Phygitar: Envisioning the Rhythmic Phygital Ecosystem in 2050

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Abstract

This paper takes us to a possible future world called Phygitar - a rhythmic phygital ecosystem in 2050 where the co-existence of people, technology, and nature flow in rhythmic synthesis, and where digital and physical are seamlessly fused. Using the approaches of futures-studies, this envisioning is done to better understand concepts from 2050 and to see how we can engage with and use those effectively in 2023 for IS theory development and management practice. We use the 2009 movie "Avatar" by James Cameron as the playground of our imagination. We apply illustrative elements to depict some key characteristics and concepts from this rhythmic phygital ecosystem and to show some ways of navigating through it. We hope this will trigger the imagination of scholars of what might be out there in the next generation of post-digital IS theories rather than being rooted in the mindset of what is or what has been.

Keywords: Futures studies, future IS theorizing, science fiction prototyping, phygital, rhythmic phygital ecosystem, Fast & Flow, Flow with the Go.

1. Introduction

Responding to the call from this HICSS-56 mini-track, "Informing Research: Engaging with Futures," this paper seeks to contribute to new ways of thinking that shift significantly from current patterns of theorizing. Using the year 2050, we envision a future paradigm where humans and digital technologies have learned to co-exist in intelligent and sustainable meshed forms which we have conceptualized as a rhythmic phygital ecosystem. This envisioning breaks with what the track calls "well-trodden" conceptual conventions and focuses on future post-digital life worlds. We seek to set the foundations for theory envisioning for such an imagined future world and how that provides insights for IS scholars.

We draw on future-studies approaches (Hovorka & Peter, 2021) that outline and articulate three different categorizations of conceptions of the future and associated methods. Category 1 assumes that the future

exists and can be discovered. The focus is on a limited number of factors, and it assumes that current explanations of phenomena are stable. Some of the representative methods include trend extrapolation and road-mapping. Category 2 assumes that the future is transformed and created through choice and action, and that future states can be manipulated. Category 3 assumes that futures are actively imagined to critically engage the present. Some of the representative methods include using artifacts from the future, critical design, and science fiction.

In this paper we use both Category 1 and Category 3 conceptions in succession. We also take advantage of science fiction prototypes (Burnam-Fink, 2015) to help us conceive our imagined future as a rhythmic phygital ecosystem and new phenomena around it. We creatively move through time from the present to Phygitar 2050 using Category 1 futures thinking and road-mapping. We then move our attention to the year 2154 using Category 3 futures thinking via a science fiction prototype drawn from the popular movie Avatar. We then travel back again to year 2050 with those insights to theorize our envisioned future of the rhythmic phygital ecosystem. We end by using our Phygitar 2050 conceptions to engage the present (2023) through insights for IS scholars.

The remainder of the paper is organized as follows: in Section 2 we use Category 1 futures thinking and road-mapping to explain what our initial vision is for the evolution to a rhythmic phygital ecosystem in the year 2050. In Section 3 we use Category 3 futures thinking by using the movie Avatar as a science fiction prototype from 2154 to provide insights for the rhythmic phygital ecosystem in 2050. In Section 4 we use those insights to identify and describe the key characteristics and concepts of the 2050 rhythmic phygital ecosystem and how to navigate the 2050 rhythmic phygital ecosystem in Section 5. Finally in Section 6 we provide reflective questions for IS scholars.

2. Towards an Evolving Rhythmic Phygital Ecosystem in 2050

We envision a scenario for a 2050 world that may be useful for theorizing about post-digital futures

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(Parmiggiani et al., 2020). Mueller & Hovorka (2021) refer to the post digital future as a time when phenomena have become so naturally and inherently digital that calling it digital will be senseless and ancient.

We pick the year 2050 because it is far enough to be imagined as quite different from 2023, yet close enough so that we can still somewhat ground it in current reality. Thus, we can simultaneously use the two categories of what Hovorka & Peter (2021) have called speculative engagement with digital geographies: Category 1 (the future exists and can be discovered) and Category 3 (futures are actively imagined to critically engage the present). We use Category 1 thinking in this section, and we use Category 3 thinking in Section 3.

We agree with those views that it will be post-digital, but we believe an emerging phygital future may lead to a new state of collective intelligence provided that radical technological innovation co-occur with radical mindset transformation of humans (Ringberg et al., 2018).

In the practitioner world, "phygital" has been presently used to characterize omnichannel integration between physical and digital channels (cf. Prior, 2021; Adhi et al., 2021). A McKinsey report (Adhi et al., 2021) foresee that we are entering the world of phygital as technology advances and fuses with physical. The conception of phygital is becoming more sophisticated and richer and expands from entertainment, education, and retail to other domains. For example, Wunderlich et al. (2022) expands the concept to the context of digital twins in industrial settings. Virtual worlds such as the Metaverse will further advance the richness of the phygital concept. We are not fully phygital yet, but in the future, its impact will overwhelm all aspects of our lives, so how will our digital ecosystems evolve when we approach the year 2050 to what we call Phygitar?

