

Interplay Between Cybernetics and Philosophy as an Essential Condition for Learning

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Abstract¹

In the 21st century, there is an increasing interest in studying the relationship of cybernetics and philosophy. My paper is also inspired by the recent enormous efforts in developing machine intelligence and machine learning to replicate human intelligence and human learning. Furthermore, my paper is motivated by the continuing merge of natural sciences and social sciences. I argue that in the network and wisdom economy, the subject of study in natural and social sciences is converging, which makes the topic of my paper interesting, contemporary, and needed. Here, I will focus on the interplay between philosophy and cybernetics as a necessary condition for learning. This conceptual paper is based on the study of the literature. After presenting the objective of the paper, I will discuss the concept of learning. Then, I present the main characteristics of the five leading learning paradigms such as behaviorism; cognitivism; cognitive and social constructivism; humanism; and connectivism. Next, I briefly discuss how cybernetics and philosophy relate to learning and offer a framework to show the interrelatedness of cybernetics, philosophy, and the learning paradigms. Finally, I conclude with my key arguments.

Keywords: *Cybernetics, Philosophy, Learning, Learning Paradigms, Experiential Learning, Collaborative Learning, Transformative Learning.*

1. Why does Learning Need both Cybernetics and Philosophy?

In the 21st century, there is an increasing attention to explore the relationship of cybernetics and philosophy. This is an interesting phenomenon because on the one hand, cybernetics has a relatively short history (Tondl, 2008) and on the other hand, philosophy has a very long history (Russell, 1954; Durant, 1954). My paper is also motivated by the recent enormous interest in developing machine intelligence (MI), machine learning (ML), and deep learning (DL) to replicate human intelligence (HI) and human learning. Furthermore, there is an extensive research on brain in the neurosciences to understand the human mind, learning and thinking. How do artificial

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intelligence (AI) and human intellect differ? Is AI a threat or an opportunity for humans? Can AI make moral and ethical decisions? The importance of these questions is demonstrated by the largest single donation of GBP150m from Mr Schwarzman (Jeffreys, 2019) to Oxford University in June 2019. The purpose was to establish a new institute to study the ethics of AI. Mr Schwarzman raised important questions: “*Why are we here? What are our values? How does technology deal and interact with that?*” He also said that it was “*important for people to remember what being human is*” (Jeffreys, 2019).

I argue that it is vital not only to *remember* what being human is, but to *understand* it too. In his recent article, Heaven (2021) interviewed neuroscientist Dr Jeff Hawkins about AI and biological intelligence and about his research into human brains and MI. Hawkins raises an essential point related to DL and AI: “we first have to figure out what intelligence actually is, and the best way to do that is to study brains”. Further he argues that HI has four main features such as: (1) learning by moving and building mental models (embodiment); (2) sensing the world to build up an overall viewpoint about it; (3) continuous learning (accumulating knowledge), and (4) structuring our knowledge using reference frames. Hawkins assumes that “The key thing is that any intelligent system, no matter what its physical form, learns a model of the world by sensing different parts of it, by moving in it”. He is also quite critical saying that “most people in AI have very little understanding of neuroscience” and “neuroscience itself has been struggling to understand what the hell’s going on in the brain”. Why do people try to develop an AI and intelligent machines? Concurring with Hawkins, I believe that the goal is to preserve human knowledge that has been accumulated through learning. He concludes: “We’re not going to be around forever, but our machines could be. ... I think AI ... is a way of essentially preserving ourselves for a time and a place we don’t yet know” (Heaven, 2021).

Understanding and replicating HI are exciting and difficult tasks. To be human in the 21st century, according to Pink (2006), we need people with a whole new mind. There is a need for “creators and empathizers, pattern recognizers, and meaning makers ... artists, inventors, designers, storytellers, caregivers, consolers, big picture thinkers” (Pink, 2006, p. 1). In the conceptual age “inventiveness, empathy, joyfulness, and meaning – increasingly will determine who will flourish and who flounders” (Pink, 2006, p. 3). There is a challenge for brain researchers, philosophers, neuroscientists to replicate all these human qualities in AI and preserve

human knowledge for the future.

