III. From Problem to Possibility
Imagination, Experience, and Emotion

Innovation advertisements, campaigns, and images display glowing light bulbs, dynamic arrows, and networks that connect related terms. One sees Michelangelo's 'The Creation of Adam'-like images in which a human hand approaches a robotic hand—sparking what between them, a Promethean spark? A network is unfolding; somewhere, there is the term 'AI', and elsewhere, there are strings of numbers of zeros and ones. There are icons of cogwheels, brains, and puzzle pieces. (Book) titles such as *From the Idea to Market Success* (Bundesministerium für Wirtschaft und Energie, 2020), *The Creative Mind* (Boden, 2004), or *Where Good Ideas Come From* (Johnson, 2010) grace the scene.

No matter what one is ultimately confronted with, the glowing light bulb, the robotic hand or simply the word *idea*, the central focus persists: *creativity and ideas* take centre stage. It is the sudden idea, the envisioning of a future that enhances a current situation, the work, or the intricate thought—the puzzle piece—that presently leads to the refinement of an idea, something novel that humanity has not witnessed before, perhaps similar but distinctly unique.

Founders, inventors, and hackers often recount an idea that struck them suddenly, perhaps during sleep, linked to a problem encountered in everyday life. Their idea serves as a realm of possibilities, envisioning a better world. Imagination should precisely be the starting point for this chapter and the emergence of an idea because, even if the aforementioned images aim to promote innovation as an act of creativity, they underscore one crucial aspect: imagination and creativity are the realms of possibilities for any innovation and, consequently, are highly emotionally charged. The term 'imagination' is subsequently followed by 'experience' and 'emotion'. These three terms constitute the theoretical foundation for delineating the emotional aspects of innovation processes. They run parallel to the pragmatist approach of thinking, feeling, and acting, guiding the reader through these interrelations and their significance. These terms serve as the conceptual tools throughout this work, reappearing in subsequent sections related to prototyping and innovation developments.

3.1 Imagining Possibilities

> What would an inventor or innovator be without his idea? After all, the idea is what innovation is all about. An idea [can be a dream of a better world], and it somehow carries the character of utopia. In general, the idea always refers to a "could-be".
> *(Interview from 06/04/2020, Christian, Founder of M.lab, own translation of the German transcript)*

Imagining possibilities assumes developing one's thoughts into hypotheses that become the expression of a state of possibility in the past, present, or future. This signifies a human act of creativity to imagine a life, an interaction, or a state of affairs and, therefore, differs from the actual situation. This manner of contemplating a departure from reality can be seen as an ambition, particularly when an idea is involved. The capacity to imagine, i.e. how we conceptualise what and how, also results from experiences, which are inherently intertwined with emotions. These are cascading reactions directly linked to one another. Our imagination centres around an object evoked by external or internal stimuli (Brentano, 2015). Based on experience, our engagement and interaction with the world take on emotional dimensions, meaning a motive force imbued with feelings that stir us and thus shape our mindset in the world, our stance towards something, and our relationship with the world. This can subsequently lead to actions and reactions, especially if our idea is destined for further development.

Imagining an idea thus means a distinct form of a hypothesis. Unlike in the past, speculation about the present and future encapsulates the potential for a reality collectively experienced. It is precisely this allure of the future that often leads to romanticising proposed solutions for past and present predicaments. Speculative research, in particular, has critically examined questions surrounding social futures and their logic and rationalities over the past five to ten years (Wilkie et al., 2017). In the temporal process, the prolonging present itself inhabits the future, an ever-continuing state (Wilkie et al., 2017: 2). However, this seemingly never-ending future does not replace the present but merely adapts the same logic and rationalities of the present. Consequently, the future is strategically planned and calculated based on present uncertainties and fears, losing its imaginative essence and remaining devoid of vision (Wilkie et al., 2017: 2). Often assessed through the lens of the past, the future loses its potential for change. If the future becomes a space for shaping past and present problems, it loses its modern ideal of progress, and the hypothesis then no longer expresses a possibility but degenerates into a description of a state. Here, the anxieties and uncertainties of modern times become evident as 'matters of concern' (Latour, 2004), warranting serious consideration. However, as a glimpse into the future, they are only intermittently usable, provided that uncertainty does not spiral out of control, stifling any potential for change (Adam et al., 2000). It turns

out that speculation and contemplation of possibilities often clash with expectations and the desire for security, explaining the frequent absence of a bold perspective.

Particularly for innovating, being stuck in contemporary rationalities and logic can be counterproductive, and innovation hubs, prototyping labs, and incubators reach their limits as a result. The crux lies in the fact that what is deemed 'new' does not necessarily equate to 'innovative', and the overly new faces acceptance difficulties among its potential users (Chapter IV). The definition of what is considered new remains a matter of negotiation. Nevertheless, to speculate at all, to create a vision, and to be inventive requires imagination. In this context, imagination is discussed philosophically and psychologically, especially by the pre-phenomenologist understanding of it as a mental force.