In the past fifty years there has been an evolutionary change in organizational forms and organizational boundaries as the turbulence level, digital intensity, and tempo of the business environment have increased. Simultaneously, this increases the strategic scope from individual organizations, to supply chains, and to broader digital platform ecosystems and beyond. We depict this evolution in Figure 1.

Figure 1 illustrates the shifts in strategic focus and the evolution to our envisaged future in 2050. We shifted from what used to be a singular focus on the enterprise and its internal processes (*Production*), to what expanded to an enterprise and its supply chain all the way from sourcing to customers *(Pipelines)*. In the 2010s the ecological perspective of business strategy expanded the organization's business ecosystem to participants beyond just tight supply chain partners who are directly involved in the delivery of an organizations' products and services, but also other entities that help the ecosystem niche survive and thrive further expanding the scope of strategic focus. Concurrently with the increase of digital intensity and digital platforms, this has further evolved in the late 2010s into an ecosystem view with entities that are connected as digital platform ecosystems (*Platforms*). This shift from pipelines to platforms is well-documented and explained in both research and practitioner journals (cf. Van Alstyne et al., 2016), as are the new critical properties that digital platform business models bring such as network effects. The increasing proliferation of interconnected digital business platforms has further blurred the boundaries between organizations and their partners and ecosystems, as well as adjoining business ecosystems. This is articulated in detail elsewhere (cf. Rydén & El Sawy, 2019b) and space precludes us from elaborating on it here. Briefly, an ecosystem is a concept that recognizes that in any system, the participants of that system must work with–and around–each other to keep the system healthy, hopefully also optimizing the collective benefit. This progression to broader business ecosystems has been prominent in major management consulting company conversations (https://www.ey.com/en_us/alliances/what-business-ecosystem-means-and-why-it-matters).
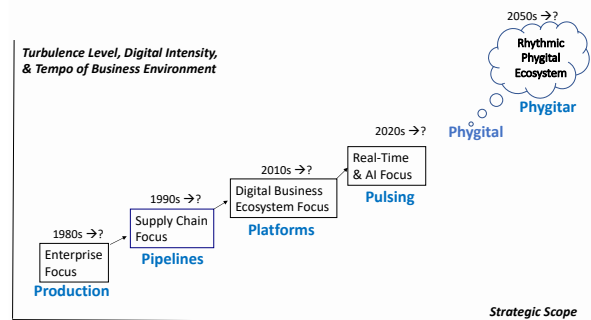

Figure 1 Changing Strategic Scope to 2050

We believe that the 2020s are bringing the emergence of a fourth evolution *(Pulsing)* where the rapid interconnection of digital platforms is generating accelerated tempo through constant real-time data flows. We are surrounded by a bombardment of data pulses 24x7 generated from the mounting activities of digital platform ecosystems and their participants. This is further exacerbated by the Internet of Things (IoT) and multiple sensors generating continuous data, as well as the rapid data generated by AI systems that learn faster than people. An increasingly faster data-pulsing enables organizations providing services to constantly compress the time separating detection and response to address a range of needs. The constant generation of data flowing from multiple data sources, generate multiple rhythms that trigger the way that organizations

analyze, decide, manage, and execute. These digital, human, organizational, and environmental effects interweave in a constantly interconnected information network accelerating real-time data-driven business environments. With this follows an increased need to sense and synchronize the many rhythms to manage. This Pulsing Era emergence sets the stage for the next progression of Phygital where the physical and digital fuse in increasing intensity and scope. That takes us to a potential future in 2050 *(Phygitar)* of the rhythmic Phygital ecosystem.

3. Science Fiction Prototype Inspiration from Avatar

To better understand how the Phygitar era will be, we start by using Category 3 speculative engagement (futures are actively imagined to critically engage the present) and go the year 2154 through science fiction example using the creative 2009 movie "Avatar" by James Cameron.

Imagining the future is nostalgia in the sense that humans predict what the future will be like by using their memories (D'Argembeau & van der Linden, 2004). In acknowledgement, we use "Avatar" as a science fiction prototype for illustration of a sustainable world of highly evolved species being deeply conscious about the biological neural network of life (Bell et al., 2013). It provides a lens for characterizing and conceptualizing new phenomena and laying the foundation for inventing new theory that is surfacing questions; not just answers (Burton-Jones et al., 2021). We will use those conceptualizations and questions to critically engage the present IS community.

In the paradigm of the Avatar movie world, people have reached a level of collective awareness–a global mindset shift (see Ringberg et al., 2018)–that enables them to co-exist with intelligent and advanced technologies in a mindful flow manner. At the same time, they have learned by experience that if we are not able to regain balance in our biological ecosystem and synchronize it with the digital ecosystem and social ecosystem, there will not be a future. By hard lessons, people have finally become mindful about how everything is connected in a sensitive and intelligent ecosystem. People have also acknowledged that the crucial task is to ensure that human intelligence and artificial intelligence synchronize to enforce collective intelligence flows, being the core to sustainable life on *any* planet.

