Towards Sensemaking in the Meshwork of Technology, Ecology and Society: Symbiosis of Aesthetics, Performance and Digitalization

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Abstract

To act, humans first need to make sense of the world. Thereby, sensemaking goes beyond accumulation of pure information of objects or rational knowledge production, but it encompasses additional information such as meaning, mindful engagement, socially embedded knowledge, cultural and work contexts. To navigate in diverse environments, sensemaking becomes central to social settings, also to engage with technologies and understand dynamics in ecological environments. In a complex world where technologies are added components of everyday life and are envisioned as partial means to approach global challenges, social, technological, and ecological environments become intertwined. This meshwork of environments also means to bring together different kinds of knowledge as a base of sensemaking through experience. In the Digital Sensemaking project we specifically look at digitization processes, the interaction with IoT Elements and Digital Twins through the lens of performance art to elaborate on the non- cognitive core constituents of sensemaking processes: embodiment, action-sense nexus, and temporality. We show that aesthetics can be found as an important dimension to bridge the cognitive and non-cognitive process and explore the role of art in this kind of research. It facilitates process and technological development in organizations entangling the social, technological, and ecological.

Keywords

Sensemaking, Digital Sensemaking, Embodiment, Digitalization, Aesthetics, IoT Elements, Digital Twins, Performance, Embodied Experience, Symbiotic Organizations.

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Introduction

"Now this makes sense" is an expression that is regularly used by many people. What does it mean though, and why is collection of information alone often not enough for something to make sense? The more complex the environment becomes, the more difficult it is to make sense of situations. For example, concerning the climate crisis many artworks aim to establish a connection for the audience between scientific insights on a global scale, or

global climate dynamics, with specific manifestations of the same issue on a more local or individual scale. The same is true for other artistic projects that deal with global challenges, such as helping individuals living in Western countries with a mindset informed by the needs of their lives in Western cities to better understand the impact of their behavior. [1] More specifically, to create awareness how behavior and decisions of citizens in urban environments can affect rural environments in other countries, or how mindsets framed by social and cultural ideas in one country can lead to exploitation of ecological systems that the very same population has an interest in preserving. In these endeavors, artists engage in the creation of experiences to help the audience make sense of abstract information.

On the other hand, environments of social interaction, cultural production, and work processes become increasingly enriched with technology, connected to digital systems, or even completely digitized. Engaging with digital processes, socio-technical or socio-hybrid systems can lead to a new version of the disconnect presented above: how much are workers in touch with what they are producing? For example, rhythms of a production factory, materialities of components, noises of the machine, and embodied knowledge such as feeling the right pressure might be important for production workers to understand if everything is going well in the process.

When they are suddenly confronted with a digitized version of their work, depicted in software on a computer and with robots taking over much of their physical work, how do they still make sense of the process that is going on? [2] Which clues do they actually need? Or how can individuals purely connected through technological systems still make sense of what they do together?

In the era of global challenges and digital transformation of central processes in work, government, and society, organizations and individuals are challenged to make sense in such complex situations that are constituted by

merging information, abstractions, and experiences (or the lack thereof). Starting from sensemaking theory based in social sciences which has been discussed within organization science for about 40 years now with a strong focus on social context and cognition, we aim to explore sensemaking in a potential symbiosis of social, technological, and ecological environments. Scholars already pointed out how important it is to include embodiment, sensemaking with non-human and more-than-human actors or environments, and to go beyond a focus on logos or exploration of a mind-body dualism in understanding sensemaking; to develop a decentered notion of sensemaking "—not simply at the disposal of human subjects—and where sense is always and already given and made simultaneously", but as a process beyond logocentrism that unfolds "in the meshwork of life". [3] This means to include a focus on immanent and embodied aspects, including temporality, leaving anthropocentrism by including more specifically actors and aspects that are part of the sensemaking process such as materialities, technological elements, or ecology. According to Karl E. Weick, sensemaking is about patterns that enrich and develop organizational structures, about the attribution of meaning to processes and situations.

In the Digital Sensemaking project that we present in this paper, we answer this call of scholars in the field of sensemaking theory through experimentation in diverse settings that connect to non-human and more-than-human components in a controlled way. Therefore, creative new methodological approaches are needed. [4] Our analysis of this experimentation is informed by methods from qualitative research in social sciences, visual studies, and methods in performance studies. We are especially interested in deepening the understanding of embodied sensemaking and the role of embodiment in sensemaking, aesthetic experience, and the role of aesthetics in sensemaking. Therefore, we work with performance artists in the setting of artistic research and performance art.