Could cybernetics with its interdisciplinary approach be the solution? Cybernetics started to emerge since the 1940's when Wiener, the founder of cybernetics, coined the term "cybernetics" (Wiener, 1948). Behavior and purpose as basic principles of cybernetics and the idea of the scientific integration of different disciplines have been developed by Rosenblueth, Wiener and Bigelow (1943). Cybernetics has a transdisciplinary approach. It is an integrative field of science that includes different domains of knowledge such as operations research, mathematical communication theory, information theory, and in data analysis and decision making. Later its focus has shifted to general systems theory and system analysis, control theory and optimization.

Philosophy, compared with cybernetics, has a very long history. Philosophy has always been concerned with issues important for human life such as meaning, values, norms, ethics, love, beauty, truth, knowledge, wisdom, and learning. While cybernetics aims to *explain* complex human functions (e.g., learning), philosophy helps to *understand* what it means to be human. Therefore, I believe that it is important that philosophy should closely be related to cybernetics.

This brief paper is a conceptual paper. The most relevant literature is selected to support my arguments. It is important to note that here I do not seek to provide a comprehensive review of the history of cybernetics and philosophy but rather to highlight why and how they together can help us to better explain and understand the complex phenomenon of learning. My aim is to develop arguments why learning requires an interplay between cybernetics and philosophy.

After I presented the need for this paper and my motivation to engage with this topic, the rest of the paper is organized in four sections. First, I will discuss the concept of learning. Then, I present the main characteristics of the five leading learning paradigms such as behaviorism; cognitivism; cognitive and social constructivism; humanism; and connectivism. Here, I also introduce experiential, collaborative, and transformative learning as social learning approaches. Next, I briefly demonstrate the relationships of cybernetics, philosophy, and learning; offer a framework to show the interplay of cybernetics, philosophy and learning paradigms. In conclusion, I summarize my key arguments why the interplay between cybernetics and

philosophy serves as an essential base for fully understanding learning.

2. What is Learning?

Learning theories have a long history. People have been always fascinated by learning. The two extremes of learning approaches are behaviorism and connectivism. Social learning paradigms (i.e., social constructivism, humanism, and connectivism) have developed as a critical reaction to behavioral and cognitivism learning approaches. Social learning theories emphasize the role of social context, interactions between people, belonging to a community, and the ability of the learner to develop (i.e., construct or create) his or her own learning. Social learning approaches assume that knowledge seekers are motivated, critical thinkers, problem-solvers, who could, through reflections, add *new* meaning to their old experiences. Another difference between behavioral and social learning paradigms is that behavioral learning is a teacher-focused (i.e., teacher as knowledge provider), while social learning is a learner-focused (i.e., knowledge seeker) approach.

Learning is a complex phenomenon. According to Boisot (1999), the social learning cycle (SLC) integrates the two different but *not* mutually exclusive knowledge creation assumptions, namely, the cumulative and a paradigmatic view of knowledge. Boisot (1999, pp. 90-116) argues that the first one, what he calls N-learning (i.e., neoclassical learning), leads to a ‘hoarding strategy’. It means that knowledge is cumulative, and it is a collection of facts and theories. Conversely, the second one, the S-learning (i.e., Schumpeterian learning) leads to ‘sharing strategy’. This strategy could lead to a paradigm change or shift. Boisot emphasizes, however, that these two learning strategies are complementary rather than competitive and they can coexist. The S-learning could be considered as transformative learning that leads to *new* knowledge by questioning existing assumptions based on real world experiences. Transformative learning is essential in *new* knowledge creation because it challenges the old ways of thinking and this way it could lead to changes in actions, identity, and knowing.

Learning is contextual. I concur with William F. Hanks’ foreword in Lave and Wenger (1999) when he argues that:

Lave and Wenger seem to challenge us to rethink *what it means to learn*, indeed to rethink what it means to understand by putting the meaning, understanding and learning processes into social contexts because for them learning is a process that takes place in a participation framework, not in an

individual mind, *learning is a way of acting in the world, learning is way of being in the social world, not a way of coming to know about it.* (Hanks in Lave and Wenger 1999, pp. 13-24, emphasis added)

Learning is a social practice. According to the social learning perspective, learning cannot be isolated from social practice and contexts. I concur with Wenger (2005) saying that learning cannot be designed, “learning happens, design or no design” but “we can design *for* learning” (Wenger, 2005, p. 225, emphasis original). Learning can be facilitated and enabled (e.g., education, educators, knowledge activists). Similarly, a context and conditions for learning could be designed. I assume that learning happens consciously and/or unconsciously, in formal and/or informal contexts (e.g., education, work, family, friends, and society). It happens throughout life. Concurring with Lave and Wenger (1999), I assume that learning is located not in individual heads, but in the processes of co-participation and in experiences. I see learning as a social act, as a process of practice and reflection.