3.1.1 Imagination as a Mental Force

A mental force means that a moving force is set in motion (Brentano, 2015). In his work 'Psychology from an Empirical Standpoint', Franz Brentano precisely refers to the imagination as the starting point to develop a feeling of something outside oneself. His theory explores the *activity* and *creativity* of the mind and its ideas, conceptualising feelings as mental phenomena endowed with intentionality akin to *imagination* and *judgement*.

Although the term 'intentionality' remains somewhat undeveloped in Brentano's work and subsequently presents many difficulties, his thoughts on the subject have several intriguing and ground-breaking perspectives for his time. He views (psychological) phenomena as objects of inner perception and states that they are ideas (Ger. *Vorstellungen*) or at least founded on these. Brentano makes a clear distinction between mental[1] and physiological phenomena, categorising physiological phenomena as *objects* perceived through the senses, such as tones, colours, and tastes. These phenomena arise in the present through immediate conscious awareness during sensory experiences like seeing, smelling, hearing, or tasting.

In contrast, mental phenomena encompass acts of imagination that involve objects, such as thinking, feeling, fantasising, or dreaming. Thus, the act of listening to a tone, seeing a colour, passing judgements, and experiencing emotions like sadness, love, hate, or desire falls under mental phenomena. Initially, this awareness occurs subordinately.

However, Brentano's distinction already highlights the interconnection of experience (see subchapter 3.2), the capacity to imagine, and consequently, our emotional responses to the first two (subchapter 3.3). In summary, the realms of imag-

1 In the literature, this is sometimes also called a psychological phenomenon. However, to differentiate more easily while reading, the term *mental* is used here.

ination, experience, and emotions prove challenging to disentangle from one another (Beaney, 2005: e.g. 60 f.).

Thus, the inner perception (Ger. *innere Wahrnehmung*) serves as a prerequisite for every mental phenomenon. Whenever we engage in imagination, it occurs through the capacity of our imagination—often referred to as 'the inner eye'. Importantly, this imaginative process encompasses physiological phenomena, sometimes acting as the initial inspiration for subsequent imaginings. Brentano directs attention to the consciousness of a thing or a person. As elucidated, intentionality, as he describes it, signifies that a person's mental state pertains to something—an object, for example.

Consciousness is the mental faculty that allows awareness of something, thereby bringing it into existence. In this context, the reality of the idea does not hinge on its existence in the 'real world' (e.g. talking animals in dreams). The imagination of the thing (like a talking horse) renders it 'real', allowing one to contemplate things, whether real or unreal, proximate or distant. This mental capacity to be directed towards something beyond the mind, be it real or imagined, is known as intentionality.[2]

A physiological phenomenon, an experience derived from the senses (referred to as first order in the previous explanation) in the tangible world—such as an event—elicits a reaction. This reaction to an object or person may transform into a mental phenomenon. Consequently, the original experience becomes a past event. However, one's memory and the associated emotions from that past experience reside in inner perception, persisting in the present. Therefore, by recalling an event from the past, one can evoke the corresponding emotions in the present. This memory not only establishes a connection between the past and the present but also constructs a bridge from past thoughts and emotions to those of the present. Thus, the physiological phenomenon transitions from the first order to the mental one, as one cannot summon emotions through imagined scenarios without the prerequisite of a past event. 'But if physical phenomena have more immediacy in consciousness than mental acts, Brentano is at pains to point out that mental acts have a superior degree of "reality". Like all primary objects, physical objects exist in consciousness only as parts of the mental acts that contain them' (Fancher, 1977: 208).

Further, this consciousness involves a dynamic relationship between the subject and object, constituting an emotional process (Ger. *Bewusstseinsprozess*). Consequently, intentionality encompasses the direction of emotions towards something. This element gains significance as, per Franz Brentano's concept, emotions become

2 Although the interchangeable use of the words 'real' and 'true' in Brentano's language can be confusing, this is a compelling point in his theory as now, it indeed does not matter if something is real.

an external manifestation, serving as a connective link between the inner (my consciousness) and the outer (the world). As a result, the process of judgement ensues.

This intentionality, i.e. the capacity for imagining something, enables us to represent the world. However, what modes of representation are there? It is crucial to discern mental phenomena that provide descriptions of the world, with perceptions aligning with the real world. Desires and intentions may not necessarily align with reality but reveal how we aspire to construct it (and thus how we arrive at our judgements). Consequently, they can serve as motivation to effect changes in the world. This motivation, rooted in emotions, acts as a driving force, prompting societal engagement, political involvement, and participation in various ways (Marres, 2012). In more technical terms, emotions propel and activate individuals to either maintain a certain status quo or initiate actions that alter it (see 3.3: 'Emotions Constituting the Technological Artefact'). In both cases, it involves an activity that pertains to both the inner self and the external world. In essence, there exists a connection between subject and object, where something prompts an individual to act. For instance, a psychological phenomenon—an inner perception (idea)—elicits emotions *within me*, *motivating me* to take action. Consequently, *this idea has an impact on me*, generating a reciprocal reaction to the world. This dynamic can be conceptualised as feedback effects, reflecting a continuous oscillation between the inner and outer.