The ability to understand the nature of human and digital life as inherently consisting of rhythms, and that we are interconnected as techno-social rhythmic fabric,

has been the main driver towards balanced and collectively intelligent lifeforms. At the Earth, as well as any living system, rhythms define the core energy that binds us all together, so the common characteristics at Pandora–as exhibited in Avatar–should inspire us to think more deeply about how to be able to live in an ecosystem where synchronized rhythms of biological, human and machine-generated intelligence flow freely and abundantly enforcing each other positively.

Let us give a quick presentation of an imagined dystopic future of 2154, where humans have depleted Earth's natural resources, leading to a severe energy crisis. This led them to mine a valuable mineral called unobtanium at the moon called Pandora (Wikipedia, 2022). Here, they meet utopia of Pandora where the Na'vi clans live, a humanoid species in an atmosphere poisonous to humans, symbolizing how humans are not evolutionary-ready for this life form.

Pandora reveals itself differently to the characters who sense and respond to the environment either in a curious or hostile way. The Na'vi fight to restore the balance of Pandora and to regain the natural rhythms. Eywa is the deity who pervades and animates Pandora. It is a source of life nurturing, providing, and protecting the balance of life. The Na'vi revere Eywa as the mother of collective intelligence symbolizing the deep interdependence of all living organisms of their world.

"Avatar" is used as a metaphor for travelling to an envisioned future paradigm where we consider how humans, nature, and technology can flow harmoniously as a phygital ecosystem (https://www.independent.co.uk/arts-entertainment/films/news/cameron-sees-metaphor-for-earth-in-avatar-5512106.html).

The life at Pandora can enlarge our vision of ethics and empathy (Dunn, 2014). The Na'vi acknowledge that everything is connected, and they act with a caring respect for the rhythms of life. They seem to sense and synthesize with their ecosystem and cosmos and this unique enactment of collective intelligence is discovered and admired by the scientists. "Collective intelligence" is in scientific terms defined as the process by which a large group share their knowledge, data, and skills. The point of collective intelligence is to make life easier and more enjoyable through the application of acquired knowledge and for the purpose of solving ecosystem issues. The Na'vi embody what Durkeim (1912) stated: that society, by definition, constitutes a higher intelligence because it transcends the individual over space and time.

The Avatar world utopia helps us to envision a potential post-digital future meshing the physical and the digital into a phygital world characterized by new forms of networked consciousness, leading to a wanted state of synthesis and harmony.

Being mindful about how everything is connected in a sensitive and intelligent ecosystem is the core to sustainable life on *any* planet. The ability to understand the nature of human and digital life as inherently consisting of rhythms and that we are interconnected as a techno-social rhythmic fabric has been the main driver towards a balanced and collectively intelligent lifeform for the Na'vi. At Pandora as well as Earth, rhythms define the core energy that binds us all together, so the common characteristics as exhibited in Avatar should inspire us to think more deeply about how to be able to live in an ecosystem where synchronized rhythms of biological, human and machine-generated intelligence flow freely and abundantly enforcing each other positively.

Searching for a language for an ideally balanced co-existence of digital doings and human beings, triggers our imagination and curiosity of what might be out there to aspire for in the next generation of IS theories. These significant new lines of inquiry thus aim to inspire a new generation of ideas and scholars (cf. Table 1 in Burton-Jones et al., 2021). Quoting vintage James Cameron at the time of the Avatar movie: *"What's in the great beyond? What exists at levels we can't see with our five senses?"* (https://www.inspirationalstories.com/quotes/t/james-cameron/)

How can we take advantage of that imaginative Avatar rhythmic depiction to envision a closer more down-to-earth scenario that will be useful to IS and management scholars while still leveraging those new concepts? Can conceptualizing phenomena through rhythmic ecosystems thinking help us theorize more usefully in the post-digital future as well as expose new practices? That is what we explore in the next sections through Phygitar 2050.

4. Key Characteristics and Concepts of the Rhythmic Phygital Ecosystem

When the intensity of pulsing increases as it does as we move towards Phygitar 2050, then it becomes more useful to expand the understanding of the phygital ecosystem as a rhythmic fabric that constitutes multiple rhythms in real time. We identify two key characteristics of the rhythmic ecosystem: rhythmic fabric and real-time temporal logics (bottom half of Figure 2).

Figure 2 depicts the rhythmic nature of Phygitar 2050. The bottom half depicts some key characteristics and concepts of the rhythmic ecosystem, (described in the remainder of this section) while the top half shows some ways of navigating the rhythmic ecosystem (described in the next section).

4.1. Rhythmic fabric: Phygital Pulsing

As we move ahead towards 2050, digital and physical ecosystems will be further unified into 'phygital' ecosystems. This means that–as visualized in the Avatar movie–human and digital networks will be meshed and there will be phygital pulsing rather than just digital pulsing. This goes beyond the "digital first" view of Baskerville et al. (2020) in which physical follows digital and there is an ontological reversal. It also goes beyond the digital eco-dynamics view (El Sawy et al., 2010) in which elements can no longer be separable. Furthermore, it goes beyond the older "fused" view of information technology. The difference is in the high tempo continuous pulsing and that the pulsing is phygital. In Phygitar 2050, this intensification has led to the ecosystem becoming a rhythmic fabric.
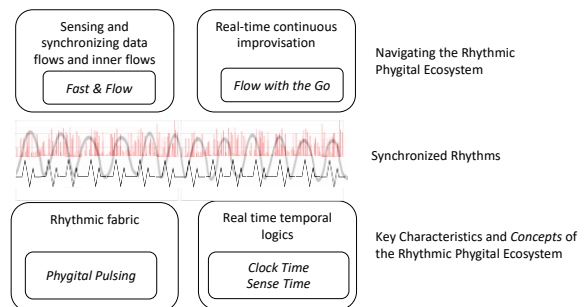

