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**New *research gives hope for Innovative rehabilitation***

# After serious head injury, survivors may still be able to learn without awareness, via different brain structures

WASHINGTON – Severe closed-head injury (CHI), like that caused in a car accident, can impair the ability for purposeful learning, for example in school or on the job. However, there is cause for hope: Psychologists have evidence that severe-CHI survivors may still be able to learn without awareness that they're learning. This kind of learning, called "implicit," may be supported by a separate, earlier-evolving brain mechanism than the "explicit" type. These findings, which are reported in the January issue of Neuropsychology, may aid the effort to remediate the cognitive abilities of CHI survivors, who often are impaired during young adulthood. The Centers for Disease Control have estimated that 5.3 million Americans, a little more than two percent of the U.S. population, currently live with disabilities resulting from CHI. Neuropsychology is published by the American Psychological Association (APA).

Two Washington State University researchers studied implicit perceptual learning in 19 participants between the ages of 15 and 55, at least one year after they sustained severe closed-head injuries, most of them in motor vehicle accidents but some in falls of greater than 10 feet. All had been in a coma for at least 24 hours. Heather M. Nissley, M.S., and Maureen Schmitter-Edgecombe, Ph.D., compared the CHI survivors' implicit perceptual learning with that of 19 non-injured controls, to learn whether the injured participants retained the capacity to learn without explicitly intending to learn, in the absence of awareness. CHI has long been known to hurt explicit learning. Here's an example of the different types of learning: In implicit learning, children normally acquire and understand the complex rules of grammar-- although (even as adults), they may not be able to describe the rules or how they learned them. In explicit learning, they learn the parts of speech in the classroom.

The first to study implicit learning in CHI using a perceptual task, Nissley and SchmitterEdgecombe asked participants to identify the location of a target number – 6 – on a computer screen, as it moved in a seemingly random fashion around a matrix of numbers. Participants did not know that the target's location was actually determined by an underlying pattern of relationships between that location and the arrangement of other numbers in the display (a "covariation pattern"). Despite slower search rates, the CHI group's improvement in locating the "6" was consistent with that of the control group, demonstrating that, like the uninjured participants, they learned perceptual information implicitly – without

conscious awareness. Plus, they demonstrated this implicit learning even though they were clearly impaired on tests of explicit learning and memory.

The findings hold two-fold interest. First, they support the idea that there may be two different neural mechanisms: one for implicit and another for explicit learning. What's more, it also is likely that implicit learning is not a single, unified learning process and that different neural substrates may support the different types of implicit learning - abstract, motor and perceptual. Some have argued that the brain areas underlying implicit learning developed earlier in evolution and thus are more unchanging and resilient across individuals than later-evolving areas; this would make implicit learning more immune to neurological injury (as well as to age and other individual differences such as intelligence and education). Additionally, with the ability to learn implicitly, people can acquire new information about their environment without it demanding the attention required by explicit learning.