Co-becoming: How to shape desirable futures in highly uncertain times

On learning and the role of futures literacy in a VUCA world

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Abstract eng

Our world has always been changing, sometimes rather gradually, at other times more radically. In today's world, we see both tremendous challenges and potential to shape it in a new and desirable direction. In almost every domain of our lives we are challenged by high levels of volatility, uncertainty, complexity, and ambiguousness (“VUCA-world”). In this context of profound technological, digital, social, and political changes and transformations, we have to ask ourselves: what is it that makes us humans human? What does a meaningful and joyful relationship between humans, technology, and the future look like? How do we meet the challenges of increasingly blurred borders between humans and technology in a more human(e) manner? Which skills and mindsets do we need to deal with our uncertain and unpredictable future in order to co-shape it in a purposeful and thriving manner?

In this paper we will explore the challenges of a VUCA-world and take a closer look at what their implications are for our educational systems. We will develop a future-oriented perspective on learning that is based on the concept of *learning as co-becoming with the world*. We will discuss that this requires futures literacies, such as sense-making capabilities,

a constructivist epistemology, systems thinking, designerly ways of thinking and making, and most importantly, a capacity to identify and make use of future potentials.

We will both discuss theoretical foundations (e.g., from cognitive science/enactive cognition approaches, systems thinking, etc.) and practical implications, skills, mindsets, and a concrete case study illustrating these concepts.

Abstract de

Titel:

Wie wir wünschenswerte Zukünfte in unsicheren Zeiten gestalten können

Über Lernen und die Rolle von Futures Literacies in einer VUCA-Welt

Abstract:

Unsere Welt hat sich schon immer verändert, manchmal eher in kleinen Schritten, manchmal aber auch radikal. In der heutigen Welt sehen wir sowohl enorme Herausforderungen als auch das Potenzial, unsere Welt in eine neue und wünschenswerte Richtung zu gestalten. In fast jedem Bereich unseres Lebens erfahren wir durch ein hohes Maß an Volatilität, Unsicherheit, Komplexität und Ambiguität ("VUCA"-Welt) immer neue Herausforderungen. In diesem Kontext tiefgreifender technologischer, digitaler, sozialer und politischer Veränderungen und Transformationen müssen wir uns fragen: Was macht uns in solch einer Welt zum Menschen? Wie sieht eine sinnvolle Beziehung zwischen Mensch, Technologie und Zukunft aus? Wie begegnen wir den Herausforderungen der zunehmend verschwimmenden Grenzen zwischen Mensch und Technologie auf eine menschlichere(re) Weise? Welche Fähigkeiten und Denkweisen brauchen wir, um mit unserer ungewissen und unvorhersehbaren Zukunft umzugehen, um sie mit Bedeutung und fruchtbar zu co-kreieren?

In diesem Beitrag werden wir uns mit den Herausforderungen einer VUCA-Welt auseinandersetzen und die Implikationen für unsere Bildungssysteme näher beleuchten. Wir werden eine zukunftsorientierte/gestaltende Perspektive auf das Lernen entwickeln, die auf dem Konzept des Lernens als “co-becoming” mit der Welt basiert. Wir werden erörtern, dass dies Zukunftskompetenzen (“futures literacies”) erfordert, wie z. B. sense-making eine konstruktivistische Erkenntnistheorie, Systemdenken, gestalterische Denk- und Gestaltungsweisen sowie die Fähigkeit, sowie Zukunftspotenziale zu erkennen und zu nutzen.

Wir werden sowohl theoretische Grundlagen (z. B. aus der Kognitionswissenschaft/enaktive Ansätze, Material Engagement Theory, Innovationsstudien, usw.) als auch praktische Implikationen, Fähigkeiten, Denkweisen und eine konkrete Fallstudie zur Veranschaulichung dieser Konzepte diskutieren.

1 Status quo of our world and educational systems

We are living in the age of Anthropocence in which we experience that our own past actions have an increased impact onto our current conditions. Contemplating the current state of our world, we can identify several characteristics, paradoxes, as well as challenges and

opportunities (e.g., Miller 2015; Peschl et al. 2019; Harari 2018; Teece et al. 2016, and many others) that have to be considered in the context of what is referred to as “VUCA world” (Baran and Woznyj 2020; Bennett and Lemoine 2014; Johansen and Euchner 2013, and many others); i.e., an environment impacted by high levels of volatility, uncertainty, complexity, and ambiguity, as we experience them today in almost all areas of our lives. Let’s have a look at a selection of the most important issues:

1. *Continuity vs. discontinuity*: While in past centuries events and even changes were rather predictable and showed a mostly continuous dynamics, we are confronted with increased levels of discontinuity and disruption (e.g., Hopp et al. 2018) nowadays.
2. *Although humans are capable of identifying (dis-)continuity, discontinuity is inherently unknowable*: It lies in the nature of discontinuity and disruption that it is unknowable in advance (Sarasvathy et al. 2003). This is mostly due to the complexity, speed, and exponentiality of today's technology driven environment.
3. *Lack of radically future-oriented skills and mindset*: Considering discontinuity almost omnipresent, it turns out that classic (statistical, bounded rationality, past knowledge-driven) approaches to prediction do not work any longer in a reliable manner (e.g., Felin et al. 2014; Kauffman 2014; Grisold and Peschl 2017; Meadows 2001; Tsoukas and Shepherd 2004, and many others). We need approaches that are oriented toward and driven by the future.
4. *Learning starts with not knowing*: Tapping into an unknown/unknowable future implies having to acknowledge that such a learning process involves an approach of “not knowing”. This, in turn, means that we have to give up our pre-existing conceptions of a future and adopt an attitude of *radical openness*.
5. *Lacking capacity of anticipating what does not yet exist*: Humans have a strong cognitive drive seeking to understand what already exists in the world. However, when it comes to future-issues, our cognition heavily relies on this knowledge from past experiences (Hohwy 2013; Clark 2016).The challenge is to engage in the above-mentioned openness allowing us to develop a sense of what is “not here yet”, of what wants to emerge, or what “wants” to come into being (e.g., Scharmer 2016; Peschl 2020). In other words, as we will show in this paper, we may develop a capacity for sensing future potentials and novelty which requires a whole new set of cognitive abilities and skills as well as epistemological attitudes and mindsets.
6. *(Questioning) The primacy of control*: Our technology-driven world seems to be dominated by an attitude of control both in an epistemological and ontological sense. I.e., we are using technologies (in the broadest sense of extending human capabilities and tool-mediated social practices; Cole and Derry 2005, p 211) mainly for shaping and manipulating our (material, social, cognitive, etc.) world according to our own—sometimes egoistic—ideas and goals. The underlying mindset assumes that, even if we have positive intentions, our technologies can control both our environment and the effects of our own actions. Looking at our current status of the world, we can see that such a controlling attitude has not always led to a better world.

   One way out of these dynamics is to question the primacy of a controlling attitude and seek alternatives that are more sensitive and sustainable with respect to the goals, purposes, and means of changing and transforming our environment. An approach of co-becoming and correspondence with reality (e.g., Ingold 2013; Malafouris 2014; De Jaegher 2019; Peschl 2019a) will prove crucial in this context.

Summarizing these observations and issues, we can conclude that we are largely *unprepared* for dealing with such a technology-driven, high-speed VUCA world both on an individual and an institutional/organizational level. This does not necessarily imply that we are unwilling to change that; from both a cognitive (e.g., Hohwy 2013; Clark 2013) and organizational (e.g., Tsoukas and Chia 2002; Felin and Zenger 2017; Brook et al. 2016; Grisold and Peschl 2017; Peschl 2019; Teece et al. 2016) perspective, it can be shown that we do not have the necessary dispositions, (cognitive and organizational) capabilities and tools, mindsets, or education/training to cope with such a disruptive environment in many cases.

