PRESS RELEASE

A potential screening tool for learning difficulties in schoolchildren: As simple as pressing a button

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A team of scientists in Switzerland have shown the relationship between multisensory and cognitive abilities, identifying a potential new way to screen for learning difficulties in schoolchildren by asking nothing more of them than to detect sounds and flashes.

How do you tell if a young child is on a good trajectory for their cognitive development? An estimated 17% of children have at least one developmental disorder that affects their global cognitive abilities. Early intervention strategies are widely recognized as the best course of action. However, such strategies rely on early and reliable identification of at-risk children, that typically involves lengthy neuropsychological assessments with tests of attention, memory, language, and executive functions. Moreover, how could we foster any normal development, or sustain cognitive development?

In a study published today in ***Scientific Reports***, a team of Swiss scientists from the University Hospital Center and University of Lausanne (CHUV-UNIL), the University of Applied Sciences Western Switzerland - Valais (HES-SO Valais), and the University of Geneva (UNIGE) shows how a simple task performed on a laptop (easily transferrable to a smartphone) can already inform about the child's memory and cognitive abilities. This simple task required children to do nothing more than press a button whenever they saw a flash of light or heard a sound. At times, each was presented alone, and on other times – the two appeared simultaneously together. Still, all the children needed to press a button whenever they saw or heard anything. Trivial!

Professor Murray, senior author of the study and Associate Professor in the Faculty of Biology and Medicine at the University of Lausanne, reports how the team then extracted the extent to which each child benefited from detecting the combined auditory-visual "beep-flashes" compared to either flashes or sounds alone. Using just this measure of such multi-sensory processing in a group of 68 schoolchildren aged 4.5-15 years, Murray and colleagues could accurately predict children's memory abilities and fluid intelligence; two global cognitive skills. "What is interesting, visual or auditory processing alone did not have a similar predictive quality. There is something special in the way the brain combines simple, sensory information that reflects one's cognitive abilities," describes Professor Murray.

Mrs. Solange Denervaud, a doctoral student at the University of Lausanne, explained the impetus for the study. "The interplay shown is this study between multisensory capacities and cognitive development of school-aged children have two major implications. First, it means that school pedagogical practices should not only focus on the student's cognitive skills, but also on training and using their sensory skills. Indeed, developing children's

multisensory competencies may effect their cognitive outcomes. ” Mrs. Denervaud was keen to add “Second, our findings open the exciting possibility that a simple perceptual task could be a valuable complementary screening and assessment tool for cognitive development. The test we introduced should not as a replacement for tests currently used in clinical practice, but rather as a potential first-step screening tool.”

Aside from the impact of their results on developmental disorders, this work also sheds new light on our understanding of how the brains of schoolchildren process information from the different senses. Dr. Paul Matusz, an experimental and developmental psychologist at the HES-SO Valais, points out that the *Scientific Reports* study builds on some of his collaborative work with Professor Murray on the ways that multisensory and memory functions are linked together and highlights the importance these results for education. “The existing models of children’s cognitive development are limited in explaining behaviour and learning in the classroom because they are derived from studies limited to just a few categories of stimuli - like just visual shapes or just sounds. Such simplified, experimental tasks stand in stark contrast with the dynamic and demanding, multi-sensory nature of the classroom. We therefore capitalised here on our prior findings in healthy adults and the elderly, linking multi-sensory benefits in simple detection tasks with sensory processes on the one hand, and memory functions on the other. What we observe here in children is consistent with our findings across the lifespan.”

This research is the product of national collaboration between the University Hospital Centre and University of Lausanne (CHUV-UNIL), the University of Applied Sciences Western Switzerland (HES-SO Valais/Wallis), and the University of Geneva (UNIGE) that is supported by the Swiss National Science Foundation, the Pierre Mercier Foundation, and a grantor advised by Carigest SA.

Professor Murray concludes, “We are particularly excited about this work because it shows how a very simple and low-cost test can help identify a wider population of at-risk children. Our findings clarify the link between our vision and hearing and their role in supporting complex mental functions like memory and intelligence. It becomes increasingly clear that our cognitive abilities depend on the integrity of our senses. This importantly extends our similar existing findings in the elderly, where the same task could discriminate between healthily aging individuals and those with mild cognitive impairment.”

The team is now designing new ways to optimize and validate this new screening tool, working hand-in-hand with clinicians, teachers, and therapists. They are likewise turning their attention to the potential role of specific pedagogic approaches as well as to the role of attention skills in different intervention strategies for remediating learning and developmental disabilities. For example, Professor Murray and collaborators are currently working with neonatologists in Switzerland and the United States to determine how early life experiences shape early sensory functions that are the scaffold for developing memory and cognition.

Reference:

Denervaud S, Gentaz E, Matusz PJ*, Murray MM* (2020) Multisensory Gains in Simple Detection Predict Global Cognition in Schoolchildren. *Scientific Reports*, https://doi.org/10.1038/s41598-020-58329-4.

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