Figure 2. The Rhythmic Phygital Ecosystem

In 2050, the notion of the earth as a rhythmic fabric has become common understanding and acknowledged by scholars by combining management and information systems with basic fields such as psychology, biology, and physics. The physicist David Bohm in his landmark book (Bohm, 1980) argues for a model of reality that is made up of a manifested explicate order (space-time domain) and a hidden implicate order (frequency domain)–and that physics and natural phenomena suggest that reality might be better viewed as a flow and as an undivided wholeness of flowing movement with multiple rhythms. For example, science for detecting earthquakes is based on monitoring seismic waves as part of the Earth's natural constantly pulsing rhythms that have sudden moves (Burkett, Given & Jones, 2014). Also, Baygi, et al.'s (2021) study of continuous socio-technological transformation in a fluid and dynamic digital world conclude that everything flows. They have also argued that researchers can benefit from shifting from an actor-centric to an alternative, flow-centered orientation to theorizing when we are dealing with rapidly shifting digital phenomena. They state that *"we tend to structure our ideas about the fundamental nature of IS phenomena in spatial terms (e.g., as arrangements of bounded entities such as systems, components,*

modules, artifacts, users, organizations) at the expense of the temporal flow of action (e.g., the rhythmic trajectories, directionalities, intensities, and momentums with which IS phenomena flow), p. 424". They argue for a shift toward a theoretical vocabulary that orients us to foreground the ongoing temporal flow of IS phenomena, as they flow.

However, most importantly, the implicate order is the primary one, and the fundamental laws are between the enfolded structures that interpenetrate each other, rather than between their separated forms that are manifested to our senses. Similarly in neuropsychology, Hunt and Schooler (2019) find that all natural phenomena are processes being constantly in motion, vibrating, oscillating, and resonating, at different frequencies. It is also the case that these rhythms often become self-organizing. One adaptive view of learning is that of cognitive, affective, and behavioral interaction in complex responsive processes that produce emergent coherence and self-organization. It occurs when different vibrating processes come into proximity (Hunt and Schooler, op. cit.) and they eventually begin to vibrate together at the same frequency.

We argue that as pulsing intensifies and becomes phygital, the view of a rhythmic fabric may be a more useful perspective to use for theorizing around ecosystem issues.

4.2. Real Time Temporal logics: Clock time and Sense Time

The second characteristic of the rhythmic phygital ecosystem that we would like to identify and articulate is that of co-existing real time temporal logics (bottom right of Figure 2). In the real-time environment of Phygitar 2050, humans and technologies acknowledge the importance of integrating two types of time. This has been identified as Clock Time and Sense Time in management settings (Rydén & El Sawy, 2019a) or Chronos and Kairos in philosophy and organization psychology (Hernes, 2022). "Chronos" referred to an objective time that is measured with clocks. "Kairos" referred to the subjective deep time identified by philosophers and mystics where the world seems to stop while the individual can move forward in the present.

Clock time obeys the clock and is linear. Real time is related to performance improvement by acting fast. Managers influenced by a utility time framing, tacitly assume that time is a scarce resource that they must save by acting and executing as fast as possible. On the other hand, in a Sense Time framing, real time is relative and depends on the subject (cf. Shipp et al., 2009; Tang et al., 2020) and context rather than the clock. Some have associated sense time with acting at a slower pace and being more mindful. Regarded as a private resource, it

expresses energy or an emotional sense of being in the present moment. Sense time can be associated with being mindful of human interaction and digital engagement.

Having described the key characteristics of this 2050 rhythmic phygital ecosystem, how can we navigate our way through it? We address that in the next section.

5. Navigating the Rhythmic Phygital Ecosystem

In understanding how to navigate the rhythmic ecosystem, we need to think through what the requisite sensing and synchronizing logic might be. In this section we draw on the top half of Figure 2 that leads to our next questions: *How can we better understand the synchronization of the real-time tempos of human and digital processes–and even biological processes–in phygital business ecosystems?* Is the pulsing of real-time data flows and inner flows of people following any specific direction? If so, how flexible is it, and how can we better coordinate between the fast pulsing of real-time digital data flows and processes with the inner (and often slower) physical and human processes? What kind of concepts do we need to help us?

5.1. Sensing and synchronizing data flows and inner flows: Fast & Flow

To better answer this question, we bank on the Fast & Flow approach that has been used to characterize synchronized real-time management (Rydén & El Sawy, 2019a). The Fast & Flow approach leverages the notions of Clock Time and Sense Time explained in Section 2 above.