Due to these radical and disruptive dynamics and changes, we are confronted with turbulences and disorientation in almost every domain of our lives. However, "both individually and collectively, we can learn how to have change happen through us, not to us! But we must find out how to look, listen, and learn—to really see and hear and understand the underlying patterns of change so that we can distinguish between those dynamics that are destabilizing and those that forward the thrivable futures of protopia[1]." (Laszlo 2018, p 385)

Outline of this paper

This paper is structured as follows: having discussed the challenges and opportunities of our VUCA-world above, section 2 will explore the cognitive foundations of humans being confronted with such environments in order to understand the educational needs and necessary skills for dealing with them. In section 3 we will develop a "conceptual toolbox" discussing various theoretical frameworks and concepts that are a necessary prerequisite for becoming a future-oriented and future-making person. This leads us to the concept of futures literacy (section 4), where we will derive concrete principles, skills, and mindsets from our theoretical concepts enabling our cognitive capabilities to shape the future in a beneficial and purposeful manner. In section 5 we will present a case study in which these insights are applied and illustrate how they might lead to a disruptive and future-driven innovation. The final section discusses key findings and implications for the field of the future of education.

2 Humans as cognitive systems: sense-making, social interaction, and future-oriented action

In order to be able to find an answer to these challenges and to address educational issues, it is—in a first step—necessary to take a closer look at what is our understanding of humans (as cognitive systems) confronted with such a VUCA environment. We propose to adopt a cognitive science perspective because cognition is intrinsically about making sense of an unpredictable and complex world as well as acting in and shaping it.

More specifically, this means that among many other (cognitive) capacities, such as perceiving and understanding complex phenomena, making use of and producing language, reasoning and decision making, engaging in a world that is driven by cultural practices, by artifacts and technology, etc., four characteristics seem to be essential: 1. humans are

[1] See, for instance here for a recent description of the protopia framework: https://medium.com/protopia-futures/protopia-futures-framework-f3c2a5d09a1e

beings trying to *make sense of the world*, 2. we are *social beings*, 3. we are *creative beings* (in the sense of creating novelty/innovation in a future-oriented manner), and 4. we are having an *impact on our environment* by shaping and transforming it (i.e., we are "future-making beings" (Wenzel et al. 2020)). Hence, if we are interested in the future of education, we have to clarify first what it means that humans are social and creative by anticipating their future.

We consider cognitive science as the appropriate discipline in which these phenomena are addressed in a profound manner across various disciplines. For our context, the *4E/enactivist* approaches in cognitive science (see below for an explanation) are best suited to explore these issues, as they not only adopt a natural science and neuroscientific perspective, but also include a broader humanistic stance (e.g., Varela et al. 2016; Froese & Di Paolo 2011; Jaegher & Di Paolo 2007; Rowlands 2009; Newen et al. 2018).

Thinking with our brains, bodies, and the environment

From an enactivist cognitive science perspective, humans are regarded as cognitive and living systems. This implies that we have to consider the underlying biological processes and functionalities, as well as more complex phenomena, such as social processes, production of artifacts, cultural processes, creativity, etc. Consequently, cognition is not some abstract phenomenon taking place in our brain only; rather cognition is embedded in material (biological) processes and has to be understood as an *embodied* process. It is distributed all over our body, we are "thinking with our body". Moreover, cognition is not only limited to our bodies, but encompasses and is *embedded* in the environment as well. We do not only interact with our environment via our sensory and motor systems, but cognitive processes *extend* to the environment, we "think with our environment". We shape, design, and create our environments and, in turn, these environments affect our thinking and actions, they design back on us (Willis, 2006). By doing so, we *enact* ourselves and our environment in a recursive feedback-loop.

In brief, that is what is referred to as the *4E approach* in cognitive science; the 4 "E"s stand for cognition being embodied, embedded, extended, and enacted (Clark 1999, 2008; Clark & Chalmers 1998; Varela et al. 2016; Newen et al., 2018, and many others). As living systems, humans are enacting and shaping their (internal and external) world by following their own autopoietic dynamics (e.g., Maturana & Varela 1975, 1980; Razeto-Berry 2012); thereby they develop their *autonomy* in a continuous process of *becoming* by *interacting* with their environments.

What happens in these processes of interaction? A cognitive system engages in a process of (mutual) coupling with the environment in which the it takes some control over the environment. The stimuli originating in the environment are perceived by the sensory systems and conceived of as *perturbations* (Maturana & Varela 1975, 1980): they are interfering with and perturbing the homeostatic equilibrium of the cognitive system. The cognitive system tries to *make sense* of these environmental stimuli by ascribing meaning to them. However, this "meaning" or significance of a perturbation from the environment is *not* solely determined by the environment, but also by the cognitive system itself. Hence, meaning can neither be found in the environment itself nor in the living system itself. Rather, meaning emerges in the relational domain of the interaction between these two systems (i.e., the human and his/her environment). Meaning is *enacted* in a process of *co-creation*, *co-determination*, and interaction (Newen et al., 2018). *Sense-making* (apart from adaptive

capacities) can be considered the most basic process of life and cognition. It is "... the enaction of a meaningful world by an autonomous system." (Froese & Di Paolo 2011, p 9)

Participatory Sense-making—from cooperating with the world to cooperating with others

Hence, humans "actively participate in the generation of meaning in what matters to them; they enact a world." (De Jaegher & Di Paolo 2007, p 488) This is achieved by *actively engaging* with the world in a process of (co-)creating meaning. What we have described as "interaction" with the world goes far beyond a "neutral" (in the sense of non-intentional) interaction process. Rather, it is an active process of *cooperation* with the world, in order to make sense of it and, by that, sustain the process of being alive (in a biological, epistemological, as well as social sense).

Apart from interacting with nature, objects, or artifacts, humans also interact with other humans. They engage with each other and establish a *social* domain as a form of social coupling (mediated, for instance, via language or the use of other symbol systems/artifacts). This expands our understanding of sense-making to what is referred to as *participatory sense-making* (De Jaegher & Di Paolo, 2007; De Jaegher 2019).

In this case, sense-making is no longer an activity of an individual cognitive system interacting with its (non-cognitive) environment, but extends to a cooperative process of two or more cognitive systems or even a whole social system, such as organizations or societies giving rise to organizational processes/structures or cultural processes (Maturana & Varela 1980; Newen et al. 2018; Goldspink & Kay 2003; Malafouris 2013; Kay 2001). Participatory sense-making can be considered a process in which two or more coupled cognitive systems participate in each other's activities of sense-making. As a metaphor, think of a couple that is dancing together: humans engage with their environment (including also another cognitive system) in a semi-stable emergent pattern of interactions/behaviors and both establish a *joint/single transient system*, a new unity emerges. Both systems are autonomous, however, in their interaction they perturbate/interfere with each other in such a way that they establish a stable pattern of behaviors/interactions; they become "one", a single system over a period of time. As we will see, they co-become with the world as well as with the emerging future.

3 A conceptual toolbox for learning how to shape desirable futures

What are the implications from these considerations concerning human cognitive systems and their interaction with social and technological environments in the context of the challenges from a VUCA world? What are necessary consequences for developing alternative cognitive capacities, skills, and mindsets as well as for the design of future educational approaches and systems capable of dealing with these high levels of uncertainty and complexity? Both experience and scientific evidence show that the traditional pedagogical approaches will no longer suffice (e.g., UNESCO 2021; OECD 2018; Miller 2018; Peschl 2007).