The research is based in the academic Institute for Business Informatics—Communications Engineering that focuses on digitizing work processes, cyber-physical systems, and digital twins. Thus, central to the artistic research and artistic performance development of the artists involved is the engagement with these systems in the context of sense-making processes. With this interdisciplinary project we connect arts-based work and the creation of aesthetic experience through artistic practice (performance) into exploration of technology with contributions to theory building within the social sciences and contributions to technology development.

The paper is organized as follows. We will start by introducing sensemaking theory and the theoretical context of why and what we aim to explore with the Digital Sensemaking project. We then account for our methodology to work with performance artists to investigate embodiment and aesthetics in sensemaking with digital technologies, cyber-physical systems, and digital twins. We will present our insights on embodiment and aesthetics in sensemaking in the above-mentioned "meshwork of life" and explore how including art in the research process can open avenues for research and symbiotic organizations.

Sensemaking

In everyday experience, sensemaking is referred to as a process in which experiences, information and situations suddenly fit together parts fall into place, relations between bits of information in a certain environment, or as sense-making scholars write "[sensemaking] is the primary site where meanings materialize that inform and constrain identity and action". [5] Since the 1980s the theory of sensemaking has been explored extensively in the field of organization studies. Organization studies is interested in understanding human behavior of individuals and groups, organizing processes, work, hierarchies, but also in questions of shared meaning and communication in groups. With its entanglement in sociology, psychology, anthropology, ethnography, work, and management studies, it has been a fruitful field to expand the original concept of sensemaking. Sensemaking is considered as an ongoing process of clarification, as enactment of sensible environments, as social in terms of relation to the knowledge and sensemaking of others as well as a reflection on one's own identity. Moreover, it originally has been characterized as informed by cues that the individual becomes aware of, an urge to understand what is done as plausible, and informed by retrospective reflection on situations.[6]

Since the inception of sensemaking theory, scholars started to expand on missing aspects of the original definition. Most importantly, the strong focus on cognition, logocentrism, or even rationalistic approach to sensemaking has been criticized widely, similar to different ways of understanding temporality and the role of the human in sensemaking, and its lack of situated and embodied dimension in order to give way for research covering these aspects and more differentiated approaches in sensemaking moving away from a pure anthropocentric and language orientation – as previously

language and cognition have been first entry points to research. [7], [8], [9], [10], [11] For example, ethnographic methods and video analysis have been employed to investigate the various role of the body and embodiment in sensemaking processes, such as sense-making "with the body" and "from the body"; in other words: embodiment in the process of sensemaking, and the role of established embodiment for sensemaking. [12]

Other endeavors expanded on the influence of the material world on the sensemaking process. Going beyond the communicative support of boundary objects, the role of material practices for individuals to transit to group-level sensemaking. [13] Taking this further, researchers in human-computer-interaction started to investigate technologies to support sensemaking processes. [14] A first step to connect the idea of aesthetics and sensory knowledge to sensemaking has been identified in cases through linking embodied and implicit knowledge in the handling of objects in work and knowledge production processes.

In a first step, individuals make sense of what they are working with, for example data in the field of physics which is their specific field of education and work. At a later point in research, their implicit knowledge about the look and feel of the data and their ingrained knowledge of physics creates difficulties in finding fresh perspectives on the data. Aesthetic re-interpretation of the objects can help them through this process. [15] Thus, objects become part of sensemaking, and technological environments to which individuals relate to daily or which mediate their work, are part of their sensemaking processes. This entanglement with the material world in sensemaking processes and as important sensemaking dimensions for humans becomes visible beyond the engagement with human-made objects or the use of objects and technologies to mediate sense-making between individuals—or may restrict it in the case of ubiquitous use of technology.

