# A Broader Definition of Learning Could Help Stimulate Interdisciplinary Research

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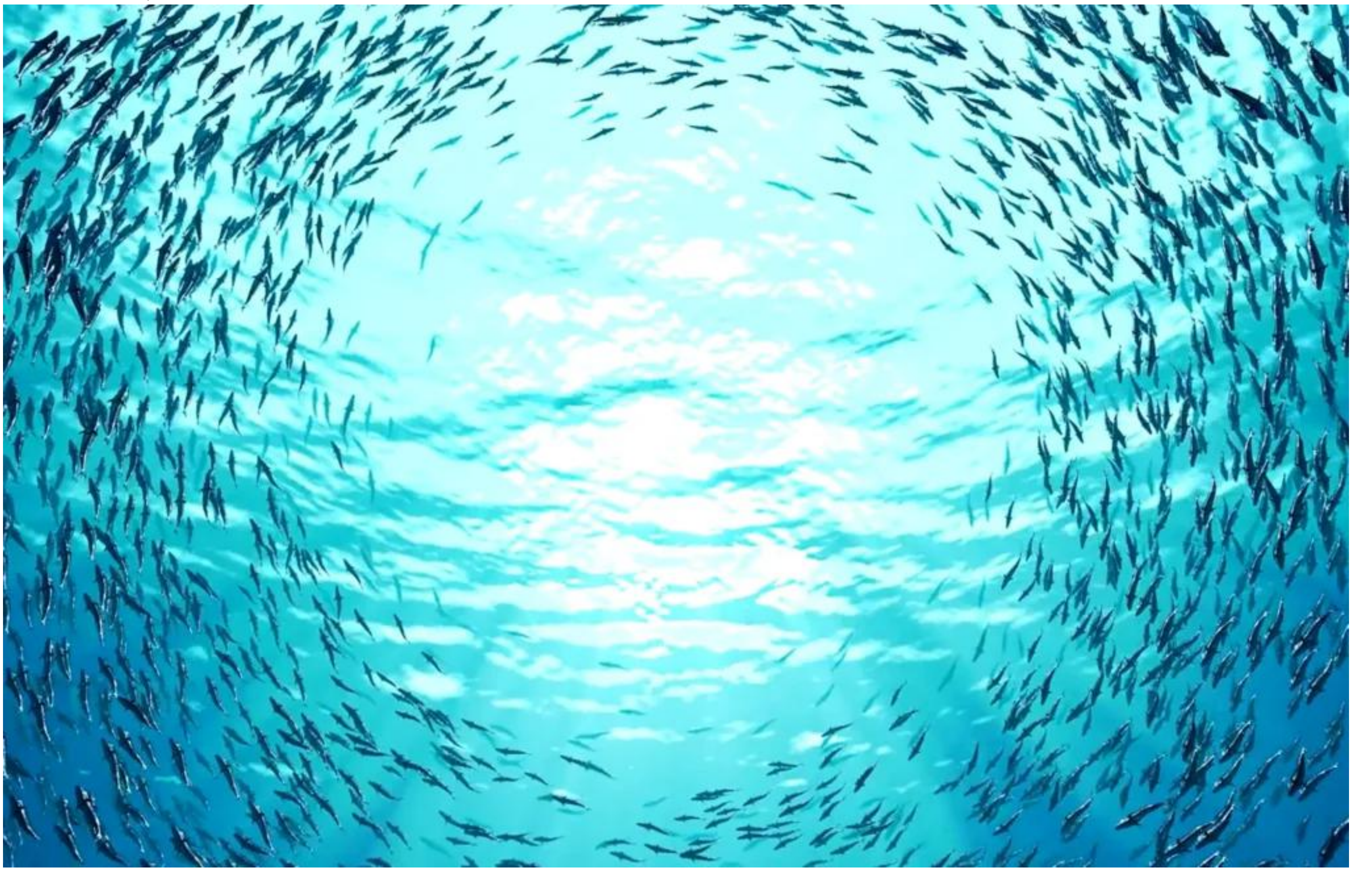

We often conceive of learning through the lens of cramming for an exam or teaching a dog to sit, but humans and other mammals aren't the only entities capable of adapting to their environment—schools of fish, robots, and even our genes can learn new behaviors, explain Jan De Houwer and Sean Hughes (Ghent University) in a new *Perspectives on Psychological Science* article. Embracing a broader definition of learning that includes any behavioral adaption developed in response to regular features of an environment could help researchers collaborate across the fields of psychology, computer science, sociology, and genetics, De Houwer explained in an interview.

"Most people think of learning as some kind of mechanism for the storage of new information, but this makes it very difficult to compare learning in different systems because different systems probably use different mechanisms for storing information," De Houwer said. "We define learning as changes in the way a system responds to its environment—that is, as learned behavior."

Much like Darwin's theory of evolution, De Houwer and Hughes' functional definition of learning focuses on how systems adapt to their environment, regardless of the mechanisms through which those adaptions may occur. The "system" in question could be an individual organism, a part of an organism such as a gene or the spinal cord, or a community of organisms. In fact, De Houwer added, evolution itself could be conceived of as a form of learning in which a species of animal is seen as a system that adapts to its environment.

“Because our definition of learning is ‘mechanism-free,’ it allows for interactions between scientists who study learning in different systems,” De Houwer said. “It breaks the barriers between different sciences and allows for an exchange of ideas that is bound to promote the study of learning in general.”

In addition to supporting comparisons between learning in different kinds of systems, this definition can also help researchers take a closer look at how these systems may influence each other’s learning, De Houwer and Hughes write. A corn plant may learn to become more drought resistant, for example, because its genes have an epigenetic response to dehydration that prompts its cells to retain more water, ultimately influencing the learned behavior of the entire plant.

Learning can also occur at the group level, such as in a school of fish, because of the learning of some but not all members in that group, De Houwer added. A fish at the head of a school may learn to avoid a shipwreck after repeatedly finding sharks there, for example, whereas fish at the back of the school may perform a similar behavior by simply continuing to follow the fish ahead of them without learning about the shipwreck.

This analysis can also be applied to the study of robots and artificial intelligence. Though each can be studied separately, the ability of a robot to learn how to navigate obstacles also depends on how its algorithm responds to the environment, the researchers explain.

It is important to note, however, that a system cannot be described as learning just because its behavior has changed in response to the environment. A system can only be said to have learned something if it changes the way it responds to a stimulus as the result of regularities in its environment, such as repeated exposure to a stimulus or the co-occurrence of stimuli, De Houwer said. Learning researchers examine the conditions under which regularities in the environment change behavior, he continued.

Developing a precise definition of learning can help scientists communicate existing findings and promote new interdisciplinary research, De Houwer and Hughes conclude.

“Definitions are tools at the service of better science,” they write. “Our definition allows scientists to share knowledge and thereby explore new ways of studying learning in different systems.”

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**Reference**

De Houwer, J., & Hughes, S. Learning in individual organisms, genes, machines, and groups: A new way of defining and relating learning in different systems. *Perspectives on Psychological Science.* Advance online publication. https://journals.sagepub.com/doi/10.1177/17456916221114886