Rethinking our relationship to/with the world

One of the major necessary shifts in our cognitive capacities and educational systems concerns the issue of having to radically question and reconsider our relationship to and with the world—both ontologically and epistemologically. As has been discussed in our

theoretical considerations about extended and enactive approaches to cognition above, cognitive systems are always embedded in their environments in a continuous recvursive process of sense-making and making. As a consequence, we have to engage in a relational, interaction-driven, existential, and *cooperative* relationship with the world rather than in a relationship of primarily knowing or learning "about" it, (abstractly) knowing it, and controlling it. This novel relationship was also identified as a key imperative in a recent UNESCO report on the future of learning and education:

„...we have recognized that we *live and learn in a world*. Our pedagogies no longer position the world 'out-there' as the object we are learning about. *Learning to become with the world* is a situated practice and a more-than-human pedagogical collaboration… By focusing on worldly relations and encounters as inherently pedagogical, acknowledging that it is not only humans that teach and learn, and by mobilising human *curiosity to learn from what is already going on in the world*, we… make the shift from only ever learning about the world to *learning with it*." (UNESCO 2021, p 7 [emphasis added])

Hence, the challenge of education and learning is to engage in a process of *co-becoming with* the world rather than just learning *about* the world. This has a social dimension as well, as it implies not only a co-becoming with the "non-living world", but also with other cognitive systems/humans. Participatory sense-making (De Jaegher and Di Paolo 2007) is the foundation for such a process which ultimately leads to co-creating/co-making the world as a socially enacted environment. As we have seen in our theoretical considerations above, we suggest to go even one step further: in order to contribute to shaping a thriving future in a VUCA world this process of co-becoming also has to encompass the aspect of *anticipation* and *future-making* (Wenzel et al. 2020).

How can we educate ourselves and our young generation to address these challenges? Which skills, cognitive and social capabilities, mindsets, as well as epistemological attitudes do we need for such a future-driven perspective of education? What are possible conceptual and educational frameworks that are implicitly or explicitly based on or at least compatible with the theoretical considerations from the previous sections? Of course, this is a huge field and many books, papers, and studies have been written about this topic (e.g., Gleason 2019; Harari 2018; The Lisbon Council and Accenture 2007; Miller 2018; OECD 2018; Schneider and Kokshagina 2021; Ingold 2013; UNESCO 2021, and many more). However, there are only a few approaches that bring together these state-of-the-art concepts in an interdisciplinary manner and also incorporate the latest findings from cognitive science and research in innovation and learning. Among other conceptual frameworks, the following approaches and mindsets seem to be essential for our context.

Knowing and acting: Constructivist approaches

According to one of its founders, E.v.Glasersfeld (1989, 1995), (radical) constructivism draws on ideas from G.Vico, J.Piaget, second order cybernetics, H.Maturana, F.Varela, and many others and is based on the following premises: Knowledge is the result of an active process of *construction* rooted in our cognition. Hence, knowledge does not necessarily reflect or map the structure of the external world through more or less passive perceptual processes, nor is it objective or "justified true belief", but can be seen as a "capacity to act" (Adolf and Stehr 2014, p 2).

Moreover, these construction processes in our cognition lead to knowledge that is a dynamic process rather than a static "entity" and that has the aim to generate functionally fitting/viable behavior rather than being "about" the world in the sense that it is true in that it corresponds

to an objective reality. Constructivism is an epistemological stance that is not only one of the foundations for the enactivist/4E approaches in cognitive science having been discussed above, but has far-reaching implications on our understanding of language, communication, meaning, learning, and dealing with the (social) world in general.

Ecosystems: Systems (and eco-systems) thinking approaches

Ever since Bertalanffy (1968) published his influential work on systems theory this field has rapidly developed in a variety of areas. To name a few, systems thinking has entered the fields of engineering, biology, chemistry, cognitive science, organizational theory and many more. Systems thinking comprises various skills and capacities of being able to understand, predict, and design complex (adaptive) systems ("CAS") in a complex (VUCA-)environment; i.e., systems that are composed of a large number of highly interacting subsystems/parts leading to emergent complex behaviors. These parts may be physical/material, they can be humans, objects, products, as well as non physical, such as knowledge, beliefs, practices or behaviors. Systems thinking is not only about describing the behavior of CASs as symptoms (on a superficial level), but about exploring and identifying their underlying structures and principles offering explanations in a broader (systemic) context.

One of the key characteristics is that such systems do not follow linear dynamics and classic Newtonian cause-effect mechanics (e.g., Kauffman 1993, 2014, 2016; Meadows 2001; Mitleton-Kelly 2003; Nicolis and Prigogine 1989; Weinberg 2011, and many others) and cannot be understood or predicted by reducing them to their interacting parts. A reductionist analysis of the parts of a CAS has to be replaced by an approach of synthesis and explaining what the role of these parts is in the larger system. „Systems mindset, therefore, requires a shift from disconnections to interconnectedness, from linear to a circular way of thinking, from silos to emergence, from parts to wholes, and from isolation to relationships. Systems mindset brings the ability to see problems in their wider context and in terms of their underlying structure." (Broo 2021, p 4).

Making: designerly ways of thinking, knowing, and doing

While systems thinking has a strong—though not exclusively—focus on analyzing and understanding complex (adaptive) systems, its components and their interactions, *design* shifts attention to *shaping* those components and to the construction of novel structures or artifacts: design focuses on how things ought to be and on the creation and making of things that do not yet exist as well as on shaping human experience or even social systems (e.g., Cross 2001; Krippendorff 2011; Simon 1996). While scientists try to be as objective as possible and exclude themselves as causes from the phenomena they study and observe, "designers intend to cause something by their own actions, something that could not result from natural causes, defying causal explanations in effect." (Krippendorff 2007, p 1382)

Hence, designers are concerned with the *creation of the artificial* by applying a specific form of thinking and inquiry; it is referred to as "*designerly ways of knowing/thinking*" (e.g., Buchanan 2019; Cross 1982, 2001; Dorst 2015; Schön 1983; Simon 1996, and many others). However, designerly ways of thinking should not be confused with the concept of design thinking having been propagated by, for instance, T.Brown (2009), IDEO, or IBM (e.g., Lee 2021). Although they share the same name and some of their characteristics, the original concept having been coined by Cross (1982, 2001) and other design theorists goes far beyond being a methodology for human-centered and user need-driven design. Designerly ways of thinking and knowing is a conceptual framework that comprises both a

deep theoretical and philosophical foundation and concrete skills, practical tools, and mindsets and introduces an art-based way of thinking. As we will see, it also shares some elements from systems thinking, making it a powerful tool for dealing with the challenges of today's VUCA world.

First of all, design is not (primarily) about an aesthetic approach of “making things beautiful” or functional (Brassett and O´Reilly 2015, p 37). Rather, it is a cognitive capacity and a way of thinking and doing that focuses on shaping the environment (be it physical objects, artifacts, processes, services, (user-)experiences, social systems, organizations, etc.) in a meaningful and purposeful manner. Interestingly, the Latin roots of design go back to the words of “de-” and “signare”, and mean making sense of something and giving something a (novel) meaning. Hence, design is a process of making sense of things (Krippendorff 1989, p 9) and can be understood as a core cognitive activity having been discussed in the context of the enactivist approach above.