A "Fast" view of real-time management frames time as a monetary resource that should be utilized, while a "Flow" view of real-time management frames time as a flow state enabler that can ensure mindful, creative, and intuitive thinking which are important for developing improvisation capabilities. It is the conscious combination of these two Fast & Flow approaches that gives us insight in to how to better the synchronization between human, physical and digital pulsing flows in high-tempo rhythmic fabrics in a way that is comfortable and productive for humans and societies. This may address the increasing welfare challenges of most fast-paced societies that are facing mental and emotional consequences of well-intended, but ill-managed digitalizing efforts.

Rydén & El Sawy (2019a) found that Fast & Flow temporalities are mutually reinforcing when

synchronized and meshed, rather than sequentially moving from the one to the other. Thinking about this from a pulsing perspective, it is almost as though there are two different types of pulsing data flows that need to be managed within an individual and the organization. We begin to see the importance of understanding ways for human-digital synchronization for solving grand challenges of businesses and societies today. Harmonious phygital environments occur when we are able to enact the Fast & Flow principles of synchronizing the speed of information flows with emotional and cognitive energy in real time (See Dolcos et al., 2011).

The Na'vi seem to manage Fast & Flow quite well, guided by the deity of Pandora and force of life, Eywa. The Na'vi believe that Eywa acts to keep the ecosystem of Pandora in perfect equilibrium. Their ability to enact based on the deep and shared knowledge of how their ecosystem work and synchronize with how the various rhythms flow is expressed in many of the learning conversations between Jake and Neytiri.

Fast & Flow can also be exemplified by the unique connecting of consciousness between the pa'li, a direhorse and the Na'vi, which takes place through "Tsaheylu". This Na'vi word for neural connection describes the physical process by which all Pandoran life forms mentally connect to one another using their queues. Tsaheylu has several different uses to different creatures, but primarily, it allows beings to mentally connect and share information with each other in a Fast & Flow manner. When two creatures are bonded, they gain access to each other's physical senses; this means they will feel the pain of whatever they are bonded to, among other things.

Like the Na'vi, the Phygitar 2050 civilization has developed advanced empathetic competencies and real-time continuous improvisation skills to constantly synchronize the complex flux of continuous flows in the rhythmic phygital ecosystem. We call that "flow with the go".

5.2. Real-time continuous improvisation: Flow with the Go

The emergence and growth of digital platform ecosystems and the real-time interactions and exchanges they are creating, is pushing us slowly, but surely, from exceptional improvisation towards continuous improvisation in real time. We are thus moving to an era of continuous real-time improvisation in high tempo environments. We believe that will be the case in the Phygitar 2050 environment.

In the real-time data-pulsing ecosystem of 2050, changes are happening continuously everywhere and at a pace that cannot be slowed down or stopped; rather, it continuingly increases. The Na'vi have therefore developed the capacity to sense and synchronize the pulse of the huge amounts of connecting data flowing from the digital technologies, monitoring digital and human processes and activities in real time while interpreting the issues and their implications. This synchronization with the pulsing rhythms has been referred to as "Flow with the Go." (Rydén & El Sawy, 2022). "Flow with the Go" coins the improvisation needed to synchronize the human and digital pacing that leads to better performance in digital ecosystems in general and phygital ecosystems in particular.

To "Flow" refers to a state of being in synch with the continuous flow of changes through the sensing of data pulses and being able to engage oneself and others in the creation and implementation of the changes that follow (Csikszentmihalyi, 2000; 2008) "The Go" defines the continuity of the high-speed fast-changing environment of phygital digital platform ecosystems.

This calls for what might be called improvisation energy (Crossan et al., 2005). Improvisation has usually been treated as an exceptional form of behavior: organizations need to improvise episodically, when routines fail and there is forced learning-by-doing (Crossan et al., 2005).

There have been more traditional studies of IT-enabled dynamic capabilities and organizational agility (Pavlou & El Sawy, 2006; Park et. Al., 2017) as well as IT-enabled improvisational capabilities (Pavlou & El Sawy, 2010). There have also been many studies and conceptualizations of organizational improvisation (Cunha et al., 2017). Crossan et al. (2005) define improvisation as the point where time to plan converges with time to act and propose improvisation as a vehicle for articulating a dialectical view of time-based organizational phenomena. The connection between improvisation and real-time management has also been alluded to by Cunha et al. (2011) and they have characterized improvisation as a form of ''real-time foresight."

To become more skilled at thinking on your feet is central in improvisation, and something you effectively practice in a real-time environment. But improvisation may also be designed to bring people in a flow state, which increases wellbeing and performance (Prior, 2020). That means to be able to tap into the explicit knowledge that is pulsing through the ecosystem and mesh it with the tacit knowledge and new ideas that can more likely be released by people when in flow.

5.3. Synchronized rhythms

In Avatar, the Na'vi seem to understand how to synchronize the various rhythms of the phygital

ecosystem and balance tempos and processes. There are scenes that illustrate how they do that, for example the connecting of come together and Tsaheylu.

