Chapter 99
A Social Constructionist Model for Human–Machine Ecosystems

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ABSTRACT

Future learning experiences will be shared in hybrid communities that include humans and non-human agents. Students will need to be protagonists of their social learning situations, together with interactive "smart" tools, and teachers will share planning responsibilities with high-tech assessment tools. Personal engagement will be a major factor for educational success, and collective constructionism will represent the unified model for understanding human-machine interaction. The authors analyze the factors that influence how this will happen through three specific domains of socio-cognitive development: explicit information acquisition, implicit knowledge development, abstract meta-reflection. Humans will experience unpredictable cognitive changes just by merging their goals and actions with artificial intelligence agents. A social constructionist educational system needs to take this into account, plan for the unknown, and work with these evolutions with the goal of developing a new ethos based on a society that is global, networked, collective, ethical, and inclusive.

INTRODUCTION

No one can hold a whole culture, or the compendium of knowledge in a field, in their head. Knowledge is developed and spread throughout communities, and is acquired by interacting in society (Vygotsky, 1978). Learning a linguistic or mathematical code, for example, is not just a function of time or study. It is the result of use and interaction (Papert, 1993). In the near future, we are not only going to be sharing learning experiences in communities of humans, but we will be sharing experience and knowledge in

DOI: 10.4018/978-1-7998-2460-2.ch099

the cloud, with machines, as well. This hybrid community of shared knowledge will include non-human agents and interactions, and they will become as important as other humans, in many ways.

When humans first developed language, they acquired the possibility to communicate about events that happened in some other time and place that the listener did not know. It gave them the ability to transcend the "here" and the "now." It also gave them the ability to store, in collective memory, acquired experiences and knowledge, coming from anybody. They used these to build common collective abstractions that support culture. Continuity and sustainability in this context means maintaining the spirit of a distributed community, with respect to tools, strategies and values. Focus passed from "I" to "We."

If humans developed culture from social interaction, can a machine equivalent of culture arise from the Internet of Things? Machines are assigned unique identities and then connect with other machines in large networks, creating a decisional ecosystem based on algorithmic languages and machine codes (Morgan, 2014).

Whatever the case, this technological expansion is creating an extra-sensorial field of interaction, that amplifies our capabilities, not only in time and space, but also in memory, cognitive processes, and social problem-solving. In this field, machines are becoming protagonists, and build their own communicative layers. Human culture is not only globalizing, it is integrating non-human agents to become a hybrid society, where algorithms will automate learning situations, and humans will blend content, emotion, and intention. This is a major game changer for society, and an immense challenge for education.

The new idea of community sustainability will necessarily include intercultural communication, including transmedia interactions. New generations need to learn new communication codes and techniques to interact in this emerging world. New jobs are being created for trainers, explainers, and sustainers (Wilson, et al, 2017). New teaching and learning experiences are needed to meet these challenges, blending formal and non-formal education, and bridging disciplines.

In this chapter, the authors explore different scopes for suggesting learning situations where the traditional constructivist approach, focused on the individual knowledge process as the unique experience of each learner (Crotty, 1998, p. 58), is surpassed by the more complex constructionist concept of the collective generation and transmission of meaning, where knowledge and social processes go together (Young and Collin, 2004, p. 376). Students will be protagonists of their social learning situations, together with interactive "smart" tools, and teachers will be sharing planning responsibilities with highly technified assessment tools. In this teaching and learning process, personal engagement will be a major factor, and collective constructionism will represent the unified model for understanding human-machine interaction.

Starting from Papert's vision of constructionism as opposed to instructionism (Papert 1991), the authors extend social constructionism to include interactions with non-human agents, following a progression through three specific domains of socio-cognitive development:

- An explicit information acquisition domain
- An implicit knowledge development domain
- A meta-domain of abstract reflection.

These three domains correlate with the three main competency levels of the OECD PISA evaluations (OECD, 2016), and are also coherent with the well-known Bloom's pyramid (Bloom et al, 1956), as adapted for the digital era (Fisher, 2009).