As is shown by Peschl and Fundneider (2015) or Verganti (2006, 2009), there is a close relationship between *design* and *innovation* when it comes to translating a novel idea or knowledge into a concrete artifact. From such a perspective, any innovation process is a design process leading to meaning-making and/or future-making (Wenzel et al. 2020) in the form of an artifact that embodies new meaning and contributes to a desirable future. It brings something into being that is “not yet” (Bloch 1986), that is/was still in the future.

Artifacts as results of design and innovation processes — designing meaning and purpose

Before having a closer look at what it means to design or innovate for the future and how we can learn from the future (see section below), we have to be clear about the “object” of these processes: *artifacts*. Generally speaking, an artifact is an object that has been intentionally made or produced for a specific purpose (Risto 2011). In other words, there has to be one or more “authors” or cognitive agents (“creative minds”) who are responsible for bringing about this artifact. As such, an artifact is a rather general concept and is not necessarily limited to (artificial/man-made) physical objects, although an artifact is always expressed via some material manifestation.

From an ontological perspective and by following Aristotle, we have to take a look at what the role, the qualities, and characteristics of the material basis of these novel artifacts is and how they come about. Conceptually speaking, Aristotle (1991a, 1991b) suggests that an object is constituted as a unity or compound of form and matter. Form (formal cause) gives matter (material cause) its determination, its “meaning”, its intelligibility, its “what it is” as well as supports its purpose (final cause). As will be discussed later, any (innovation) artifact has a material basis that has or receives a specific form. This form has its roots in a cognitive system´s knowledge: simply speaking, knowledge/meaning (form) or a “(new) idea” in a cognitive system’s mind is transformed into action/behavior itself shaping matter (i.e., artifacts, environmental structures) according to this knowledge or idea. In most cases, a plan has to be developed that is then executed by motor activities and/or via using more of less complex tools for “engraving” form into matter. In other words, form(al cause) “in-forms” matter and the resulting unity (of form and matter) constitutes a designed object or (innovation) artifact having a specific meaning. This meaning is *embodied* in the artifact. It is, for instance, the artist and his/her idea or knowledge (i.e., formal cause) bringing form to bronze (matter/material cause) and, by this artistic activity (efficient cause), shapes a statue (concrete object). This perspective is referred to as the *hylomorphic* framework and has

been discussed (as well as put into question) widely in various fields (e.g., Ainsworth 2016; Ingold 2013).

Considering this rather general process leads us to an understanding of design (as well as innovation) and designerly ways of thinking and doing that not only clarifies the meaning/sense-making aspect of design, but also opens up a wide field of possible "objects" of design. Krippendorf (2006, 2011), for instance, proposes what he refers to as a trajectory of artificiality or an ecology of artifacts. It spans from a whole range of domains from material objects to immaterial and social structures, behavioral patterns, and even the design of (social) mindsets. He suggests to consider the following dimensions and types of artifacts when being in a design process: (i) Products, (ii) goods, services, and (brand, corporate, etc.) identities, (iii) interfaces, (iv) projects, (v) networks, organizations, and multi-user/stakeholder (eco-)systems, and (vi) discourses.

These 6 domains are compatible with Buchanan's (1992, p 9ff) four orders of design spanning from the design of (a) symbolic and (visual) communications, via (b) material objects and (c) activities and organized services, to the design of (d) complex (eco)systems or environments for various fields in our everyday lives and educational, work, social, or economic contexts. In any case, this implies that, whenever we are engaged in design or innovation processes, we have to keep in mind that they are not only about (novel) physical objects, but have to be considered in a much broader context of the (semantic, social, technological) ecosystems they are embedded in. In other words, we have to start from a systems thinking perspective as outlined above. Rather than focussing only on the material aspects, we should take into account and explicitly design and innovate for the ecosystem and the interactions between its stakeholders and material/technological artifacts. Although these artifacts still manifest in some kind of materiality (e.g., interaction patterns, behaviors, social practices, brand and user-experiences, etc.), they become more and more virtual the further we progress on this trajectory of artificiality. From an educational perspective, designerly ways of thinking require that we have to learn to engage in meaning-making (Verganti 2009), sense-making, socio-epistemic construction processes, etc. rather than exploring material artifacts and technological paths only.

4 Towards futures literacy: Skills and mindsets for shaping desirable futures

Futures Literacy

Given these theoretical concepts, we need to ask ourselves which skills and mindsets as well as educational environments/frameworks are necessary to enable such processes of sense-making and future-oriented thinking and acting. In this context, the notion of *futures literacy* (Miller 2015, 2018; OECD 2018; Peschl et al. 2019; Karlsen 2021; UNESCO 2021) plays an important role. While the classic understanding of literacy focuses on proficiency in reading, writing, or mathematical thinking, more recent forms of literacy concern critical thinking, dealing with technology, social/empathic abilities, etc. (e.g., Karlsen 2021).

Futures literacy goes one step further by claiming that it is an essential (cognitive) capacity to cultivate and educate our *anticipatory* capabilities and that "the imperative is to colonise

tomorrow with today's idea of tomorrow." (Miller 2018, p 21) In many cases, however, these capabilities are mistakenly reduced to planning or setting and achieving goals; they do not go beyond a strategy of extrapolating from the past that is based on the assumptions of linear thinking, prediction by probabilities, continuity, and "no change in the conditions of change". (Miller 2015, 2018; see our discussion in the introductory section). This rather narrow perception of shaping the future has its roots in an understanding of the future as a goal or desired state that we already have in mind and that has to be achieved. This is in contrast to what is referred to as *anticipation for emergence* (e.g., Poli 2021, Miller 2018). The later-than-now is no longer an explicit and planned goal, but a potential that exists in the present; it is in a process of unfolding and emergence and will actualize at a later point in time (Ingold 2013; Peschl 2020). Hence, futures literacy is *not* an ability to "know the future", but about exploring, preparing, and *enabling* possible futures. Furthermore, it is about "what is needed and what we can do to help the latter emerge through engagement in action research/learning environments." (Kokshagina et al. 2021, p 4) Hence, the future, more accurately, the emerging future potentials in the present become one of the main sources in this process of future shaping. In this sense futures literacy "makes use of the future" (instead of the past) and becomes a source of new opportunities and possibilities for the present (Poli 2021; Miller 2015, 2018; Bloch 1986).

The question arises as to what this actually means, and more importantly, how it can be achieved and what appropriate education for it might look like. The theoretical foundations will be discussed in our section on *anticipatory sense-making* below. As for educational issues, we have seen that, in such a future-oriented perspective, it is neither enough that one provides already existing knowledge only, nor that we teach how to predict or plan for the future. Rather, the challenge is to learn how to deal with open-endedness and the emergent and disruptive nature of the future; this can be achieved by exploring, co-creating, and shaping new spaces for action as well as by identifying and cultivating enablers for realizing latent potentials in the present (Poli 2021, p 5). This implies that we have to penetrate into the depths of the present by understanding and exploring its essence/core and potentials. More specifically, to sense and make use of the future in terms of identifying core aspects of novelty that have not been tapped yet and that might have been obscured by our extrapolations from the past (Scharmer 2016; Poli 2021; Peschl 2020). In other words, futures literacy is about engaging in a process of co-becoming with an unfolding reality (Ingold 2013; UNESCO 2021).

Principles, skills, and mindsets for futures literacy

If futures literacy is about co-becoming with the world, what are the implications for successfully implementing such processes from the conceptual frameworks having been discussed above with respect to principles, skills, and mindsets? Apart from many other approaches and suggestions in this field (e.g., OECD 2016, 2018; UNESCO 2021; Ingold 2018; Harari 2018; Gleason 2019 and many others), we argued that these frameworks are at the core of a prudent and successful engagement with a VUCA world in a future-oriented manner. In the remainder of this section, we will return to these frameworks and examine them in more detail from the perspective of what are necessary and important concepts for an educational context.