Learning is also a continuous reflective practice. Schön (1987) proposes a new epistemology, i.e., the epistemology of practice. Schön argues about the importance of reflection-in-action in the learning process what he calls ‘*reflective practicum*’. First, second, and third loop of learning, i.e., knowing-in-action, reflection-in-action, and reflection on reflection-in-action are central to epistemology of practice. Schön argues that “knowing-in-action is tacit, spontaneously delivered without conscious deliberation” ... while “reflection-in-action has a critical function, questioning the assumptional structure of knowing-in-action” (Ibid., p. 28).

According Wenger (2005, pp. 226-229), learning has the following characteristics:

- learning is inherent in *human* nature
- learning is the ability to negotiate new meanings
- learning creates *emergent* structures (e.g., communities of practice)
- learning is fundamentally *experiential and social*
- learning *transforms* our identities
- learning constitutes trajectories of participation (i.e., history of participation, individual and collective *becoming*)
- learning means dealing with boundaries (i.e., multi-membership)
- learning is a matter of social energy and power
- learning is a matter of *engagement*
- learning is a matter of imagination (i.e., processes of orientation, reflection, exploration)
- learning is a matter of alignment

- learning involves an interplay between the local and the global (i.e., dynamic combination of engagement, imagination, and alignment) and
- learning cannot be designed; it can only be designed *for*.

Learning is a holistic, human process. One of the social learning approaches is the experiential learning theory (ELT). Kolb and Kolb (2005) argue that ELT is a holistic theory of learning that is built on the following propositions (Kolb and Kolb, 2005, p. 194, emphases added):

1. learning is best conceived of as a *process*, not in terms of outcomes,
2. all learning is relearning,
3. learning requires the resolution of conflicts; conflicts, differences, and disagreement are what drive the learning process,
4. learning is a *holistic process* of adaptation to the world (thinking, feeling, perceiving, and behaving),
5. learning results from synergetic transactions between a person and his/her environment, and
6. learning is the process of creating knowledge.

Summing up, learning is evolving, emerging process (i.e., complex responsive processes) that takes place in a social context where people are connected and interact. According to Stacey (2003), “learning is the activity of interdependent people and can only be understood in terms of self-organizing communicative interaction and power relating in which identities are potentially transformed. Individuals cannot learn in isolation and organizations can never learn” (Stacey, 2003, p. 325). Learning, according to Stacey, is social and individual at the same time.

3. How do we Learn?

Learning in the knowledge economy is essential. Harris (2001, pp. 195-248) refers to Alvin Toffler saying that “The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn and relearn” (Ibid., p. 195). Undeniably, the ways of learning depend on several factors such as age, identity, context. Therefore, the following questions could be asked: Do children and adults learn the same way? How does learning relate to identity formation? How does the learning context influence (enhance or prohibit) learning? How have distance education and e-learning changed the way we learn? In order to explain the different ways of learning several theories and approaches have been developed. These issues will be briefly discussed next.

3.1. Do Children and Adults Learn the Same Way? How does Learning Relate to Identity Formation?

The role of social context (i.e., family, other children, friends, teacher) is utmost important in children's learning. Pollard with Filer (1996), applying social constructivism approach and symbolic interactionist analyses in five longitudinal cases in their ethnography research, demonstrate the learning and identity development of children from age four to seven. They conclude that social interactions, feedback, guidelines, and experiences are critical in learning and identity development of children.

Fenwick and Tennant (in Foley (Ed.), 2004, pp. 55-73) discuss adult learning based on three assumptions: (1) no one learning theory is best, (2) learning does not occur in a vacuum, and (3) the 'learner' is not separable from the 'educator' in learning-teaching situations. Based on these assumptions they explore four perspectives of adult learning such as: learning as an acquisitional process, learning as a reflective process, learning as a practice-based community process, and learning as an embodied co-emergent process. Understanding adult learners, their background, attitudes, experiences, existing skills and competencies, and their goals is necessary for achieving effective learning outcomes. Similarly, Merriam, Caffarella and Baumgartner (2007, ix) argue that "it is especially important to know who the adult learner is, how the social context shapes the learning that are engaged in, why adults are involved in learning activities, how adults learn, and how aging affects learning ability".

