, a neurologist at the Beth Israel Deaconess Medical Center in Boston who has studied how structures in the brain are related to perfect, or absolute, pitch.

Others believe that most people, even in Western countries, do retain an almost exact "pitch memory" but simply lack a means of giving names to each pitch and putting the ability into practice, as speakers of tonal languages can do.

"What it means to me is that people have a very accurate memory for musical pitch," said Dr. Daniel Levitin, a cognitive psychologist at McGill University in Montreal who has studied perfect pitch. "You and I don't have the ability to attach these labels to it."

Another conceivable explanation for the results could lie in innate differences between Western and Asian populations, but Dr. Deutsch dismissed that possibility as "extraordinarily unlikely."

For the study, Dr. Deutsch, a psychologist, collaborated with Trevor Henthorn, an audio engineer at the Center for Research in Computing and the Arts of the University of California in San Diego, and Dr. Mark Dolson, a specialist in audio signal processing at the Creative Advanced Technology Center of the company Creative Technology Limited in Scotts Valley, Calif.

In one series of measurements, the team asked seven native speakers of Vietnamese to read a printed list of words that spanned the range of tones in that language. Days later, the task was repeated, and

recordings of each word were broken up into five-millisecond intervals on a computer and analyzed for their average tonal content. The differences of pitch between the two repetitions of a word by a particular speaker were all less than 1.1 semitone, and four of the seven speakers displayed pitch differences of less than half a semitone.

The results for 15 Mandarin speakers were perhaps even more striking, with nearly all of the speakers showing differences of fractions of a semitone from session to session.

How many of the speakers displayed what is usually called perfect pitch? "You could argue that they all did," Dr. Deutsch said. "If people show it, give or take a semitone, they'll claim perfect pitch," she said.

The unexpected results, Dr. Deutsch said, raises the question of why perfect pitch seems to be so rare in the West.

One possible explanation, she said, is that most babies are capable of acquiring perfect pitch, just as they can learn to speak any language without an accent. But as some window of time begins to close -- earlier for some children, later for others -- they can no longer acquire perfect pitch or speak a new language without an accent.

"Maybe up to a certain age you're going to be able to learn and memorize absolute representations of these pitches," said Dr. Schlaug, "but after a certain age it's not possible."

But that remains to be seen.

There remains the question, which Dr. Deutsch is attempting to answer with new research, of the precise connection between perfect pitch in music and tonal speech.

Dr. Perry Link, who teaches Chinese language and literature at Princeton University, says that he doubts the connection is direct. Native Chinese speakers, he says, are often unable to identify the tones they are correctly using, just as English speakers may use the language properly but be unable to parse their sentences grammatically. Absolute-pitch musicians, however, can explicitly name each tone they hear.

But Dr. Levitin of McGill University says the results are reminiscent of studies demonstrating that even speakers of languages like English that do not depend on tone can usually sing extremely familiar tunes in key without accompaniment. The tentative conclusion, he said, is that most people have excellent pitch memory, but the ability to express that memory diminishes in a person who does not speak a tonal language or study music at a young age.

Despite the fond hopes of parents, however, the new findings do not indicate that every baby carries the seeds of a Mozart inside, waiting to sprout. "Mozart had absolute pitch, and he was a composing genius," Dr. Levitin said.

"Are we all composing geniuses? No," he said. "But do more of us have absolute pitch than we thought? Yes, absolutely."

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