Futures literacy principles, skills, and mindsets derived from (eco-)systems thinking

In the context of the systems thinking approaches, we consider the following core principles and skills, among others, essential for future-oriented work (e.g., Williams et al. 2017; Weinberg 2011; Thurner, Hanel, and Klimek 2018; Broo 2021):

1. *Adaptive capacity*: Understanding how systems adapt to a constantly changing environment and maintain resilience. This implies that systems (thinkers) have to learn how to transform and how to deal with change and how to balance it with stability.
2. *Emergence*: One can observe emergence in a complex system when new qualities, behaviors, patterns, etc. arise that cannot be found in the parts of the (sub-)systems (e.g., Corning 2002; Stephan 2002, 2006). This new level of complexity is due to the high level of interconnectedness of the subsystems. It does not have its roots in a central controlling entity, but rather emerges as an effect of the system's interactions as well as from the self-organizational capabilities and autonomy of its subsystems. From a systems thinking perspective, we have to learn how to deal with these emergent effects, as they are—in most cases—not predictable; above that, we have to learn how to design environments or eco-systems in which these new qualities may arise as a "non-deterministic" system property. We are referring to such environments as Enabling Spaces, as they have to provide enablers supporting the emergence of novelty (e.g., Peschl and Fundneider 2012, 2014).
3. *Network effects and interconnectedness*: If one is interested in understanding and intervening in a complex system, it is crucial to comprehend how its interconnected parts are structured in a network architecture and how their interactions are realized and might change dynamically. They have to be considered as (semi-)autonomous agents interacting with each other and—as a whole—determine the overall emerging behavior of the system. From a systems thinking perspective, one is confronted with the challenge of "balancing the relative autonomy and self-preserving tendencies of organizations, with recognizing their roles and responsibilities as part of wider systems". (Williams et al. 2017, p 871) This is especially important in the context of leading or designing organizations, ecosystems, or social systems.
4. *Feedback dynamics*: From cybernetics we know that complex dynamic systems are always embedded in a circular causality (e.g., Ashby 1964; Bertalanffy 1968; Foerster 2003). There is a constant feedback-loop between the actions/outputs of a system on its inputs and vice versa (both internally and externally). This implies that the behavioral dynamics of such a system is "non-linear" and becomes almost unpredictable, if one does not know its inner workings. Furthermore, one has to give up the idea of being able to control such a system. Rather, we have to learn, as Meadows (2001) puts it, to "dance with the system".
5. *Complexity*: As we have seen, complex (adaptive) systems, such as living systems, social systems or organizations, consist of a large number of (less complex) subsystems or parts that are highly interconnected and interacting with each other (Nicolis and Prigogine 1989). Complexity arises from the interactions between the subsystems (e.g., people in organizations, neurons in brains, etc.) leading to complex, non-linear and emergent behaviors. We *experience* complexity when we try to apply a reductionist and classic Newtonian worldview (Kauffman 2000, 2014) to a complex (adaptive) system: as a result, we will fail to reduce the complex behavior of such a system to simple cause-effect relationships. And even more so, if we want to

change or design the system by following such a mechanistic, reductionist and non-emergent approach.

6. *Self-organization*: is considered the ability of a system to develop, sustain and create its (new) structures, behaviors, or patterns by *itself*; i.e., there is no external control "instructing" the system how it should behave, change, or maintain its identity. Self-organization is solely driven by its internal architecture determining the internal dynamics and interactions of its autonomous sub-systems (while the system is exposed to an external flow of mostly unspecified energy). Living or social systems and their autopoietic structure and processes are good examples for self-organizing systems (e.g., Maturana & Varela, 1975, 1980; Razeto-Berry, 2012): they are able to maintain their homeostatic (precarious) processes of being alive, create a boundary to their environment, as well as to produce and reproduce themselves (without external control). These are emergent effects and, as systems thinkers, we have to learn to be patient and trust that these systems are capable of functioning well without external control especially when designing for such complex adaptive systems (e.g., in organizational, educational, or leadership contexts).
7. *(Respecting) Autonomy*: „An autonomous system is a system composed of several processes that actively generate and sustain their systemic identity under precarious conditions." (Froese and Di Paolo 2011, p 7). Autonomy has at least two dimensions in complex systems: (a) internal autonomy: as we have seen above, a complex system consists of a network of autonomous actors interacting recursively with each other. They are autonomous in the sense that they can only be influenced by the activities/behaviors of actors with whom they are directly or indirectly connected. (b) External autonomy: As a whole, this network of actors forms an autonomous system that is organizationally closed (Maturana 1970; Maturana and Varela 1975); its activity is both cause and effect sustaining the system's identity and autonomy. As a consequence, we have to respect this autonomy in the sense of acknowledging that it is almost impossible to fully determine the behavior of a complex system (such as a social system, an organization, etc.) from the outside.

As one can see from the points above, these topics cannot be treated separately, but are dependent on each other. Moreover, they require a set of overlapping skills and mindsets to deal with them in a sensible way. This is especially important, when it comes to the fields of (leading or transforming) organizations or social systems, designing ecosystems, policy making, etc.

Futures literacy principles, skills, and mindsets derived from designerly ways of thinking

What are the implications from the insights about designerly ways of thinking (and how do they relate to the systems thinking approach) for futures literacy? Among many others and apart from the classic well-known design principles, such as user-centeredness, empathy, etc., we consider the following to be the most important principles and necessary skills to be taught/learned in future(s literacy) educational concepts:

1. *Meaning is at the core of design (and innovation)*: As a result of sense-making processes (see our theoretical considerations above; De Jaegher and Di Paolo 2007; Froese and Di Paolo 2011), we do not only assign meaning to our environment, but also actively construct meaning, reinterpret our surrounding, create novel meaning by

designing and realizing artifacts embodying this meaning. We have to become designers and innovators of meaning (e.g., Buchanan 2015; Cooper 2006; Glanville 2007; Hernández et al. 2018; Krippendorff 2006, 2011; Verganti 2009).

2. *Designing purpose*: Purpose is closely related to meaning, but goes beyond the understanding or semantics of a phenomenon or an artifact to be designed; it is a driving force giving direction to a thing or person. The Oxford English Dictionary defines purpose as "the reason for which something is done or made, or for which it exists". Actually, one of the roots of purpose can be found in Aristotle's (1991) concept of final cause asking the question of what is the goal, what is the end of an object/phenomenon/process/person, or that for the sake of which something is done or the "why" something exists. Purpose is highly relevant for the design of social systems. A clearly defined and lived purpose is not only a critical instrument for offering direction, orientation, and coherence (between stakeholders), but also equips a social system or an organization with its own future and (innovation) strategy. As we will show, purpose is always about future states and future potentials; it is situated in the future, grounded in the present, connects the future with the past, and attracts a system from the future, as a "cause that lies in the future" (v. Foerster 2003, p 230). Therefore, it is essential to explicitly design for the purpose of a system regardless of whether it is a material artifact, social system, organization, urban environment, etc. It is its core reason for being, what it stands for, and the reason why and what it exists for and will exist in the future.
3. *Focus on (designing) behavioral patterns, interactivity, and interfaces*: Design is no longer about creating material artifacts, but about how these artifacts are *used* and/or how these artifacts support and enable interaction with them, with the world, as well as between stakeholders. An artifact has to be understood and designed as an enabling *interface* facilitating and connecting its use with its users and their needs in a meaningful manner; they are forms of extending a user's cognitive and material activities into the world (Clark 2008; Menary 2010). The driving question of the design process does not primarily concern the functionality of the artifact, but the qualities and functionality of how this artifact functions as a meaningful extension of our minds and/or socio-material activities.
4. *Affordances and making the world part of your design process*: An affordance is defined as a resource that the environment offers a cognitive system; by offering interaction possibilities, it makes sense for and can be used by this cognitive system in a—for this system—meaningful manner. In other words, an affordance provides a variety of behavioral (interaction) opportunities or possible uses that can be exploited by a cognitive system for its purposes (Gibson 1986; Chemero 2003). Hence, in such a perspective, design is no longer about making plans and realizing them in the world. Rather, we propose to make the world and its affordances an intrinsic part of the design process and situate "innovative action in the interaction between embodied individuals and their socio-material environment (associated with the skillful coping mode), rather than just stemming from thinking processes that are supposed to result largely from antecedently planned ends... Innovative action is an engagement that exploits this rich variety of action possibilities that aspects of the socio-material environment offer." (Yakhlef and Rietveld 2020, p 100). As we will see in the section below, affordances always carry in themselves an aspect of a future opportunity or potential that is not realized yet, as they are open to be used in a wide variety of ways. It is an aspect of the environment that is neither explicitly defined,