3.1.2 Creativity as an Imaginative Act

In scholarly discussions, the act of imagination is frequently interpreted as either constructing an alternative reality (e.g. Beaney, 2005; Byrne, 2005; Roese & Olson, 1995) or as a human faculty generating individual knowledge (Harris & Rapport, 2015: xiii). The former, as discussed in subchapter 3.1.1, involves a response to something—the status quo—that has been encountered. The latter implies a broader understanding, where it remains ambiguous whether one is reacting to the environment or independently creating an idea or knowledge. 'The imagination is a common practice, something to which human beings attend whenever they make sense of their environments and situate their life projects in these environments' (Harris & Rapport, 2015: xiii). Creativity can result from imagining a situation differently through what is learned from the environment. However, as noted by Berys Gaut (2003),not every act of imagination necessarily constitutes a creative endeavour, a perspective that appears valid. We are thus assuming an act of creativity that arises in the confrontation with the experience of reality. In this respect, as described in subchapter 3.1.1 by Brentano and the concept of intentionality, these are acts of experience that develop creativity themselves. For example, next to Franz Brentano, Berys Gaut and Michael Beaney

> [have] admitted that a creative act must be intentional, which presumably involves *thinking* of something. If, at the same time, that creative act *originates* something, then since that something did not exist prior to the creative act, the thinking that was involved must have been a thinking without commitment to its existence (at the time it was thought of) [see 3.1.1: Imagination as *a Mental Force*]. So, by Gaut's own definition, "imagining" must have been involved. Even if imagination does not imply creativity, then, *creativity may imply imagination* (Beaney, 2005: 195).

Hence, I aim to delve into creativity as the manifestation of an imaginative act and provide a more specific exploration of creative thinking and 'how people invent new instances', as articulated by Ruth Byrne (Byrne, 2005: 190). Byrne distinguishes three ways in which individuals engage in counterfactual imagination, outlining three categories of creative thought: inventing categories, concept combination, and insight. Concerning the first aspect, 'inventing categories', she states: 'They may think about a category by keeping in mind some possibilities. They may think of possibilities corresponding to true instances of the category, and they may not think about possibilities that are false (Byrne, 2005: 191).' Her analysis emphasises that the imaginative process builds upon known categories, where an existing idea is renewed through 'additions.' It is not a true process of invention but an expansion of existing concepts through the incorporation of other categories. Moving on to the second category, she explores how people invent new ideas through 'concept combination' (instead of categories). 'People can understand and produce new combinations that they have never heard [of] before. New concept combinations regularly enter into everyday language use. New knowledge may emerge from the interaction of existing ideas (Byrne, 2005: 193).' This form of creativity involves the ability to combine different concepts in individually meaningful ways, focusing on word composition based on the concepts. Despite potential variations in interpretation, it underscores the certainty of interpretation in the context of the ability to combine. Byrne highlights the reliability of human imagination and interpretive ability, drawing on prior knowledge to generate something new. This underscores the interplay between experience or familiarity and innovative development.

The third form described by Byrne is 'insight,' referring to what others might label a spontaneous idea—an idea that emerges in the moment, unpreceded by contemplation, reflection, or fantasising. This phenomenon occurs without predetermined rules or regulations.

Additionally, Byrne presents a series of experiments highlighting the constraints on creativity when individuals perceive certain elements as having 'fixed functionality' (Byrne, 2005: 194). This concept refers to situations where the ontology of an artefact is perceived as unalterable and consistently serves its original purpose. 'People often add mistaken assumptions to their mental representation when they try to

solve […] problems. They can solve them when they are primed to think about alternatives' (Byrne, 2005: 195).

> To be honest, I've never considered whether imagination is important. But when I think about it now, I guess without imagining something, it's just or probably not possible. So, it's just not possible that I want to invent something and don't think about it beforehand. Something always happens beforehand, then I think about it, and then I usually know what I want to do. Or, also in another way: sometimes, in a conversation or something, I suddenly think, wow, that doesn't exist yet. We have to do that! It's a sudden idea that just comes to me. Of course, I didn't think about it for so long, but the idea is still there. It's also fun, somehow. *(Interview from 18/06/2021, Karwen, Private Investor and Innovator, own translation of the German transcript)*

In this context, distinguishing between passive and active creativity proves meaningful. Passive creativity, as Beaney notes, involves an idea that 'pops into one's head' (Beaney, 2005: 196). 'Active creativity, on the other hand, involves a deliberate process of trying out different approaches, ideas or solutions until the right one is found (Beaney, 2005: 196).' This distinction aligns with Ruth Byrne's classification, where the first two are considered active and the last as passive acts. Both experiences are recognisable. Passive creativity represents a spontaneous and uncontrolled event reacting to the environment. As previously discussed, this may not be a conscious thinking act but an unconscious event manifesting itself in a reaction. On the other hand, active creativity involves a purposeful and controlled mental process aimed at finding a solution to a problem—a conscious and goal-oriented search. Both processes are evident in practice (see Chapter V) and are apt for describing the genesis of an idea and subsequent prototype development.