To conclude, I argue that face-to-face education, adult/teacher-led education is more vital for children and for their identity formation than for adults. Adults' learning is more a self-directed learning.

3.2. How does the Learning Context Enhance or Prohibit Learning? How have Distance Education and e-Learning Changed the Way we Learn?

Learning takes place in social contexts, in interactions of people. In the 21st century learning is increasingly enhanced by technology. Spencer (in Foley (Ed.) 2004, pp. 189-200) discusses on-line learning. Spencer argues that distance education as a delivery method has its challenges and benefits. "Distance education is also being renamed flexible learning, distributive learning or, more specifically, computer-mediated communication, on-line learning or e-learning" (Ibid., p. 189). On-line learning, according to Spencer,

has its limitations and strengths. However, he concludes that its strengths outweigh its weaknesses. On-line learning will grow in the future and “it is the most exciting development from an educational perspective” (Ibid., p. 200).

In the digital economy we need to rethink learning, working, and their relationships. According to Tapscott (1996, pp. 197-216) there are six learning themes of the new learning emerging: (1) increasingly, work and learning are becoming the same, (2) learning is becoming a life-long challenge, (3) learning is shifting away from the formal schools and universities, (4) some educational institutions are working hard to reinvent themselves for relevance, but progress is slow, (5) organizational consciousness is required to create learning organizations, and (6) the new media can transform education, creating a working-learning infostructure for the digital economy.

Digitalization has an impact on the ways of learning. Similarly, to Tapscott, Laakso-Manninen and Tuomi (2020, pp. 174-199) argue that learning to learn and flexibility are the key competencies in the future work. They write that “high quality teaching must support the learning style of each individual student, whether it is peer group learning, individual learning or learning by doing” (Ibid., p. 177). Digital learning environment enhances learning any time and any place, it increases flexibility in learning.

3.3. What are the Main Learning Theories, Approaches, Paradigms?

The five main learning paradigms are: behaviorism, cognitivism, constructivism (cognitive and social), humanism, and connectivism. The main characteristics of these learning approaches are summarized in *Table 1*.

First, second, and third order types of learning (cf., single-, double-, and triple-loop learning) are distinguished by Engeström (1994). In his view, behavioral learning theories belong to the *first order learning* where conditioning of reward and punishment, imitations and copying of certain behaviors belong to learning. In *second order learning*, trial and error, experimentation and investigation are the ways to learn (cf., constructivism). The *third order learning* (e.g., expansive learning, transformative learning) is when the learner questions the validity of tasks and problems and the learner makes an effort to change the context that posed the problem (cf., humanism, connectivism).

Table 1. Characteristics of Learning Paradigms

Main Characteristics	Learning Paradigms				
	Behaviorism	Cognitivism	Constructivism	Humanism	Connectivism
Time	Agricultural and industrial economy	Industrial and information economy	Knowledge economy	Mind economy, creative economy	Network economy, wisdom economy
Place & Space	Physical place, objective reality	Physical place and virtual / cyber space, objective and subjective reality	Mental and cognitive space, subjective reality	Moral, ethical and emotional space (altruism), social reality	Social and cultural place and space, social reality
Aim	Transfer existing knowledge, produce behavioral change in desired direction	Stimulate thinking, develop capacity and skills to learn better, learn new roles and behaviors	Enhance creativity, innovation, construct knowledge	Become self-actualized, mature, autonomous, increase acceptance, tolerance for others and nature	Create new knowledge for the benefit of humanity
Focus	Develop skills, focus on behavior, responses on stimuli	Increase thinking capacity of students, focus on how they organize new information	Develop skills and competencies of learners, how they interpret and apply new information and knowledge	Enhance human values, self-actualization	Utilize diverse, network knowledge
Source	Data, data analysis and processing	Data and information processing, modelling (application systems, industrial robots)	Information and knowledge (decision support systems)	Knowledge and intelligence (AI, humanoid robots)	Human intelligence and wisdom
Actors	Sender – receiver, trainers, managers, knowledge providers	Students, teacher, lecturer, engineers, scientists	Learners, knowledge seekers, scientists, innovators, managers	Learners, activists, NGOs	Learners, leaders
Actions	Giving instructions, stimulating, and regulating (reward, punish), positive and negative reinforcement	Providing models, frameworks, concepts, lecturing, learner builds and applies knowledge	Innovating, constructing, and applying knowledge based on previous experience	Collaborating, socializing	Connecting, collaborating, communicating, utilizing network knowledge