Based on the experience with the non-human and the more-than-human in the environment of remote material landscapes and the sensemaking of ecological processes by indigenous peoples, ethnographic methods have been employed to investigate ecological embeddedness of sense-making and the increasing inability to make sense of subtle ecological cues of Westerners who predominantly live in urban or industrial areas. This lack of extending sensemaking to the environment in that sense leads to vulnerability, for example by misunderstanding dangers in wildfire situations or regions prone to high waters or other harsh conditions that need to be recognized to enable individuals to predict danger. [16] This still increasing

detachment of macroscopic aspects in the environment that play into sensemaking processes is supported by the simultaneously increasing focus on sensemaking on microlevels, in personal "bubbles", specific organizational settings, disciplinary work, or even cultural perspectives.

Although the meshwork of life, i.e., social, technological, and ecological dimensions of the environment are becoming more central in the understanding of sensemaking theory, there are still gaps to research, e.g., to raise awareness of problems in the focus of sensemaking process on specific microlevels, to better understand a new dimension that is introduced through certain technologies: digitalization, and to entangle aesthetics and art with interdisciplinary sensemaking research. It is supposed to connect cues from the environment, experience, sensory information, embodiment, and diversity of media relevant to sensemaking.

Towards Digital Sensemaking

Experiences in the Covid-19 pandemic accelerated the digital transformation as envisioned by protagonists of Industry 4.0, that includes the implementation of Internet of Things (IoT), robotization, cyber-physical-systems, but also propagated ideas within the transhumanist movement. At the same time, digital transformation can also lead to work overflow as tasks arrive much faster at the responsible human actors, and to information overflow as much more details and relevant factors need to be described because they cannot anymore be experienced directly – but at the same time become more abstract –, and meaningful experiences and decision-making processes become more difficult. [17], [18] On some scale many people experienced such effects during the Covid-19 pandemic: being decoupled from on-site team meetings, communication might have become difficult over time, or understanding the actual situation in a production hall through digital twinning of information might have been difficult and can have led to delayed decisions, or even to oversee important moments to avoid problems.

Digital transformation is often associated with changes in mental representations of knowledge of those who engage in the digital transformation, in order to be able to adjust the behavior to new situations. [19] This idea is strongly rooted in social information studies and mirrored in processes of communications engineering and computer science. One reason can be that digital transformation is understood as being based in transforming information into digital representations and abstractions that seemingly follow rational logics. Thereby, logocentrism, anthropocentrism, and a focus on disembodied abstractions that are represented through words, numbers, or most importantly also visualizations surface in this field and such settings. But considering the often experienced disconnect between digitized work process and internalized hands-on work in production companies, the resulting information overflow, and difficulties in decision-making, it is important to ask the question how to create meaningful experience in digital transformation and sensemaking in the interaction with digital technologies. [20], [21]

Weaving digital transformation (and its predominant focus on cognition and abstraction) with the concept of sensemaking and the most recent scholarly contributions with an increasing focus on the body, embodiment, and physical interaction with the environment, the question we explore with the concept of digital sensemaking is where the body and the senses are in the case of digital transformation? Thereby, the concept of digital sensemaking aims to integrate the body and the mind, cognition, and experience, as necessary for sensemaking with digital technologies, in cyber-physical systems, and thus create opportunities to design meaningful interaction.

This integrative perspective adds an important aspect to human sensemaking when connecting beyond technology or the immediate micro-environment. Or the other way 'round: enhancing sensemaking with digital technologies which are embedded in the meshwork of life, for resilient organizations and human beings in scenarios where technology, ecology, and the social need to be integrated for sensemaking.

The Role of the Body and Aesthetics

Ideas of what sensemaking is are not necessarily bound to knowledge about social scientific theories on sensemaking. Thus, we started this project by a preliminary investigation of what individuals who are experienced in working in both, in academia as well as in the arts, do understand as sensemaking. The preliminary investigation consisted of four qualitative interviews with artists who work in academia and focus on sensemaking in their work without focusing on the theory. The answers we received to the question of "what is sensemaking for you?" are striking. They represent beautifully how body, mind and experiencing

the world are entangled in sensemaking. In the first interview, an artist with a bodily artistic practice who is also embedded in natural science research, says:

"It's a mess, making sense of the world, different biases, we spend so much time trying to make sense of the world. I don't try to make sense of it, through dance I just experience and feel, don't think just do. I like to learn more about the complexities, but the deeper I go, the less it makes sense. Dancing helps to see different things in different ways. Everyone has both sides of the brain in their head, both sides are needed for everything. Being analytical in the dance is really important. [...] I'm talking about science and art separately. In dance you see a movement and intuitively move. In physics – breakthroughs – you learn it so much that it becomes intuitive."