In the realm of Science and Technology Studies (STS), the significance of imagining futures or future imaginaries is prominent. Scholars such as Sheila Jasanoff, Sang-Hyun Kim, and Steven Hilgartner have highlighted the influence of the rich visual heritage of science fiction in the development of technology and innovations (Hilgartner et al., 2015; Jasanoff & Kim, 2015). Notably, a somewhat staggered development of technological ideas can be observed, often drawing inspiration from literary or cinematic sources. Examples range from 'Frankenstein' (Shelley, 1897), 'Brave New World' (Huxley, 1932), and 'Klara and the Sun' (Ishiguro, 2021) to widely watched films and series like 'Star Trek' (Roddenberry, 1966), 'RoboCop' (Miner, 1987), 'Minority Report' (Spielberg, 2022), and 'Black Mirror' (Brooker, 2011). In this dynamic, science fiction transitions into science fact. 'Belying the label "science fiction", however, works in this genre are also fabulations of social worlds, both utopic and dystopic (Jasanoff & Kim, 2015: 1).' These imaginative utopian and dystopian reference reality and the present while aspiring to be avant-garde, often describing

existing realities transformed to varying degrees, incorporating modern and, consequently, future visions. They seldom emerge entirely novel but rather depict an existing reality, transforming it to a discernible extent that incorporates contemporary perspectives and, consequently, future visions. The depicted objects frequently represent advancements of pre-existing categories or concepts, as discussed above. In doing so, they chart out potential opportunities that could capture the attention of the tech industry down the line. Nevertheless, these ideas and (re)presentations encapsulate entire societies and cultures that relate to reality and, thus, to a world of experience. In this context, the inception of ideas and inventions finds its roots in imagination and, consequently, everyday experience. It is through this imaginative form that such a 'bringing into being' arises,inciting emotions within oneself and others. Whether explored in the works of Franz Brentano or expounded upon by subsequent proponents of his phenomenological theory like Edmund Husserl, Maurice Merleau-Ponty, or Martin Heidegger, the intricate relationship with the world, whether real or surreal, finds expression through these channels.

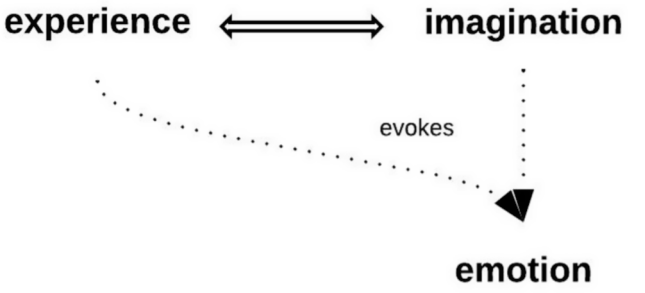
Primarily, the focus lies on the 'idea' as empiricism or an extra-mental scenario. This entails an exploration of experience, as delineated in philosophy—a conscious engagement with the external world, characterised by interactions that give rise to feelings. In a more specific sense, these interactions are often construed as structured contexts of experience.

C: Mhm, you are always confronted with something. With us, it's usually like this: people come here and already have a mental picture [Vorstellung] of what they want to do. Then, they need tools. [...]
I: Let's go back to their mental picture. Can you describe in more detail what you mean by that? Are these already finished ideas, or how do I best envision them?
C: Yes, not necessarily finished ideas, I think. From what I hear, they have concepts about what their thing should or should not be able to do. That's clear. You know, that "Swiss army knife" ["eierlegende Wollmilchsau"] thing. Something super great, perfect. *(Interview from 06/02/2020, Christian, Founder of M.lab, own translation of the German transcript)*

Hence, the ensuing subchapter diverges from experiences, referencing the imagination, as elucidated earlier, as a reality in the process of becoming. Subsequently, it enquires about problems and possibilities through a pragmatist lens, more precisely exploring the space of possibilities that the imagination unveils concerning the future. Thereafter (subchapter 3.3), attention is directed to the sociality with objects, elucidating how emotions play a role in constituting a technological artefact through value judgements. The concluding subchapter examines how an individual idea evolves into a collective idea, representing a form of knowledge accumulation in the realms of innovation theory and industry. Diverse economies sustain the

iterative loops within the disciplines involved in the development and design process. Throughout these segments, expressions of feeling are significant as internal responses to the external environment.