nor directly perceivable or exploited (yet); it has to be identified and used to bring its purpose to life. That is what we mean by “making use of the world” in a design process.

5. *Co-design*: User-centered design has been one of the key principles in design for a long time and has received new attention especially in the field of user interface design and design thinking (e.g., Brown 2009; d.school 2010). Approaches in co-design go one step further, however. The idea of a passive end-user becomes a myth (Krippendorff 2011). While in classic user-centered design the user as the object of investigation (of the designer) is still rather passive, the roles change in co-design (Sanders and Stappers 2008): the potential user of future designs takes the role of an expert who is involved in the processes of knowledge/idea creation, concept development, and sometimes prototyping. The user becomes a creative actor, a co-designer, alongside the designer.
   Due to the complexity and challenges of our modern world, designers are no longer solely responsible for the design of an artifact, but have to involve a wide range of stakeholders and experts to support and inform the design process. Each of these stakeholders brings in his/her perspective and expertise. The designer’s role is to facilitate this socio-epistemic process and integrate these perspectives in a coherent, yet discussable form. He/she engages in a process of sense-making and meaning-making and, finally, in realizing the resulting (novel) knowledge/meaning in concrete artifacts and eco-systems.
   Approaches in participatory design (e.g., Saad-Sulonen et al. 2018) or in open innovation (e.g., Chesbrough 2003; Hippel 2005) are examples of such a process of *democratizing* design and innovation and distributing (design) responsibilities and decisions in which (design/artifacts) are co-created by networks of stakeholders (Krippendorff 2006, 2011).
6. *Designers (and innovators) are engaged in shaping the future*: As we have seen above, design is always concerned with creating novel artifacts (in the broad sense) and interaction/behavioral patterns that are embedded in a larger socio-technological ecosystem. They embody a purpose that lies in the future. Such a broader view implies that designers (and innovators) are engaged in shaping a (hopefully) thriving future, they become future-making agents (Wenzel et al. 2020). We will discuss the implications in detail in the section below.

From these principles we can conclude that “design and the thinking upon which it depends is a cultural and humanistic art, a discipline of transforming surroundings into environments for human experience.“ (Buchanan 2019, p 99) Furthermore, it has become clear that design, systems thinking, constructivist approaches as well as processes of sense/meaning-making (see sections above) cannot be dealt with separately. They are mutually dependent and it is necessary to integrate and apply them in their combination if we want to shape the future in a responsible and purposeful manner of co-becoming.

If design is understood as shaping and transforming our environments for human experience in a(n eco)systems-thinking manner, we are clearly engaged in a *future-making activity* (Wenzel et al. 2020) in which human intent and meaning, goals, values, future purpose, etc. can prosper and come to some sort of fulfillment or actualization (e.g., Buchanan 2015, p 18). Theoretically speaking, design is about, as we have seen above, giving form/meaning to matter and, by that, giving and creating new meaning. In turn, this means that we bring

something that is in *potentiality* (i.e., matter; as an example, think of a log), or something that does not yet exist, into *actuality* (i.e., matter + form; as an example, think of a chair). Therefore, we need to go one step further and integrate the proposed frameworks by taking a closer look at what it means to create or design something from such a *future perspective*. We will see that we will have to question and even replace the hylomorphic approach as it is often rooted in the past. Furthermore, we will sketch the skills and mindsets involved in such processes.

Designing for the future: from participatory sense-making to anticipatory sense-making

In our considerations regarding cognitive systems, sense-making has turned out to be constitutive for cognition both in interacting with the world and/or with other cognitive systems as well as in designing or transforming an aspect of the environment. These activities have in common that (i) they result in a kind of *unity* between the participating systems, (ii) some form of *anticipation* is necessary for achieving this unity, and (iii) that—in many cases—this unity incorporates an element of *novelty*. As we have seen in our discussion about designerly ways of thinking, this novelty or novel meaning manifests itself in novel artifacts/innovations, (joint) behavioral patterns, novel forms of interactions or experiences, etc. In any case, they shape a future state of the participating systems; i.e., in their designerly or innovation activities humans become *future-making systems* (Wenzel et al. 2020).

From our reflections on the design and creation of artifacts we have come to see that the interacting (cognitive) systems and the mediating environment form a *novel unit(y)* in/through this artifact. While being engaged in a continuous process of participatory sense-making, the cooperating systems temporarily merge (or emerge) into a novel single system. In many cases, these interactions open up *new domains* of social sense-making that would not be available for each individual on his/her own (De Jaegher & Di Paolo, 2007, p 497). Engaging in such joint processes of sense-making creates meaning that is not only jointly constructed, but that constitutes *novel meaning* being the foundation for innovation in many cases. What is proposed in this approach, is an alternative perspective on creativity and on how novel meaning, novel knowledge, or even innovations can be brought about in an (anticipatory) emergent process of *socio-epistemic cooperation* and/or cooperation with the environment. As an example, imagine two or more musicians improvising together, or, as described above, a couple dancing together.

A mindset of giving up control

Taking our thinking one step further, we propose to consider a design/innovation process in the following metaphor comparing it to an activity of wandering: Glanville (2007, p 1193ff) describes design as a process of wandering around without a clear path or destination and stumbling upon something new in an unexpected encounter with some aspect of our environment. The point of the metaphor is that—at the point of departure of our innovation or knowledge/meaning creation processes—we do not know (exactly) where we will end up; we follow some direction or the flow of the path/environment, we might follow some intuitions that are rooted in future potentials that we discover in the space of adjacent possibles (Kauffman, 2008, 2014; Felin et al., 2014); yet, we do not have a clear and concrete goal in mind. However, there is something that *attracts us* that is latent “out there” (Poli 2011a, 2011b) in the environment. When we arrive, we will know that we have arrived, we will know that we have reached the “goal”. This implies that in such processes of innovation we have

to *give up control,* we have to open ourselves to being led by reality and/or attracted by an emerging purpose that we do not (fully) know or understand yet, a purpose that lies in the future. In other words, we have to (learn to) "learn from an unfolding future" (Scharmer 2016).