The third artist we interviewed referred to this entanglement in a similar, but different way:

Sensemaking is "when your ideals and your perception of reality are the same. When something makes sense is when you can truly believe it, now you understand it and it's real and it's the truth. You can investigate to know what is the truth, making sense of reality is to incorporate your senses to prove something as true. That's when it makes sense. When things are confirmed, they become understood, and then you come to your senses and perceive reality."

Both excerpts from the interviews show how reality, perception of reality, being in the world, understanding through body, and theoretical reflection and cognitive understanding need to come together to make sense. The first artist also refers to an additional dimension, through the reflection on "biases" the dimension of the social, of values, cultures are pointed out. On the one hand, there is cognition, abstracted knowledge about the world and how it functions (or should function). On the other hand, there is the experience, the way the world is perceived, situations that impose themselves on us. Thus, the body and the bodily senses play a central role - abstract knowledge alone does not yet lead to sensemaking. Sensemaking is informed through the situation, the experience, and subtle information of the social and cultural context. Put it in a different way, experience and "being in the world" are key to sensemaking. There is no sensemaking without all these rich additional layers of information.

Sensemaking scholars have worked in many directions to make sensemaking theory consistent, mainly by working with cases to fill in gaps in the original theory. Lately, two theorists, Sandberg and Tsoukas, used a

phenomenological approach to theoretical work and case studies on sense-making when presenting a typology of sensemaking that is ordered by as they call "four core constituents" of sense-making: sense-action nexus (or "being-in-the-world"), temporality, embodiment, and language. [22] Most knowledge in sensemaking theory revolves around language as it is strongly connected to articulation of the lived experience in order to process collectively and to connect to cognition. Sense-action nexus, temporality, and embodiment are more fluidly overlapping concepts and less clearly developed in sensemaking theory. The body plays a certain role in sensemaking - it is not only the case through embodying knowledge, but also through the experience over time and of "being-in-the-world". To experience the world, the body needs the senses, what entangles being-in- the-world with the body through the senses. Experience through the senses is connected to aesthetics as understood by Alexander Gottlieb Baumgarten. Connecting to the senses, sensory perception, sensory and sensible knowledge is also referring to building knowledge with and through the body to refine skills which implies making sense of situations or tasks. [23], [24] As an underlying theme, this is also expressed by the artists as quoted above.

Thus, while researching the role of the body for sensemaking in digital transformation and with digital technologies, we also see an opportunity to push the boundaries of knowledge within sensemaking theory. We suggest that based on the entanglement as presented above, it is necessary to unravel dimensions of aesthetics and the entanglement of aesthetics in sensemaking.

Some experimental approaches already pointed to the role of bodily interaction and aesthetics within human-robot-interaction, emphasizing that reflecting on the body and aesthetics in such interactions with technologies needs to go beyond design (UX or UI design) in order to relate to the robot, to become aware of situated dynamics, and to adhere social meaning. [25] Enabling social meaning making connects strongly to sensemaking as materialization of meaning in the context of identities and action (see introduction to sensemaking).

The Digital Sensemaking Project

The Digital Sensemaking project (DIGI-Sense) is a two-years' project to explore the rich space at the intersection of the social, the technological, and the

environment. Specifically, we focus on sensemaking in the realm of digital transformation, more precisely in cyber-physical systems, with digital twins, and through IoT elements enriched environments. [26] These IoT elements are represented by a variety of technologies, such as sensors and robots.

– What does it mean to put the human at the center of technology development considering the layered input that is needed for sensemaking? How to engage in "digital sensemaking"?

– Where is the body in sensemaking with digital technologies? What implications does this have for the development of technological systems of a symbiotic future?

What lessons can be learned from digital sensemaking on the body in sensemaking? Can we contribute to a better understanding of the body and its sensing capabilities – aesthetics – in the sensemaking process?

In the DIGI-Sense project we work with performance artists to explore digital sensemaking. In three steps – along three phases – the project team works with performance artists to explore several aspects of sensemaking through tailor-made performative research, performative installations, and performances. The performance artists work with the technological infrastructure in their performative research, development, and staging. Thereby, they can draw from the technological infrastructure (i.e., IoT elements, sensors, robots, 3D-sanning and point-cloud generation systems, digital twins).