Figure 1: Experience-Imagination Interrelations



While there are parallels between Franz Brentano, a precursor of phenomenology, and the pragmatist representatives William James and John Dewey, phenomenologists would emphasise that pragmatism starts with experience as a given, while phenomenology does not require any experience to arrive at a world conception. Brentano's work already indicates a focus on closely examining phenomena as appearances. However, the assumption that this 'given' accurately represents things as they truly exist in the world is not inherently tied to it, although implicit pragmatism will later influence Edmund Husserl's phenomenology.[3] Nevertheless, in this work, the two philosophical schools are not presented as rivals. The upcoming chapters will consider (conscious) experience as both the experience of interaction and the experience of one's own imagination as a mental form from which creativity can emerge. In this context, experience does not necessarily have to be limited to what is encountered through interaction; instead, becoming aware of the imagination is also regarded as a form of experience.

3 Edmund Husserl is not relevant in this work. Yet, to understand the similarities among the two philosophical schools, phenomenology and pragmatism, a reference can be made to the method of *epoché* as a phenomenological reduction. In this approach, the implicit pragmatism of Husserl becomes clear. The concepts do not need to be separated either for this work or in general – especially not when at times, it is only a matter of terminological preferences.

3.2 Experiencing Daily Life

> The ideas come from everyday life. […] They [the physicians] might see a problem in their daily clinic routine, and then they want to change something. *(Interview from 13/07/2020, Felix, Consultant at Health Hub, own translation of the German transcript)*

Experience assumes a challenging position within the sciences, given its initially subjective, individual nature and limited verifiability. In contrast, the verification of the truthfulness of such experiences may not be a common concern unless someone perceives a direct impact. Scientifically, it isn't regarded as objective knowledge in a realistic sense, lacking a claim to scientific objectivity. Pursuing a singular truth through experience, seen as a subjective perception, is deemed too sporadic to make reliable statements about reality or the nature of things. Modern philosophy has extensively debated the controversial nature of experience, particularly in relation to emotions, as emphasised by pre-phenomenologists and psychologists. Conversely, experiential knowledge becomes valuable when decisions are grounded in scientifically robust foundations (Wynne, 1998). This draws a dual perspective through experiential knowledge, aiming to complement theoretical understanding.

> Well, we are constantly making experiences, whether in the hospital or here at Health Hub. And then, not only with the product but also always in the team, with the people; probably everything flows into the work somehow. I just know that good experiences are pleasant, but mostly, the bad ones help us innovate. Because then we know what we must change and what we still need to do. In brief, bad experiences are the ones that make us think and are easier to sell as a result. *(Interview from 30/01/2020, Bahar, Physician & Innovator at Health Hub, own translation of the German transcript)*

From an empirical standpoint, experiences are understood as all that *has been*, provided it has been consciously felt. Our memory influences *a* given present and, therefore, *a* possible future. Experiences are identity-forming, and their collection forms the basis of how and what we feel as they provide information about an ultimate, collective as well as individual reality through a network-like interplay of situational and momentary interactions. Experiences are resonant interactions of human beings with their world. We retain those that we are not necessarily aware of now (e.g. trauma) but which can nevertheless be evoked in our memory. These memories take place individually or collectively, are part of our identity, and have an immense impact on our emotions and how we value an object (Husserl & Ströker, 2012). Actively recalled memories forge an unbreakable link between our past and present and potentially influence our future—a phenomenon akin to sensing our past, echoing Edward Shils' perspective (Shils, 1981: e.g. 52).

However, the establishment of the sociology of science in the mid-1930s, its substantive orientation by Robert K. Merton and Thomas S. Kuhn, and the late recourse to Ludwik Fleck's ideas (e.g. *Denkkollektive*) heralded a *Pragmatic Turn* and many related ones besides. Pragmatism holds that the meaning of a concept lies entirely in its practical consequences and that action is, therefore, the origin of all things. Thinking is an instrument for bringing forth new ideas in the world (Bernstein, 2010). Thus, it signifies an active-creative function of thinking and, in consequence, a rejection of all those concepts in which thinking is seen as a display of transcendent, ontological realities which are merely received in the act of thinking.

This turn is particularly evident in STS, an interdisciplinary, scientific research field established in the 1970s to investigate the interactions between society, politics, and technological development. In the process, well-known scientific approaches such as the Actor-Network-Theory (e.g. Latour, 1993) or the Third Wave of Science (Collins & Evans, 2002) assign a new or higher status to experiential knowledge.

These anecdotes underscore the emergence of a new conception of experience within diverse scientific disciplines, driven by pragmatism and its subsequent resurgence prompted by the mentioned turn. In the following, the concepts of experience of William James and John Dewey, as prominent representatives of pragmatism, will be examined. Their contributions facilitate an active comprehension of experiences imbued with emotion.