Outcomes	Intended skills, change in behavior	Industrial robots replacing manual work and processes, change in thinking, change in goals	Supporting human thinking and decisions, change in assumptions and believes	Adaptive systems, flexibility, AI replacing human service work, reflecting on how we learn, understanding the context	Synthesis, technology augment human practices, change in life, reflecting on how we learn
Field of Science	Natural sciences, mathematics, physics, chemistry, biology	Robotics, engineering, computer sciences, information sciences	Psychology, philosophy	Social sciences, sociology, history, (bioengineering, trans-disciplinary development)	Convergence of natural and social sciences (e.g., on-line education, on-line banking, telemedicine)

(source: author)

Summing up, though learning is seen differently under different paradigms it does not mean that the learning approaches cannot be complementary to one another. Learning theories are dynamic. They are changing and progressing continuously, and they are open to new assumptions. Learning theories are interrelated and they overlap. They are multidisciplinary as they have their roots in several disciplines.

Next, I will focus on second and third order learning approaches (i.e., social constructivism, humanism, and connectivism) because they could lead to change and new knowledge. Pollard with Filer (1996, p. xiii) write that “the emphasis of social constructivism is on the ways in which learning is influenced by culture and by interaction with others ... individual learners are seen as being active in such processes, constructing understanding and ‘making sense’ of new experiences and challenges”. Next, I will briefly discuss three types of social learning such as the experiential, collaborative, and transformative learning.

3.3.1. Experiential Learning: According to Kohonen, Jaatinen, Kaikkonen, and Lehtovaara (2001, p. 30), experiential learning theory, developed by Kolb (1984) (cf., Kolb and Kolb, 2005), has four characteristics:

1. learning is the process of creating knowledge through the transformation of experience in which the learner is actively involved,
2. learning is a continuous process that is grounded in experience (i.e., knowledge and skills learned in one experience will help to understand the situation in next experiences),
3. learning requires the resolution of conflicts between dialectically opposed modes of grasping and transforming experience, and
4. learning is a holistic process of relating to the real world.

3.3.2. Collaborative Learning: One social learning approach is collaborative learning, where knowledge emerges through discussions, active dialogues among the learners while working in groups to achieve a shared understanding. Collaborative learning is an iterative process during which knowledge is constructed (Jakubik, 2008).

One key goal of collaborative learning is to enhance the critical thinking of the learners by questioning existing solutions and assumptions and by creating new ones (cf., double-loop learning). Knowledge seekers take an active part in the learning process and they take responsibility for their own learning. In this process anyone of participants could take the role of knowledge provider or knowledge seeker. These roles could be taken dynamically. Collaborative learning has different forms such as investigative learning, progressive inquiry-based learning, project-based learning, problem-based learning.

3.3.3. Transformative learning: In transformative learning (cf., Boisot, 1999, S learning) the learner reflects on the insight and makes a conscious decision to act. Because this learning is influenced by the living social cultural context and time - where the agent, its activity, and the world are integrated in practice - it could be considered as situated learning (Lave and Wenger, 1999). According to Mezirow (1991) and Kohonen, *et al.* (2001, p. 18), transformative learning has two dimensions. First, the meaning perspective that consists of generalized orienting predispositions and second, the meaning scheme that is a cluster of specific attitudes, values, beliefs, and feeling where critical reflection and action are essential. For Mezirow, action includes:

making a decision, making an association, revising a point of view, reframing or solving a problem, modifying an attitude, or producing a change in behavior ... Action in transformation theory is not only behavior, the effect of a cause, but rather ‘praxis’, the creative implementation of a purpose. (Mezirow, 1991, p. 12)

Learning as a meaning making process leads to knowing, which is a state of understanding our concrete experience, our social cultural situation, and ourselves. How does it happen? I concur with Wenger (2005) saying that learning means *becoming* an “insider”, “moving towards the center of the community”. Similarly, Brown and Duguid (1991) argue that:

The central issue in learning is *becoming* a practitioner not learning *about* practice. This approach draws attention away from abstract knowledge and cranial processes and situates it in the practices and communities in which knowledge takes on significance. (Brown and Duguid, 1991, p. 48)

In the network economy, where culturally, socially, physically different people are highly connected, the attitude of learning from and about others and learning competency are vital in developing and sustaining positive relationships across difference (Davidson and James, in Dutton and Ragins (Eds.), 2009, pp. 137-158). Davidson and James argue that “the change in attitudes and behaviors that results from learning is indicative of one’s willingness to be open and receptive to new information, ideas, perspectives, or people - being open to difference” (Ibid., p. 147). They suggest five core learning skills that contribute to learning competency. Individual, self-focused skills are: (1) processing emergent emotions and (2) reframing conflicts, differences. Social skills are: (3) sharing reactions with the other, self-disclosure during the relationships, (4) inquiry, asking questions, asking about rationales, exploring assumptions, goals, and interests of others, (5) giving and receiving feedback. Concurring with them, I argue that these skills and learning competency play especially critical role in the humanism and connectivism learning paradigms (cf., Table 1).

In brief, learning involves not only explicit knowledge, but also tacit knowledge that can emerge in collaborative actions, interactions, learning from and about others, finding new ways of doing things, developing new skills by acting in a specific community context, and in questioning, transforming old ways of doing and thinking.

4. How do Cybernetics and Philosophy Relate to Learning?

Cybernetics is a transdisciplinary science. It covers broad range of theories. Learning is one area of studies in cybernetics. Marinescu (2017) argues that:

Cybernetics is concerned with concepts at the core of understanding complex systems such as *learning, cognition*, adaptation, emergence, communication, and efficiency. Cybernetics has been influenced by and, in turn, has applications in fields as diverse as psychology and control theory, *philosophy* and mechanical engineering, architecture and evolutionary biology, or social sciences and electrical engineering. (Marinescu, 2017, emphases added)

Several concepts applied in cybernetics (e.g., behavior, purpose, feedback, feedback-loops, learning, pattern recognition, adaptation, regulation) are closely related to learning as well. Especially nowadays, cybernetics focuses on artificial intelligence (AI), machine learning (ML), and deep learning (DL).

Cybernetics with its systematic and analytical approach contributes to explaining learning processes. Smith and Smith (1966), already in 1960's wrote about the cybernetics principles of learning. They emphasized the role of the environment, space, context, feedback, patterns, and the design of learning situations (cf., Wenger, 2005; Lave and Wenger, 1999). They write:

Learning is more than the openloop forming of new stimulus-response associations--it is a *process* of reorganization of sensory *feedback* within a closed loop, or *pattern*, which increases the learner's level of control over his (*sic.*) own behavior and the stimuli in his *environment*. Thus learning is *space-organized* rather than time-organized. (Smith and Smith, 1966, emphases added)

In the literature, there are discussions about first, second, and third order cybernetics. The first order cybernetics assumes that reality is an “out there” reality, external to the observer (i.e., objective ontology). The second order cybernetics claims that the reality is perception, it is subjective, it is a socially constructed reality (i.e., subjective ontology). The second order cybernetics assumes multiple realities, that are different for each observer. To my understanding, third order cybernetics (and higher order cybernetics) includes both the first and the second order cybernetics.

Learning in the *first-order cybernetics* means that the knowledge provider is an outsider of the learning process, who observes and regulates (i.e., positive, or negative reinforcement) the process (i.e., stimuli and response) to achieve a pre-defined objective. This type of learning is the behaviorism learning approach. Learning in the *second order* means that individuals construct their own meanings from their experiences, background, context, social economic status, and so on (Smith and Smith, 1966). Cognitivism, constructionism, and humanism learning paradigms could be related to the second order cybernetics. Learning in the *third order cybernetics* could mean that the learning outcome is changing together with the emergence of the context, learning environment, and learning emerges based on who the participants are in the learning process. In my view, it is like the connectivism learning paradigm (see *Table 1*).

In brief, cybernetics with its analytical, systematic view of learning can contribute to explaining learning as a complex phenomenon. Next, I discuss why we need philosophy to understand learning.