The three phases of experimentation with the performance artists are structured as follows: in the first phase, two performers without affinity to programming and technology development nor pre-knowledge about IoT elements, sensors, and robots, engage with the provided systems. Their learning and performative research process into the technologies provided with a specific focus on embodiment and the senses is in the center of this first phase. This phase serves as an 'approaching' phase for non-familiar humans to IoT technologies and robots. Its major outcome is a set of moments that could trigger sensemaking processes.

The second phase focuses more specifically on the trilogy of sensemaking, sensebreaking, and sensegiving, again with a focus on the body, the senses, and more explicitly on aesthetics. This phase includes higher levels of digital abstraction such as digital twins. The

artist will develop a performative installation that invites performers and test persons to explore and make sense of the digital twin of their body and movements.

The third phase aims at contrasting the idea of embodied articulation to the cognitive and language-based idea of supporting change through poetic language. [27] In this way, the project spans from initially approaching cyber-physical elements to digital representations that finally can be encoded in human language, however, guided by performance art. The remainder of this paper will focus on the first phase in the DIGI-Sense project.

Methodology including Performance Art

The body and embodiment have already attracted the interest of scholars in sensemaking. They investigated the interaction with materials and objects, but also learning processes of people rowing the Amazon. (e.g., [28], [29]) The body thereby has been described as essential in sensemaking in several levels: through the interaction with other bodies, non-human and more-than-human bodies, sensemaking processes and specific moments are enriched, supported, and informed; but also the body's capability of learning, suffering, implicit or tacit knowledge, a more holistic approach to the sensemaker's body to be embedded, sentient, and situated; as well as the connection of the body to the identity and very personal processes of the sensemaker have been pointed out.

Nevertheless, it is difficult for social scientists to go deep into the question of embodiment as the bodily experience is something very personal, something difficult to abstract to rational arguments, and the methodologies used to investigate the body and bodily experience are only marginally part of the repertoire of research methods in social sciences. Connecting to art, especially performance art, is one way that has been explored by some organization scholars previously. [30], [31]

To focus on embodiment and the senses in our research we work with performers. Performers have a heightened bodily sensibility as they are educated to work with the body and reflect on their embodied processes. Through working with them we aim at harvesting from this capacity for deeper understanding of the role of the body in sensemaking. Moreover, the four core constituents of sensemaking are aligned with experimentation with performance artists: sense-action nexus (i.e., do, be in the space, explore and experience

with the body and senses), temporality (i.e., process, unfold over time, ways of experiencing time and being in the situation), embodiment (i.e., work with the body, capacity to "read" the body, bodily senses, process of embodiment), language (i.e., articulation, conversation between performers, of performers, and with the researcher). [32]

Additionally, we employ methods from qualitative research in social sciences such as qualitative interviews, participatory observations, observation diaries, diaries by the performers, video footage throughout their complete process of interaction with the technologies for the DIGI-Sense project, and photo documentation. For the visual material, we also employ strategies from visual research and performance research. [33], [34], [35] Connecting bodily experience and in-depth interviews has also previously been used to examine micro-processes in meaning-making in experience, and thus is a relevant juxtaposition of the body and the senses in sensemaking with cognitive reflection. [36]

First Performance Phase

Between March and May 2022, we worked with two performance artists (one male, one female) to explore digital technologies with their artistic practice. Both artists do not have any background in working with digital technologies and did not have previous experience with integrating digital technologies in their performative practice. One of the performance artists has an additional background in human medicine, the other performance artist has previously researched interspecies communication and animal behavior in their artistic practice.

The idea was to engage in a learning process with several chosen digital technologies provided by the Institute of Business Informatics – Communications Engineering. This engaging learning and investigative process would focus on the bodily experience, embodiment, and the senses – and thus aesthetics. The process would result in "micro-performances" that express important moments of the interaction between the body and the digital technologies for sensemaking.

The artists worked individually, next to each other, and together, depending on the stage of their process and their sensemaking of the digital technologies. The places they worked at throughout the process were: at their homes and private environments, at a performance space in Vienna throughout a week-long residency, and

at the premises of the University of Linz (especially when they worked with the infrastructure that was bound to stay at the premises of the university). The researchers provided them with a selection of digital technologies to work with, which they could choose from for their performative research.

