The three learning Sciences (biological, artificial, human)

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Learning is existential, and so its study must be complex and interdisciplinary. Over the past centuries, researchers from different fields have developed many theories to explain how humans and animals learn and behave, i.e., how they acquire, organize, and deploy knowledge and skills. Basically, learning is defined as a relatively permanent change in behavior and/or in mental associations due to specific experiences. Learning is a response to environmental requirements and different from biological maturation, which, however, is a fundamental basis for learning.

Beyond psychology and biology, disciplines such as anthropology, sociology, and education focused on the topic of human learning in the course of the past centuries. However, one of the most important innovations for research on learning resulted from the emerging computer sciences and their focus on machine learning. Machine learning usually refers to changes in systems that perform tasks associated with artificial intelligence (AI). Many techniques in machine learning are derived from the efforts of psychologists to make their theories of animal and human learning more precise through computational models. Conversely, it seems that the concepts and techniques being explored in the field of machine learning also illuminate certain aspects of the biology of learning. Accordingly, closely related to machine learning is also the study of human and animal learning in psychology, neuroscience, and related fields.

In the ITS 2012 keynote speech Norbert M. Seel focused on the biological foundations of learning, mainly discussed in terms of the interplay between assimilation and accommodation that correspond the basic functions of schemas and mental models. Furthermore, he elaborated on cumulative or incremental learning as an example to demonstrate basic correspondences between theories of human and artificial learning. Last but not least, he discussed practical implications for interdisciplinary research on human and artificial learning.

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