In 2019, in an interview with Hui, Hong Kong philosopher, cybernetics for

the 21st century has been discussed (Lovink, 2019). Here, Hui mentions that: “In 1966, journalists from *Der Spiegel* asked Heidegger what comes after philosophy. He replied: cybernetics.” Heidegger, a German philosopher who has predicted that *cybernetics would replace philosophy* “but there is no sign of this so far, at least not in the Western academic world. Philosophy of technology is a marginal subdiscipline at best” (Lovink, 2019, emphasis added). Therefore, it is not true that philosophy is dead after cybernetics as a science has been developed.

Philosophy has contributed to understanding the mind, thinking, and learning from the human perspective. Why do we learn? What is the meaning of learning? How do we learn and unlearn? How do we explore new ideas? How do we apply our learning in an ethical way? How do we share our knowledge and wisdom? What values do we teach our children? These questions are eternal human concerns.

One can argue that other social sciences such as psychology, sociology and education have also contributed to understanding learning. This is undoubtedly correct. However, it is philosophy that is the foundation of all social sciences. Philosophy helps us to understand and remember *what it means to be human*. We cannot forget about it even if we will be surrounded by industrial and humanoid robots that serve us, help us in our work and life. We appreciate the development of technology, information systems, Internet, and all achievements in AI advancements. These achievements of humanity are extremely important, but they will not replace our moral values and ethical decisions in applying them.

Why does learning need both cybernetics and philosophy? I concur with philosopher Hui who argues that the dichotomy between natural and social sciences should end and the gap between cybernetics and philosophy should be closed:

researchers from different disciplines have to think together. We have to take this *opportunity to rethink the existing disciplines and allow new thoughts to flourish*. ... We need to rethink the education system and the existing divisions of disciplines that have been adopted in the past several decades. It is probably not possible to bridge the gap between already existing disciplines, since when you attempt to bridge a gap, this gap is at the same time maintained. One possibility is to create a new discipline in which this gap no longer exists. ... It seems to me of *ultimate importance to rearticulate the relation between philosophy, technology, and geopolitics* today, which I am afraid remains largely unthought. (Lovink, 2019, emphases added)

Based on the study of the literature and on the analyses and discussion of learning, learning paradigms (cf., *Table 1*), cybernetics, philosophy, and learning (*Table 2*), the framework “Interplay between cybernetics and philosophy as an essential condition for learning” (*Figure 1*) has emerged.

Table 2. Learning, Cybernetics, and Philosophy

	Learning Paradigms				
	Behaviorism	Cognitivism	Constructivism	Humanism	Connectivism
Learning	Single-loop (training, learning equals behavior), task-based learning	Double loop (learning to learn), deep thinking, memory and organization	Double loop (learning to learn), active collaborative learning, problem solving, critical analysis	Triple-loop (learning to learn to learn), transformational learning, humanistic learning, experiential learning	Triple-loop (learning to learn to learn), life-long learning
Cybernetics	First-order, objective reality (ontology)	Second-order, subjective reality (ontology)	Second-order, reality (ontology) and knowledge (epistemology) are social constructs (e.g., participative action research)	Second-order, observer is an insider, part of the process (e.g., Appreciative Inquiry)	Third order (?)
Philosophy	Body, sensation (as unorganized stimulus), action-reaction	Mind, thinking, generalization, perception (as organized sensation)	Mind & Body, perceptions, and judgement (as organized perception), science (as organized knowledge)	Values, norms, ethics, love, care, courage, beauty, nature, self-others, equality	Wisdom (as organized life), practical wisdom, truth, education

(source: author)

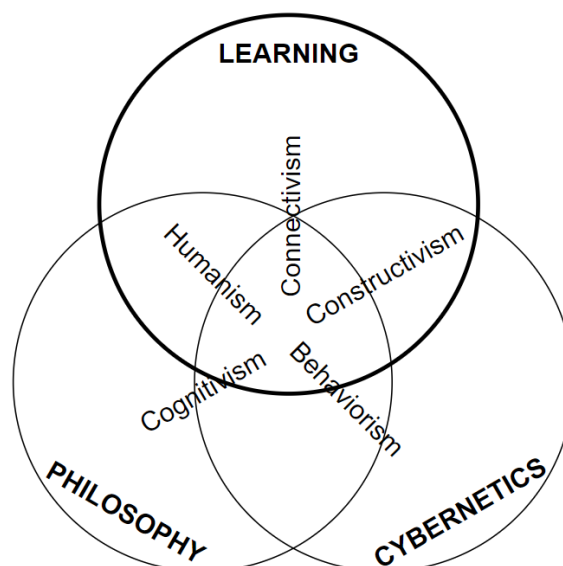


Figure 1. Interplay Between Cybernetics, Philosophy as an Essential Condition for Learning