In such situations of participatory sense-making and jointly developing (novel) meaning, one can observe a transition from a process of interaction to what is referred to as a process of *correspondence* and *co-becoming* (Ingold 2013, 2014; Roth, Socha, and Tenenberg 2016; Peschl 2019, 2020). Such a form of cooperation is no longer an inter-action between two separated systems; rather, it can be seen as joining or coupling of two or more flows of becoming (e.g., of the participating agents, the environment, etc.). In this process of co-becoming, as has been discussed above, they start corresponding to each other forming a new and emerging unity or entity/system, a novel pattern of interactions that is more than the sum of (the changes in) the participating systems. It is characterized by a mutual engagement and modulation of the participating systems leading to a new (joint) system that is defined by and has emerged from their mutual history of interactions and by being attracted by a future purpose/potential. In this sense, *cooperation* and *interaction* becomes a form of *co-becoming* being led by an emerging future. We shift our attention from participatory sense-making to *anticipatory* sense-making.

Future potentials guiding our design and innovation processes

As an implication the role and agency of the participating systems has to be reconsidered. While classic approaches to creativity and innovation focus on the creative capacities and activities of the agent/cognitive system and ascribe only a relatively passive role to the environment (see our discussion above on the hylomorphic approach; e.g., Ainsworth 2016; Ingold 2013), we propose to turn this relationship on its head. Following the arguments from above, we have to acknowledge a reversal of roles: it is not primarily our mind and cognitive/creative processes that are "in control" and the primary source of novelty, but the environment plays an important role in this process of creating novelty or innovations by providing potentials (compare also our discussion about affordances).

This means that future potentials that are latent in the environment take the lead and guide our creative/design/innovation processes in an emergent manner. This is what we refer to as Emergent Innovation (Peschl 2020; Peschl and Fundneider 2013, 2017). The role of the creative agent is to sense (Scharmer and Kaeufer 2010; Scharmer 2016) and pick up these potentials and make use of them in a sensible and thriving manner. He/she engages in a process of *co-becoming and cooperating with the future* (and its potentials) instead of trying to project his/her own ideas or imaginations to the world. This does not mean that the agent is completely passive, however; rather, the cognitive agent engages with the social and material environment in an "intimate" way, he/she is modulated by it and changes/influences it in a recursive manner (compare the discussions on Material Engagement Theory; Malafouris 2013, 2014).

The challenge, then, is to develop an ability to become sensitive to future potentials. What are (future) potentials of a mostly "unknown future"? Ontologically speaking, any phenomenon, situation, entity, system, or object unfolds its own behavioral dynamics/becoming according to its inner workings and its interactions with the environment over time. This means that this object or phenomenon is not completely determined in its dynamics both in the sense of not being complete and of being not entirely predictable.

This perspective has its roots in, for instance, Aristotle´s metaphysics (Aristotle 2007) or Kauffman's (2008, 2014) concept of adjacent possibles. It draws on the notion of potentia/possibles (in the sense of "what is not yet"; compare also Bloch (1975)) and actus/actuality/actuals. Contrary to actuals, possibles or potentials are open to develop in various ways and directions that are partially intrinsic to this phenomenon/object and partially dependent on environmental stimuli, influences, or changes; they are latent (Poli 2006), they are yet to be developed and they want to break forth (under appropriate circumstances, contexts, or influences). What is both interesting and challenging about potentials is that we need to learn how to (a) sense and identify these latent possibilities and (b) to make sense of them (sometimes by combining or integrating them with other potentials), (c) to cultivate them in a non-imposing way so that they (d) can (co-)develop into new "interesting" and meaningful patterns of interactions or innovations. Hence, the whole process is about making "things"/meanings present that are still latent in the future by "learning from the future as it emerges". (Scharmer 2016)

As a first conclusion, sense-making and co-becoming with our world have turned out to be key for (educating) a futures literate person. The frameworks and principles outlined in the sections above provide a foundation for the skills and mindsets to not only cope with today's VUCA world, but to proactively and beneficially help shape it in a future-oriented manner. One core consequence from this approach to anticipatory sense-making is a profound *shift in mindset*: from control to *humility*. As we have seen, co-becoming and correspondence is about an attitude of openness and listening to an unfolding reality rather than a creative mind "dominating" or trying to control it with his/her own ideas. In other words, future potentials having their source in the environment are guiding the process of creating novel meaning; this implies that we have to learn to question and sometimes even step behind our own conceptions of the world. This requires an epistemologically humble attitude toward an unfolding world. Only then we will be able to sense future potentials and co-create a beneficial future from them by applying the skills from the frameworks having been discussed.

5 How do these future-creating mindsets and skills play out in practice?

In order to answer the question of the section heading and as an illustration for the concepts having been discussed above, we present a project we did with the company Bene 10 years ago. Bene is an office furniture manufacturer focussing on innovative products supporting work environments. In 2012, the then CEO approached us and was interested in an innovation process which brings about new furniture by following a co-creative approach. In the project, we worked with an inter-departmental and interdisciplinary team from Bene. The goal of the innovation process was to come up with a new line of products for the classic office worker; however, the team should not limit itself to the company's existing products. The results of the six-month innovation process have not only repositioned the entire company, but more importantly have produced a new type of furniture family that both has become commercially successful and has changed the way people design and work in offices.

So how and why did this happen? In the next sections, we present three mindsets and skills derived from our discussions above that practically illustrate how we need to deal with our uncertain and unpredictable future in order to help shape it purposefully and successfully.

Mindset and skill 1: Creating meaning and purpose

The project started off with a briefing from the CEO to create a "new line of products for the classic office worker". So, the original briefing demonstrates a rather conservative approach to thinking about the future of the furniture industry (in the sense of a linear continuation of the past into the future). We intentionally did not question this goal in the beginning, but rather trusted our process of Emergent Innovation (Peschl and Fundneider 2013) that the team itself will find out what fundamental and future-driven topics/questions they will pursue during the course of the project.

In the second workshop of the innovation process, the team was supposed to present their individual ideas for an innovation project. Most proposals centered around the idea of facilitating classic office-related activities (such as dedicated meeting spaces, tools for collaborative working, loung-like chairs, etc.) embedded in an office setting. During a two-days sense-making activity, the team fundamentally re-purposed the core of the innovation project by reflecting their assumptions and premises. This process resulted in the insight that the future office will be fundamentally defined by "*working as learning*". We refer to this novel understanding and reframing of the project brief as Emergent Thematic Field. It radically changed the further course of the innovation project : the project team did not search for innovation potentials in classic work settings, but explored what kind of different learning processes will be required for future-ready organizations (remember, it was 2012 then). This opened up a completely new space of possibilities and potential purposes that was not present before this workshop. As the innovation journey continued, the innovation team engaged in a process of "listening to the future as it emerges" (Scharmer 2016; Peschl and Fundneider 2013) in order to explore and identify future potentials in the Emergent Thematic Field.

Finally, after 6 workshops, the team came up with a prototype of (later named) PIXEL (see below for further information about PIXEL). Moreover and strategically even more important, the innovation process resulted in a novel (self-)understanding of Bene´s selling proposition: it began to move beyond offering its customers products only and presenting them with a confusing array of office furniture to helping them understand what type of space configuration would best support their desired learning and knowledge processes.

From a futures literacy perspective, the interesting points are that (i) the "working as learning" topic was not yet the innovation itself, but it provided a novel "semantic container" that (ii) gave the whole project new meaning and purpose from which (iii) a completely new understanding about office furniture (see also the section below) as well as (iv) an alternative self-understanding for Bene itself emerged. As we have seen in the discussion about futures literacy as well as designerly and systems ways of thinking, they are not so much about a mindset of planning the future, but about providing a novel semantic space in which new meaning, purpose, and ultimately artifacts (embodying this novel meaning) may emerge.

