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Less pain for learning gain: Research offers a strategy to increase learning with less effort

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(PhysOrg.com) -- Scientists long have recognized that many perceptual skills important for language comprehension and reading can be enhanced through practice. Now research from Northwestern University suggests a new way of training that could reduce by at least half the effort previously thought necessary to make learning gains.

The research also may be the first behavioral demonstration of metaplasticity -- the idea that experiences that on their own do not generate learning can influence how effective later experiences are at generating learning.

"Prior to our work much of the research into perceptual learning could be summed up as 'no pain, no gain,'" says Beverly Wright, first author of a study in the Sept. 22 Journal of Neuroscience and communication sciences and disorders professor at Northwestern. "Our work suggests that you can have the same gain in learning with substantially less pain."

The findings could lead to less effortful therapies for children who suffer from language learning impairments involving perceptual skills. And they hold potential for members of the general population with an interest in enhancing perceptual abilities -- for musicians seeking to sharpen their sensitivity to sound, people studying a second language or physicians learning to tell the difference between regular and irregular heartbeats.

Previous research showed that individuals become better at many

perceptual tasks by performing them again and again, typically making the training tedious and long in length. It also showed that mere exposure to the perceptual stimuli used during practice on these tasks does not generate learning.

But the Northwestern researchers found that robust learning occurred when they combined periods of practice that alone were too brief to cause learning with periods of mere exposure to perceptual stimuli. "To our surprise, we found that two 'wrongs' actually can make a right when it comes to perceptual learning," says Wright.

What's more, they found that the combination led to perceptual learning gains that were equal to the learning gains made by participants who performed twice as much continuous task training (training which by nature of its repetition and length often is onerous).

"It's as though once you get your system revved up by practicing a particular skill, the brain acts as though you are still engaged in the task when you are not and learning still takes place," says Wright, who teaches in Northwestern's School of Communication.

Wright and Northwestern researchers Andrew Sabin, Yuxuan Zhang, Nicole Marrone and Matthew Fitzgerald worked with four groups of adult participants aged 18 to 30 years with normal hearing and no previous experience with psychoacoustic tasks. Their goal was to improve participants' ability to discriminate between the pitches of different tones.

The researchers initially determined the smallest difference in pitch that participants could discriminate from a 1,000 Hertz standard tone. They then divided the participants into four groups, each of which went through a different training regimen.

Participants in one group were trained for 20 minutes per day for a week on the pitch-discrimination task. Over and over again, they were asked to tell the difference between the 1,000 Hertz tone and a lower tone but showed no improvement.

Of greatest importance for the study, participants in a second group showed significant learning gains when the same amount of target task training (20 minutes) was combined with 20 minutes of work on an unrelated puzzle while repeatedly presenting a 1,000 Hertz tone through headphones.

Impressively, the learning of the second group also was comparable to that of a third group that for a week practiced the pitch-discrimination target task for 40 minutes per day.

A fourth group of participants repeatedly exposed to a 1,000 Hertz tone for 40 minutes per day while performing an unrelated task showed no learning gains.

Further experiments revealed that the order of presentation -- whether the 20 minutes of target task training occurred before or after the 20 minutes of the related task - did not affect learning. Each scenario yielded equal pitch discrimination learning gains.

In addition, the researchers discovered that the effectiveness of the combination of the target task training and of the unrelated training plus stimuli presentation began declining if the two tasks were separated by more than 15 minutes. Pitch discrimination learning - or evidence of metaplasticity -- disappeared completely if the sessions were separated by four hours.

More information: The article in the *Journal of Neuroscience* (Sept. 22, 2010) is titled "Enhancing Perceptual Learning by Combining

Practice with Additional Sensory Stimulation." www.jneurosci.org/

Provided by Northwestern University