Like the Na'vi perfectly embody this utopia, the scientists must mesh with technologies to be able to step into this world. They must also learn to sense in new ways to understand the rhythms of their ecosystem. That it is a rhythmic ecosystem is depicted in a scene where all the Na'vis connect with Eywa and each other and rhythmically sway in sync with nature:

Image 1: Eywa and Na'vi in rhythmic connection

They are aware how vulnerable they are to disruptions in the ecosystems, so they engage with other living creatures in a mindful and respectful manner to synchronize rhythms.

As we mentioned earlier, their ability to enact, based on the deep and shared knowledge of how their ecosystem work, and synchronize with the various rhythms is expressed in many of the learning conversations between Jake and Neytiri and "tsaheylu", the unique connecting of consciousness between the pa'li, (direhorse) and the Na'vi. Certain Pandoran florae can also perform tsaheylu to synchronize rhythms with other creatures and plant life; this connection builds the foundations of the Pandoran neural network. This network can be accessed by the Na'vi and presumably other life forms at areas like the Tree of Souls and Tree of Voices; when the Na'vi connect with the network to commune with Eywa, they can upload their own memories and consciousness to the network, and even communicate directly with the spirits of the deceased.

It is also important for scholars to highlight that real-time continuous improvisation is a pervasive, never-ending organizational process with multiple shapes and nuanced impacts on the individual. Not only do planning and action take place simultaneously (temporal convergence), but they also feed off each other substantively. This will yield new phygital organizational forms that will likely be more dispersed and less hierarchical than existing organizations but will rely more on sensing and synchronizing. This will open a whole new way of thinking of collective intelligence

(cf. Hallin, 2022) and an exciting open vista to contribute to as we move towards 2050.

6. Engaging with the Present: Reflective Questions for IS Scholars

We believe that starting from the Avatar movie paradigm and then articulating Phygitar 2050 is different enough to jolt our brains into thinking differently about the possible future world(s), how they might work, and what we can do in them and with them. We believe new characteristics and concepts of how we view this new possible world can change the mindset of IS scholars. It may also spark ideas on how to navigate the rhythmic phygital ecosystem that will change the focus, scope, and structure of our post-digital theories and practice. We realize it is speculative, but the new lens will enable us to see new realities which we otherwise would have not seen. We also subscribe to the view that portrays theory as an iterative craft that often starts with incomplete articulation and explanation of phenomena (Rivard, 2020).

We have described key characteristics of Phygitar 2050 and its rhythmic phygital ecosystem and we have suggested how we might navigate through it. While Phygitar 2050 may not happen in the way we describe it, we believe that it exposes insights for IS scholars. We have shown in Sections 4 and 5 how this might change our operating concepts for managing in real-time digital platform ecosystems. Each of the concepts and processes in Figure 2, and what they imply, suggest that we may want to try to change our mindset to be rhythmic and phygital rather than spatial and digital, and try to understand how to improve theory and practice with that mindset. As explained in Section 2, we also need to be acutely aware of the data-pulsing environment where AI and connected digital platform ecosystems increasingly and relentlessly are pushing us towards real-time and faster and faster interaction cycles.

As we view Phygitar 2050, it appears to us that we will be facing a trio of rhythmic, phygital and real time. For some it may be a terrible trio, but for IS researchers it should be a titillating trio that opens new and exciting research paths. To re-iterate the Burton-Jones et al. (2021) view on next-generation IS theories: it is critical to provide a lens for characterizing and conceptualizing new phenomena and laying the foundation for inventing new theory that is surfacing questions; not just answers. True to that view, to spark new lines of thinking and to guide IS scholars towards designing new research paths, we present some reflective questions derived from this paper on how IS might theorizing need to change in a rhythmic phygital ecosystem. We group these questions into 2 buckets. The first bucket is inspired by Section 4:

how might we have to change ontologies for IS theorizing in rhythmic phygital ecosystems? The second bucket is inspired by Section 5: how might we have to rethink IS design theories for navigating the rhythmic phygital ecosystem? We will not quote any references in this section in order not to bias the reader and keep our minds clear for the new that we derived from the paper.

6.1. How might we have to change ontologies for IS theorizing in rhythmic phygital ecosystems?

Building theories in any area requires an ontology which comprises a set of concepts and categories, their properties, and the relations between them. In order to rethink digital platform ecosystems through time domain thinking rather than space domain thinking, and to deal with a rhythmic fabric and phygital pulsing, will we need a new rhythmic ontology. We will need to define and articulate rhythmic concepts and their relationships around rhythmic fabrics in useful ways for IS and management. We will need to identify and articulate the basic elements of rhythms which could be tempo, synchronization, and arrhythmia. Given our identification of Clock Time and Sense Time, we will also need to bring more human emotional components to this ontology with concepts such as "Vibe", which we may find estrangement to in IS, but which–in a rhythmic phygital environment–can be very important. We will have to draw on other domains such as psychology, physiology, music, and physics. *Will we have to redefine collective intelligence in a more holistic way when data pulses interconnect with the sensing of biological and cognitive Pulses?* One might think that these ontologies can be relegated to management scholars, but aren't IS scholars the ones who are expected to advance the field of the management of AI, and aren't AI applications already on digital platform ecosystems–where things are moving already towards real-time as AI applications learn faster than humans?