Mindset and skill 2: Design for behavioral patterns, interactivity, and interfaces

As we have seen above, the innovation process with Bene resulted—besides an organizational repositioning—in a radically new furniture family for work environments called PIXEL. It consists of flexible building blocks which ensure that employees can quickly create and transform spatial settings (see link in footnote), such as ideation spaces, presentation

spaces, etc. to support a variety of learning and socio-epistemic processes. PIXEL describes itself as:

"The most exciting innovations develop in places where people have the freedom to think playfully. Defined areas in the office that inspire a lively group dynamic and offer a creative playground are becoming increasingly important. The challenge is to create a place that naturally compliments day-to-day working life – culturally and spatially. Furniture that is as flexible and unfussy as the team itself can help to create such a space. This is where PIXEL comes in. These ingenious little boxes can be combined to create different pieces of furniture, be it storage containers, seating or a table – PIXEL is up for anything!"[2]

The interesting idea is that PIXEL is not primarily intended to be a piece of furniture for creative or innovative spaces. Quite contrary, PIXEL acts like a Trojan Horse to reinvent how organizations work. PIXEL elements shape social and knowledge interactions between people, they facilitate their participatory (as well as anticipatory) sense-making processes (see discussion above). Office workers organize their space in a more self-determined way, according to the needs of their tasks, which in turn shapes their behaviors and interaction patterns (in the sense of the extended and enactive approach to cognition). In this respect one can say that Bene´s PIXEL was the first product which relieved innovation work from dedicated spaces and created a much more integrated perspective of innovation work within organizations.

Mindset and skill 3: Co-designing the future through artifacts

Most of the more sophisticated innovation processes create and make use of some kind of artifacts in their product development processes. This is typically labeled as *prototyping* and has become widely known by the “Design Thinking” methodology (e.g., Brown 2009; Lee 2021). During our innovation project with Bene, we created both two-dimensional (illustrations, diagrams) and three-dimensional (prototypes of PIXEL) artifacts. The interesting point here is that these artifacts enabled the project team to better understand the purpose of the innovation, its core functionalities, as well as all its associated problems and shortcomings when brought into interaction with users. As we have seen in our discussion about the enactive approach to cognition this activity of prototyping has its roots in what is referred to as “thinging” (rather than “thinking”) from Material Engagement Theory claiming that “human mental life… is a process genuinely mediated and often constituted by things. The presence of the simplest artifact has the potential to alter the relationships between humans and their environments. New artifacts create novel relations and understandings of the world… The claim is that things actively participate in human cognitive life or that human thinking is better described as thinging. We think with and through things, not simply about things.” (Malafouris 2020, p 4)

In the case of Bene, artifacts (i.e., prototypes) helped the innovation to be successful in two ways: first, simple prototypes in scale 1:1 were tested in early versions of co-working spaces to collect feedback and improve the basic framework of the PIXEL concept. Secondly, Bene-internal workshops equipped with PIXEL prototypes helped managers and coworkers to experience what it is like to change work settings according to needs and how these different work settings had a positive impact on the outcomes. This pimples that through co-creating and using artifacts as prototypes it was possible for the team to push innovation forward, and ultimately create a novel material as well as semantic space for the future for workspaces and office furniture.

[2] see: https://bene.com/en/office-furniture-concepts/office-furniture/pixel-en/

The interesting point for Bene is that—superficially speaking—they still produce office furniture, however the purpose and self-understanding of the company has changed dramatically: their offer shifted from selling individual pieces of furniture to selling socio-epistemic work/learning environments that are facilitated by their sophisticated settings of office furniture. Considering that this innovation process took place around 2012, this change was disruptive at that time as it tapped into latent future potentials that were just on the horizon (and not even trends back then). Bene developed them into a future-driven/-proof concept, a novel organizational purpose, as well as ultimately into a truly groundbreaking product/service family.

In terms of futures literacy this case study showed how some of the principles and concepts having been discussed in this paper can be applied in a concrete innovation process and how the use of these skills and capabilities led to a disruptive innovation.

6 Concluding remarks

This paper started off with a reflection of the challenges and opportunities of today´s VUCA world and we showed that we are not properly prepared to deal with these high levels of volatility, uncertainty, complexity, and ambiguity. Skills concerning coping with discontinuity, disruption, and anticipating what does not yet exist in a proactive manner turned out to be crucial; however, they seem to be currently *missing* capabilities for an environment that is driven by technology, constant change in almost all domains of our lives as well as global challenges.

This led us to two questions: (i) what is our understanding of humans (as cognitive systems) confronted with such a VUCA environment? (ii) What are the requirements concerning skills and mindsets for dealing with such a world and what are the implications for educational approaches? Recent approaches from cognitive science equipped us with an understanding of human cognition and learning in which sense-making, our social condition, and creative capabilities to shape our (future) environment turn out to be central.

Based on these findings, we presented a set of concepts and frameworks that can be ironically summarized under the catchphrase of “education for future survival” (UNESCO 2021, p 2). In addition to the classic future skills, such as critical thinking, reflection, social and leadership competencies, classic innovation capabilities, etc. we identified the following fields and approaches as being essential for contributing and developing what is referred to as *futures literacy* (e.g., Miller 2015, 2018):

- It is no longer sufficient to have a rather distanced and abstract relationship of “aboutness” to the world, but to engage in a relational, interaction-driven, and cooperative relationship with the world. In other words, learning and knowing about the world has to be transformed into learning and living *with* the world. As a consequence, we have to provide learning (as well as work) spaces in which it is possible to enter into such a relationship of *co-becoming* with the world.
- In this context, the *constructivist* approach provides an adequate epistemological framework that supports this co-becoming. Knowledge is the result of interaction and construction processes and is not so much about the world, but becomes a capacity to act in and enact our environment in a functionally fitting manner (e.g. Glasersfeld 1974; Adolf and Stehr 2014).

- Since complex adaptive systems stand behind almost all phenomena we experience as unpredictable or complex, approaches from *(eco)systems thinking* and *second-order cybernetics* offer a whole "toolbox" for understanding and dealing with these challenges (such as self-organization, non-linear or chaotic behavior, emergence, etc.).
- Futures literacy has a strong focus on shaping the future/environment. Hence, it is not sufficient to understand and interact with our world in the present and maintain the status quo, but to *design* for the future. Designerly ways of thinking and doing is considered a cognitive capacity as well as a way of shaping the environment (be it physical objects, artifacts, processes, services, (user-)experiences, social systems, organizations, etc.) in a meaningful and purposeful manner. We have seen that it is rooted in making use of affordances, focussing on novel meaning and purpose, co-creating with stakeholders and co-becoming with the environment, as well as in designing for interactions and experiences rather than just physical or technological artifacts.
- Finally, we have seen that futures literacy is not primarily about planning for the future or trying to gain control over it; due to the future's unpredictability and complexity it has turned out that we should follow a strategy of co-creating the future by establishing an *enabling environment* supporting the emergence and a beneficial unfolding of reality. This implies that we have to engage in a process of co-becoming and *anticipatory sense-making* in which future potentials are identified, cultivated, and brought into actuality.

One of our main claims was that this requires—apart from novel skills—a shift in our mindset: as future potentials in the environment become the source for our creative and designerly activities, we have to assume a more *humble* position. It is no longer our creative capacities that project our own ideas to the world, but the combination of being open and sensing future potentials, applying our anticipatory sense-making capabilities, and bringing the resulting insights as novel artifacts into the world. Only then we will be able to create bold and disruptive futures.

Although it might sound paradoxical, the future-literate person is *both bold* and *humble*.

7 References

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