The technologies they chose were a selection of M5Stack sensors as IoT components to be navigated digitally via coding language Blockly (Figure 1), and the agile robot system Boston Dynamics Spot (Figure 2). Additionally, they chose to explore the 3D-scanning and point-cloud generation system Trimble x7. The focus in their process was on the IoT elements and the agile robot system, and an additional exploration of the 3D-scanning and point-cloud generation system in one afternoon.

The two performers recorded their process with the digital technologies through filming themselves or each other in the interaction, moreover, they were asked to take notes in a diary to trace their process and took photos of their outcomes and certain moments. During selected phases of the performers' process, one of the researchers was present for participatory observation. The researcher also took videos, photos, and notes in an observation diary. Additional material about the digital technologies that was used by the performers to learn about the digital technologies has also been tracked and fed into the evaluation.

Figure 1. One of the performers exploring the IoT elements M5Stack while starting to code them in the programming language Blockly. ©Daniela Brill Estrada.
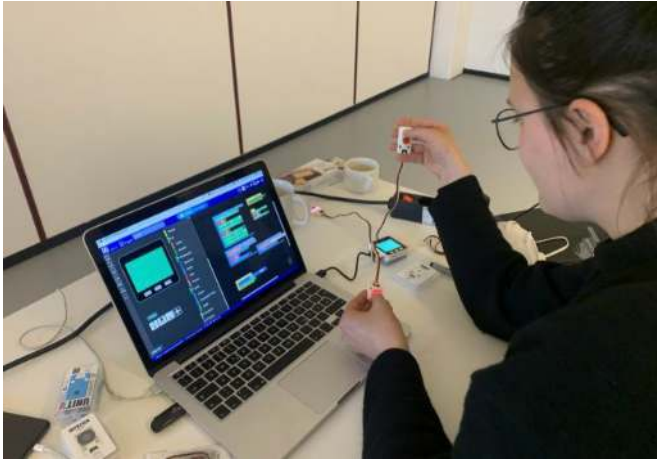
Figure 2. Performance with the agile robot system in the park of the university. ©Daniela Brill Estrada.

The performative research and exploration of the digital technologies became an ongoing process in which instead of the development of staged "micro-performances" it became more important to define key moments in this ongoing performative exploration which acted as ahamoments, oh-no moments, or moments of "suddenly everything fell into place" and "now all the movements become fluently, and parts fall into their places". Finding and analyzing these moments and the process that leads up to these moments became key to the evaluation process of the visual material. On top, the performers developed one performance with the agile robot system to be staged at the "Lange Nacht der Forschung" (researchers' night) at the university campus. Central steps in the performers' sense-making with the agile robot system could afterwards be traced in the development process for this performance. All in all, we generated 119 videos to use as data, ranging between 20 seconds and over 47 minutes in length.

Additionally, one of the researchers interviewed the performance artists at several moments throughout the process. This process started with a preliminary interview before planning the research, then we did four focused interviews with each of them. The first main interview took place before the actual performative research started, then two in the middle of the ongoing project, and one at the end of the process. All interviews have been transcribed. After the evaluation of the material, one more conversation with the performers took place to clarify specific questions and get feedback on the interpretation of the data.

Coding for Data Analysis and Interpretation

The data analysis for this first phase in the DIGI-Sense project has been done coherently after the performers submitted all their materials and data generated throughout their process. For coding and evaluation of the data, the software MAXQDA has been employed, a software to support the analysis of qualitative research data, including qualitative interview transcripts and video material. The design of the first performance phase was based on the idea to start by the exploration of digital technologies through the performance artists. We traced both their individual and group-level practices of sensemaking of the two performers, keeping in mind conversations, forms of engagement, patterns of (social) interaction, and material artifacts. Through this we aim to surface and can report on:

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Their sensemaking process in the interaction and learning processes with the provided technologies.

–

The interplay of meaning making and knowledge production through conversations, theoretical input and doing.

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Thereby, the focus is on examining the role of the body and the senses, implying the role of aesthetics.