(source: author)

In brief, with this paper, my aim was to summarize the interrelatedness of cybernetics and philosophy as an essential condition for learning. With *Table 2*, and *Figure 1* I showed how learning, cybernetics and philosophy relate to each other and to the five learning paradigms.

5. Conclusion

Currently, hot topics of cybernetics are artificial intelligence (AI), machine learning (ML), deep learning (DL). Nonetheless, when we think about cybernetics we often think about natural sciences, mechanical engineering, software engineering, mathematics and so on. We think about fields of sciences that aim to *explain* complex phenomena of our life for example the process of learning (Marinescu, 2017).

My paper was also motivated by a more general, emerging trend, namely by the continuing integration of natural sciences (i.e., mathematics, statistics, chemistry, physics, biology, bioengineering, bionics, engineering, robotics, cybernetics, etc.) and social sciences (i.e., history, anthropology, philosophy, sociology, psychology, economics, education, management, leadership, etc.). Boutellier, Gassmann, Raeder, Dönmez and Domigall (2011, p. 2) write that natural sciences seek to discover the laws that rule the world, and they focus on “the natural and not on the social world”. They refer to Ledoux (2002), who defines natural sciences as “disciplines that deal *only* with natural events” (Ledoux, 2002, p. 34, emphasis added). I, however, strongly disagree with this definition. Natural sciences are increasingly turning towards understanding human beings, human behavior, human learning in the social world, to create humanoid robots to replace parts of human work, to create AI to help decision making.

Furthermore, Boutellier *et al.* (2011) write that the difference between natural and social sciences lies in their subject of study. According to them, social sciences focus on individuals, groups, society, social interactions, and coexistence. However, I argue that topics in social and natural sciences (e.g., philosophy and cybernetics) started to converge. Social sciences focus on *what* it means to be human, on finding out *what* features of HI (e.g., learning), can be imitated and replicated by AI, ML and DL. On the other hand, natural sciences increasingly focus on *how* to imitate and replicate features of human intelligence (HI) by AI and human learning by ML and DL. I argue that in the creative network economy, the subject of study in natural and social

sciences is converging, which makes the topic of my paper, I believe, interesting, contemporary, and needed.

In this brief paper, I sought to developed arguments why interplay between cybernetics and philosophy is a necessary condition for learning. My main points are the followings:

1. Learning is a complex phenomenon that needs *both* understanding and explanations (cf., Boisot, 1999; Lave and Wenger, 1999; Kolb and Kolb, 2005; Wenger, 2005).
2. Cybernetics aims to *explain* complex phenomena such as learning (cf., Marinescu, 2017) and philosophy aims to *understand* what being human means, purpose, values, norms, ethics of learning (cf., Durant, 1954; Russell, 1954; Jeffreys, 2019).
3. Cybernetics is a transdisciplinary science, it is open to integrate different domains of knowledge (cf., Rosenblueth, Wiener, and Bigelow, 1943; Wiener, 1948).
4. Philosophy has a long history (cf., Durant, 1954; Russell, 1954). It has developed important theories and concepts related to human mind, thinking, knowledge, learning that should be contemplated in cybernetics.
5. Philosophy should be integrated into cybernetics as it provides the guiding principles, meanings, ethical objectives for learning (cf., Schwarzman in Jeffreys, 2019; Hui in Lovink, 2019).
6. Interplay between cybernetics and philosophy contributes to bridging the gap between natural and social sciences (cf., Hui in Lovink, 2019).
7. Interplay between cybernetics and philosophy is closing the gap between applied and basic research.

To conclude, I strongly believe that both cybernetics and philosophy are needed to explain and to understand learning as a complex human phenomenon. Cybernetics with an analytical approach and systematic analyses explores and explains learning processes. However, we need philosophy to synthesize and give meaning to our understanding of learning.

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