3.2.1 William James and the Creative Reality

The notion of experience held a central position in the work of William James (1842–1910). 'It is one of the most important paradigms of modern humanities in the sense of a new critique of consciousness. […] James […] formulate[s] [his] critique of consciousness as a radical-empiristic attack on metaphysical concepts of consciousness (Bogusz, 2009: 202, translated from German).'

In his treatise on the fundamental character of the subject-object relationship, James raises the question: 'Does Consciousness Exist?' (1904), initiating a critique of the entrenched dualism between subject and object, a concept long established in philosophy (Russell, 1975). Primarily, he questioned the phenomenon of cognition (Ger. *Erkennen*), which requires a consciousness; everything presupposes the subject as mind or spirit and the object as something materialised. He endeavours to reconcile the divide between rationalism and empiricism through the original tenets of pragmatism, aiming to elucidate experience as a foundational rational element with his concept of 'Radical Empiricism' (1912).

William James, a philosopher, medical scientist, and psychologist, indeed had an interdisciplinary background, and thus, he called for a holistic view that transcended scientific disciplines. His projects were to be interdisciplinary and, indeed,

transdisciplinary. James critiqued the conventional subject-object dualism prevalent in prior philosophical thought, arguing that it failed to account for the entirety of life, body, and environment. The division inherent in dualism clashed with James's holistic perspective, which sought a more inclusive understanding of truth. Thus, he contended that only radical empiricism could effectively address this challenge.

The early pragmatists, including Charles Sanders Peirce, William James, George Herbert Mead, and John Dewey, rejected the notion of adhering to theoretical constructs imposed by philosophy, particularly in its moral frameworks, in favour of engaging in experiential inquiry and experimentation to develop theories and acquire knowledge. They advocated for the examination and comparison of *multiple truths* rather than the acceptance of a singular, universally valid truth that imposes a uniform reality on all individuals. This perspective represented a radical departure from the prevailing rationalisation processes of modernity. It can be characterised as a fusion of ontology and empiricism, manifesting as a *Weltanschauung*, or mosaic philosophy (James, 2006: 29), which synthesises diverse experiences that shape our perceptions, realities, and worldviews.

James's perspective on pragmatism evolves into a humanistic framework that prioritises the centrality of human experience. In this framework, reality is not perceived as inherently given but rather emerges from subjective, situational experiences, which may not solely rely on objective facts. However, this does not imply arbitrariness in the world but rather underscores its creative nature, aiming for a pluralistic perspective (see subchapter 3.4.1). This perspective acknowledges that the world is not predetermined but offers opportunities for individuals to exert influence and agency. It posits that everyone is an active participant in a network or mosaic of experiences, thereby sharing equal responsibility for their actions—an idea drawn from James's meliorism influenced by Peirce. For James, this approach represents a means of resonating with the world.

Pragmatism fundamentally posits that the significance of a concept resides in its practical implications. Action emerges as the fundamental driver of all phenomena and serves as both the precursor and objective of all cognitive processes. James expanded upon this notion by formulating a theory of truth that associates the worth of a proposition with its utility. According to James, truth is contingent, context-dependent, and subject to continuous evolution, rendering it only temporarily valid. Consequently, as previously mentioned, there exists not a singular truth claim but rather a multitude of divergent ones—a pluriverse. This conceptualisation underpins the democratic principle, which later served as a method for Dewey to advance communicative, intersubjective experiences.

3.2.2 John Dewey's Experiences as Interactions

John Dewey's (1859–1952) pragmatism, extending from James's principles of resonance with the world and initiation of creative processes, offers a remedial approach and presents an analysis of experience as a wellspring of ideas. Particularly in his later works 'Nature and Experience' (1925) and 'Art as Experience' (1934), Dewey discusses his major philosophical concept. In 'Nature and Experience', often seen as Dewey's metaphysical exploration, the notion of nature is viewed as a preliminary understanding that anticipates the significance attributed to experience. Dewey's conception of nature elucidates that it is not a predetermined entity but rather an ongoing interaction between living organisms, species, and environmental factors within a developmental framework. This evolution is contingent upon openness and situational context, drawing upon its potential from dynamic interactions. A parallel notion emerges in his work 'Art as Experience', which probes into the philosophical underpinnings of art theory, investigating the essence of aesthetics and the interconnectedness of art, society, science, and emotional responses. However, unlike conventional art theory texts, Dewey's approach shifts the focus from the audience to the artist, providing a distinctive perspective centred on the creative act and its transformative potential.

Dewey's perspective extends beyond the artist as a creative individual. He posits that '[t]he intelligent mechanic engaged in his job, interested in doing well and finding satisfaction in his handiwork, caring for his materials and tools with genuine affection, is artistically engaged (Dewey, 1934: 4).' Accordingly, Dewey's concept of activity or creativity is not limited to the realm of art. It can be extended correspondingly and applied and aligned to this work. In this context, creativity becomes a trait of anyone who can consciously engage with their work and environment and who demonstrates commitment and care (Mol, 2008: 50; Tronto, 1993: 102).[4] I will revisit this point later. Ultimately, this premise already hints at Dewey's views on democracy.