To do so, we decided to code the collected data on the one hand for moments and information that refer to specific aspects of the sensemaking process and connect to the body, the performers' movements, or their open reflection on their bodily experience. [37], [38], [39] On the other hand, to surface an understanding of aesthetics in the sensemaking process, we also coded for aesthetic moments. These aesthetic moments are also partially connected to sense-making literature, as sensemaking scholars and sensemakers presented in sensemaking research refer to the aesthetic dimension without referring to "aesthetics" as such, and to their senses as important aspects in their sensemaking. Examples can be found plenty in sensemaking literature, and in meta studies on sensemaking. For example, expressions such as the following are used: movements get interrupted, noise creates awareness that something is wrong vs. "normal engine noises". [e.g., [40]]

For the moments in the sensemaking process that connect to the body in the video material that is supported by the additional data, we decided to search for the following codes (number of coded moments in

brackets, a total of 514 moments): "the artists are solving a problem together" (33), "wondering about something together (while working together)" (32), "proposal of a solution" (59), "direct body interaction with the element" (35), "thinking out loud / speculations about function or meaning" (40), "something goes wrong / encountering a question or problem" (71), "aha-moments" (22), "retrospective explanation of past situation step by step" (30), "communication through body, sound, movements" (37), "directly speaking to or interacting with camera" (6), "aesthetic elements of the sensors in the process of the performers" (43), "metaphors" (9), and "connection between body and machine / also aesthetic" (8). The codes needed to be adjusted for the specific inter-action modalities and functions of the agile robot system. Especially codes on the direct "human-machine interaction" (24) and "feedback from the machine" (15) needed to be added, others were slightly renamed to fit the situation with the agile robot system. Overall, the codes captured learning or knowledge acquisition moments, and modalities of behaviors, both categories addressing the performative practice of sensemaking.

For investigating the role of aesthetics, we referred to sensemaking literature and literature in organizational aesthetics to define the codes. [41] We found 51 moments that represent these. The aesthetic codes are: "rhythms", "repetitions", "movements", "sounds", "comparisons", "aesthetic analogies and metaphors", "velocity", "haptic properties", and aspects like "color, texture, form, weight".

Discussion and Conclusion

First interpretation of the data gives insights into the rele- vance of aesthetics in the sensemaking process to build relations between the sensemakers and their environment and context within which they make sense. The aesthetic information that they receive through their senses informs them about basic interaction modes with them digital technologies – and thus helps them to engage in a learning process to embody the interaction with and the use of these technologies. At the beginning, handling the IoT elements or interaction with the agile robot system is clumsier than when being used to handle them, and how the materialities feel, can be touched, or handled best, need to be learned. At later stages in the process, aesthetic feedback from handling the technologies helps to react faster and to handle them in a differentiated way. For example, over time, rhythms develop, and movements become faster, and aesthetic feedback from the technologies (e.g., sounds)

can be understood more quickly. In the interaction with the robot, the bodily interpretation of the movements of the robot changes from superficial interpretation of the robot's body to a more fluent interaction of movements.

The senses and bodily learning processes play an important role in the internalization of the knowledge and to make sense of new situations in the interaction. Thereby, the researchers interpret that the senses and aesthetics do not only play a role in the core constituent of sensemaking "embodiment", but also as a bridge to the main starting point of sensemaking, the "action-sense nexus". Being-in-the world also means being in the world with the senses and aesthetically experience to learn and to make sense of new situations.

In situations of rapid digital transformation individuals often have difficulties to adjust from embodied work to digitized systems. Becoming aware of problematic situations gets more difficult. Moving from an entangled situation that includes cognition, the senses, and bodily experiences to an abstract situation in which mainly cognition is reflected can lead to disorientation. Like ecological sense-making, sensemaking in a digital environment needs a learning phase that includes the body and the senses in order to develop fine-grained competencies. This also has implications for designing digital transformation: without personal experience of the processes, creating an abstrac- tion for digitized systems will more likely result in systems that are difficult to grasp for users.

Reflecting on the relevance for art and the cases shown in the beginning: artists are experts in dealing with aesthet- ics, creating aesthetic experiences, and translating information to various bodily senses. Especially in complex situations, art can support individuals to get a feeling for the problems (e.g., climate crisis, water, and land use) through creating experiences. This will have a stronger impact for knowledge gain than relying on cognition only. The next steps in the data analysis and phases two and three in the DIGI-Sense project, will give us the opportunity to explore these outcomes in more depth. Of particular interest is the performative practice with digital representa- tions in the second stage of the project, and the translation from digitalized processes to new embodied and materialized meaning in the final stage of the project. Especially as these steps entangle the cognitive with aesthetics and embodied performance involving physical and digital components and the actors' broader environment.

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