6.2. How might we have to rethink IS design theories for navigating the rhythmic phygital ecosystem?

We have shown in Section 5, through the Fast & Flow phenomenon, that we will need to understand how to design systems for sensing and synchronizing data flows and inner flows in conditions of real time. The design of inner flows is a novel area for IS design which goes well beyond HCI and will entail both psychological and physiological considerations. We are beginning to see elements of that in technostress research for the design of hybrid digital work environments after Covid, but we are at a very early stage. Rhythmic phygital ecosystems also expose the need for new practices such as real-time continuous improvisation, which we have operationalized as Flow with the Go. *How will we design information systems to support Flow with the Go processes? How will we design information systems with requisite sensing and synchronizing logic for rhythms? What kind of prescriptive design theories will we need for that?* Furthermore, we are still at the dawn of phygital systems design in omni-channel management in marketing and the design of digital twins in industrial applications: what kinds of designs and IS design theories will we need when phygital becomes really fused and enriched with cognitive and physiological aspects? These are very exciting issues for IS scholars and should keep design science scholars challenged for many years.

The nature of theory development depends on the interplay between ideas and phenomena. Sometimes it may be more useful that the phenomena be examined in imagined future environments that have yet to occur. While Phygitar 2050 may be very different when it happens and we may experience estrangement at this time when thinking about it, conceptualizing it is very likely to advance our IS theories.

As an ending personal note for IS scholars: when you wake up in the morning and start thinking of research, please remind yourself to change your mindset: think phygital, not digital; think real time, not anytime; think rhythmic, not spatial. And synchronize your inner flows with the collective outer flows. Then you will have become a true triumphant Phygitar!

References

[1] Adhi, P, Hazan, E., Kohli, S. & Robinson, K. (2021). Omnichannel shopping in 2030. McKinsey & Company, April 9, marketing-and-sales/our-insights/omnichannel-shopping-in-2030

[2] Aristotle (1936). *Physica.* Oxford: Clarendon.

[3] George A. Dunn (Ed.) (2014). *Avatar and Philosophy: Learning to See*, First Edition. John Wiley & Sons, Inc. UK. 272 pp.

[4] Baskerville RL, Myers MD, & Youngjin Yo. (2020). Digital First: The Ontological Reversal and New Challenges for Information Systems Research. *MIS Quarterly* 44(2), 509-523.

[5] Baygi, R. M., Introna, L. D. & Hultin, L. (2021). Everything Flows: Studying Continuous Socio-Technological Transformation In a Fluid and Dynamic Digital World. *MIS Quarterly 45*(1), 423-452.

[6] Bell, F., Fletcher, G., Greenhill, A., Griffiths, M., & McLean, R. (2013). Science fiction prototypes: Visionary technology narratives between futures. Futures, 50, 5-14.

[7] Bohm, D. (1980). *Wholeness and the Implicate Order*. Routledge, UK.

[8] Burkett, E.R., Given, D.G., & Jones, L.M., (2014). ShakeAlert—An earthquake early warning system for the United States West Coast (ver. 1.2, February 2017): U.S. Geological Survey Fact Sheet 2014–3083, 4 p.

[9] Burnam-Fink, M. (2015). Creating narrative scenarios: Science fiction prototyping at Emerge. Futures, 70, 48-55.

[10] Burton-Jones, A., Butler, B., Schott, S. V., & Xu, S. X. (2021). Next-Generation Information Systems Theorizing: A Call to Action. *MIS Quarterly 45*(1), 301-314.

[11] Candy, S., & Kornet, K. (2019). Turning foresight inside out: An introduction to ethnographic experiential futures. Journal of Futures Studies, 23(3), 3-22.

[12] Crossan, M., Cunha, M. P., Vera, D., & Cunha, J. (2005). Time and Organizational Improvisation. *The Academy of Management Review*, 30(1), 129–145.

[13] Csikszentmihalyi, M. (2008) Flow: The Psychology of Optimal Experience, New York, NY: Harper.

[14] Csikszentmihalyi, M. 2000. Beyond Boredom and Anxiety: Experiencing Flow in Work and Play, New York: Jossey Bass.

[15] Cunha, M. P. Clegg, S. R., & Kamoche, K. (2011) Improvisation as ''real time foresight'', *Futures.*

[16] Cunha, M.P., Miner, A.S. & Antonacopolou, E. (2017). Improvisation processes in organizations. In A. Langley & H. Tsoukas (Eds.), *The Sage handbook of process organization studies* (pp. 559-573). Los Angeles, CA: Sage.

[17] D'Argembeau, A. & van der Linden, Martial (2004). Phenomenal characteristics associated with projecting oneself back into the past and forward into the future: Influence of valence and temporal distance. Consciousness and Cognition 13 (4):844-858.

[18] Dolcos, F., Iordan, A. D., & Dolcos, S. (2011). Neural correlates of emotion-cognition interactions: a review of evidence from brain imaging investigations. Journal of Cognitive Psychology 23, 669-694.

[19] Durkheim, Emile, translated by Joseph Swain (1912). *The Elementary Forms of the religious life*. London: George Allen & Unwin Ltd.