Dewey's democratic perspective rejects the differentiation between high and low art. He argues that this separation disconnects society from the comprehensive experience of art and aesthetics. As a result, society loses its intuitive understanding

4 Joan Tronto and Berenice Fisher, for example, provide a convincing definition of 'care' that fits and enhances John Dewey's view of the artist's activity and explains how to imagine the engaging work of someone that impacts their surroundings: 'On the most general level, we suggest that caring be viewed as a *species activity that includes everything that we do to maintain, continue, and repair our "world" so that we can live in it as well as possible.* That world includes our bodies, our selves, and our environment, all of which we seek to interweave in a complex, life-sustaining web (Tronto, 1993: 102).'

of daily life experiences in creativity and aesthetics, relegating art to what is collected in museums. However, Dewey primarily refers to the concept of experience in his writings. He differentiates between two types of experiences: one of a somewhat unconscious nature that has no significant influence and another of a unique kind, which assumes an almost esoteric character.

'Experience occurs continuously', John Dewey writes, 'because the interaction of live creature[s] and environing conditions is involved in the very process of living.' When individuals find themselves in conflictual situations, their interaction with the environment brings emotions, ideas, and conscious intentions to the fore, exhibiting different behaviours compared to experiences not consciously perceived. 'Non-consciously' experiences, however, lack clear intentions and structure, starting abruptly and ending prematurely – 'we start and then we stop.' (Dewey, 1934: 35). In both scenarios, the focus lies on the dynamic interplay between an individual and the external world, indicating a state of continuous evolution rather than a static condition. Dewey later elaborated on this concept, introducing distinctions from the aforementioned understanding:

> In contrast with such experience, we have *an* experience when the material experienced runs its course to fulfilment. Then and then only is it integrated within and demarcated in the general stream of experience from other experiences. A piece of work is finished in a way that is satisfactory; a problem receives its solution; a game is played through; a situation, whether that of eating a meal, playing a game of chess, carrying on a conversation, writing a book, or taking part in a political campaign, is so rounded out that its close is a consummation and not a cessation. Such an experience is a whole and carries with it its own individualising quality and self-sufficiency. It is *an* experience (Dewey, 1934: 35 f.).

According to Dewey, there is a distinction between an ordinary and extraordinary experience, with the latter termed *an experience*. Whereby, through distinctive perception, the ordinary can also be 'reactivated' to be consciously perceived. In extraordinary experiences, we encounter the particular, both positively and negatively. We sense a resonance, an activity. Through the new, the unfamiliar, and the non-repetitive, we ultimately arrive at *an experience*. It has a starting point and an end. Therefore, unlike the one before, *an* experience has structure. For Dewey, consciousness is the key to transforming a habit into shock, that is, the impetus, a resistance that becomes usable for changing the existing arrangement of matter (Dewey, 1934: 35 f.).

> With us, no two days are ever the same. So, well, of course, some days are more exciting than others. However, especially when we are working towards a milestone, it feels like unforeseen things are happening all the time. That sounds kind of uncontrolled, but it just shows that we are all doing this for the first time.
> *(Interview from 30/01/2020, Bahar, Physician & Innovator at Health Hub, own translation of the German transcript)*

John Dewey interprets this moment of active, conscious experience as the birth of cognition. This cognition catalyses the formation of ideas and their subsequent creation. Dewey views art as the ultimate expression of this process. For him, art is not just a concept but a testament to humanity's ability to enhance life. It continually serves as a fresh foundation for the genesis of new creations. Art bridges the gap between sensory perception, internal needs, and impulses, manifesting them into external forms.

In 'The Quest for Certainty' (1929), John Dewey presents a surprising passage that addresses the formal essence of an object, echoing Karl Marx's perspective while also examining its emotional impact. Dewey introduces a social-emotional dimension, moving beyond mere functionality. He critiques the purely rational functional approach of modern philosophy for its neglect of experience. 'These preconceptions [that materials only follow their molecular properties] are the assumption that knowledge has a uniquely privileged position as a mode of access to reality in comparison with other modes of experience, and that as such it is superior to practical activity' (Dewey, 1929: 103). In his discussion on art, Dewey extends this argument, emphasising the integral role emotions play in connecting us with art:

> Suppose [...] that a finely wrought object, one whose texture and proportions are highly pleasing in perception, has been believed to be a product of some primitive people. Then there is discovered evidence that proves it to be an accidental natural product. As an external thing, it is now precisely what it was before. Yet at once it ceases to be a work of art and becomes a natural "curiosity". It now belongs in a museum of natural history, not in a museum of art. And the extraordinary thing is that the difference that is thus made is not one of just intellectual classification. A difference is made in appreciative perception and in a direct way. The aesthetic experience – in its limited sense – is thus seen to be inherently connected with the experience of making (Dewey, 1934: 50).