[20] El Sawy, O. A., Malhotra, A., Park, Y., & Pavlou, P. A. (2010), "Seeking the Configurations of Digital Ecodynamics: It Takes Three to Tango", Information Systems Research, 21(4), 835-848.

[21] Haeckel, S. (1999), Adaptive Enterprise: Creating and Leading Sense-and-Respond Organizations, Harvard Business School Press.

[22] Hallin, C. (Forthcoming). From the Knowledge Society to the Collective intelligence Society. Collective Tacit Knowledge and Artificial Intelligence for Policy-making. Routledge Handbook of Collective Intelligence for Democracy and Governance. Routledge. UK.

[23] Hernes, T. (2022) *Organizations and Time*, Oxford University Press.

[24] Hovorka, D. S., & Peter, S. (2021). From Other Worlds: Speculatively Engagement Through Digital Geographies. *Journal of the Association of Information Systems*, Nov/Dec.

[25] Hunt, T. & Schooler, J. (2019). The "easy part" of the Hard Problem: a resonance theory of consciousness.

[26] Mueller, B. & Hovorka, D.S. *Mini-Track Introduction for "Knowing What We Know"*, in *54. Hawaii International Conference on System Science (HICSS 2021)*. 2021: Maui, HI, USA. 5653-5654.

[27] Oliveira, N. & Lumineau, F. (2019). Time is Ripe! Using Time Conceptualizations to Advance Research on Interorganizational Relationships, *Time Issues in Strategy and Organization*, pp. 27-58.

[28] Park, Y.; El Sawy, O. A. & Fiss, P. (2017) The Role of Business Intelligence and Communication Technologies in Organizational Agility: A Configurational Approach," *Journal of the Association for Information Systems*, 18(9), 648-686.

[29] Parmiggiani, E., Teracino, E., Huysman, M., Jones, M., Mueller, B., & Mikalsen, M. (2020). OASIS 2019 Panel Report: A Glimpse at the "Post-Digital". *Communications of the Association for Information Systems*, 47, paper 27, 583-596. Dec. 2020. https://doi.org/10.17705/1CAIS.04727

[30] Pavlou, P. A. & El Sawy, O. A. (2006). "From IT leveraging competence to competitive advantage in turbulent environments: The case of new product development". Information Systems Research 17 (3), 198-227.

[31] Pavlou, P. A., & El Sawy, O. A. (2010). The "third hand": IT-enabled competitive advantage in turbulence through improvisational capabilities. *Information systems research*, *21*(3), 443-471.

[32] Peter, S., Riemer, K., & Hovorka, D. S. (2020). Artefacts from the Future - Engaging Audiences in Possible Futures with Emerging Technologies for Better Outcomes Paper presented at the Twenty-Eighth European Conference on Information Systems, Marrakesh, Morocco.

[33] Prior, P. (2021). Phygital - What Is It and Why Should I Care? https://www.forbes.com/sites/forbesbusinesscouncil/2021/06/30/phygital---what-is-it-and-why-should-i-care/?sh=151b5014587a

[34] Ringberg, T., Reihlen, M., & Rydén, P. (2019). The Technology-mindset Interactions: Leading to Incremental, Radical or Revolutionary Innovations. *Industrial Marketing Management*, 79, 102-113.

[35] Rivard, S. (2020). Theory-building is Neither an Ar nor a Science. It is a Craft. *Journal of Information Technology, May 2020,* 1-13.

[36] Rydén, P. & El Sawy, O. 2019a. How Managers Perceive Real-Time Management: Thinking Fast & Flow," *California Management Review* (61)2, 155-177.

[37] Rydén, P. & El Sawy, O. A. 2019b. Real-time Management in the Digital Economy, in *Time Issues in Strategy and Organization* (Ed. T. K. Das). Charlotte, NC: Information Age Publishing.

[38] Rydén, P. & El Sawy, O. A. (2022). Flow with the Go: Real-time Continuous Improvisation in Digital Business Ecosystems. The Routledge Companion to Improvisation in Organizations. Eds. Cunha, M. P., Vera, D., Abrantes, A., Miner, A. Routledge.

[39] Shipp, A. J., Edwards, J. R., & Lambert, L. S. (2009). Conceptualization and measurement of temporal focus: The subjective experience of the past, present, and future. *Organizational behavior and human decision processes*, 110(1), 1-22.

[40] Strogatz, S. (2004), Sync: How Order emerges from Chaos in the Universe, Nature, and Daily Life. UK: Penguin Books.

[41] Tang, S., Richter, A. W., & Nadkarni, S. (2020). Subjective time in organizations: Conceptual clarification, integration, and implications for future research. *Journal of Organizational Behavior*, 41(2), 210-234.

[42] Van Alstyne, M., Parker, G., & Choudary, S. P. (2016) Pipelines, Platforms, and the New Rules of Strategy, *Harvard Business Review*, 94 (4), 56-64.

[43]Wikipedia:https://en.wikipedia.org/wiki/Avatar_(2009_film).

[44] Wunderlich, N.; Bierrings, M.J & El Sawy, O.A. (2022). *On the wings of twins: Unfolding the phygital dynamics of digital twins*. White paper. IT University of Copenhagen, Denmark.