The moment of alienation, as previously described, is already inherent. This leads to a reordering of things, prompting a new assessment and reflection on an object's evaluation. These are familiar moments when we find ourselves revising a previous assessment, often accompanied by an astonished 'Oh, I see'. This conscious process questions the preceding one and may lead to a new conclusion, an appreciation, or even a degradation. Interestingly, Karl Marx's description of the commod-

ity fetish (Marx, 1887) and Bruno Latour's 'Factish' (Latour, 2010) both provide similar accounts of this reordering. Ontologically, the focus shifts from the purely physical or (bio-)chemical functioning of an object to what the object evokes in an individual or even a collective. The question arises as to the extent to which it possesses a specific potential for power because the mere 'belief in the belief' prevails and escapes criticism.

Emotions, which Dewey primarily characterises as aesthetic experiences, are integral to his concept of experience. As evident in pragmatism, Dewey discourages a purely modern approach. He views emotions not as fleeting or casual feelings, but as the quality that captures the complexity of experience. According to Dewey, any intense expression that quickly surfaces and fades is a reflex, referred to as an affect by others. This perspective underscores the depth and intricacy of human experience.

> Physical things from far ends of the earth are physically transported and physically caused to act and react upon one another in the construction of a new object. The miracle of mind is that something similar takes place in experience without physical transport and assembling. *Emotion is the moving and cementing force.* It selects what is congruous and dyes what is selected with its color, thereby giving qualitative unity to materials externally disparate and dissimilar. It thus provides unity in and through the varied parts of an experience. When the unity is of the sort already described, the experience has aesthetic character even though it is not, dominantly, an aesthetic experience (Dewey, 1934: 44).

Dewey, as evident in the quote, connects the previously criticised modern philosophy, e.g. the way of thinking adopted by the Cartesian Turn and the previously overlooked aspect of experience. He elevates the status of experience, a recognition it has not previously received in the realm of natural sciences. In this context, he lauds emotion as a 'moving and cementing force […] giving qualitative unity to materials'. At around the same time, his colleague Emile Durkheim would refer to the occurrence of sensations as 'social or organic solidarity' (Durkheim, 2013), attributing an indicative role to emotion in this context. It determines compatibility and harmony. Through various experiences, emotion bears witness to the degree of qualitative unity. Pertinent to this thought is the fact that from the moment of experience and the ensuing idea in prototype development with its iterative loops, numerous other experiences are gathered from different actors. Emotions evaluate these many experiences and signal the degree to which something should be incorporated as a distinct idea in the innovative artefact and to what extent a 'temporary entity' arises from it (see 3.4 Interim Conclusion: The 'Moral Economy' Around the Artefact).

> Well, I had a similar idea, and there was already something like this here [at Health Hub]. […] Moreover, Hendrik brought in the patients because we need to know

what they think and whether it works. It is the data from the patients that flow into this, and we evaluate many parameters. […] The milestone plans are a different story. We have discussions with Tim and the consultants, and there are always ideas that come into it. Tips or something – but mostly, I say that things do not work that way. In the end, it is a collection of many ideas, but what is implemented must ultimately be technically feasible. *(Interview from 04/02/2020, Viktor, Developer at Health Hub)*

3.3 Emotions Constituting the Technological Artefact

This subchapter shows in more detail how emotions can be projected onto things based on one's imagination. The assumption is that it is through emotions that we communicate (Döveling et al., 2010; Gammerl, 2012; Hochschild, 2012). Emotions are part of our actions and language, but they are also formed and shaped by our environment and culture, and vice versa. This subchapter posits a correlation between our imagination, experiences, and emotions, which is evident in our actions. This aligns with the pragmatist approach of *thinking*, *feeling*, and *acting*.

The primary focus lies on the activating moment triggered by emotion within an individual. The objective aims to demonstrate that *creativity* is awakened in individuals as a result of specific emotional states, constituting an activating moment that stimulates the generation of novel ideas or artefacts. This activation serves as a fundamental prerequisite for individuals aspiring to innovate. Furthermore, the nexus between imagination, emotion, and (re)action crystallises as the relationship with oneself, one's group, and the broader world. Through emotions, individuals assess both themselves and external entities such as things. Emotions possess an inherent value that individuals can transfer, and which can have a different value depending on the 'moral economy' (see subchapter 3.4).

I thought to myself, we have to do something about this. It made me so incredibly angry that this didn't exist yet. It's so obvious and necessary for everyday clinic life. It can't be that there isn't a functioning solution for this. I'm furious. *(Interview from 30/01/2020, Bahar, Physician & Innovator at Health Hub, own translation of the German transcript)*

The ensuing discussion will explore the pivotal role of emotions in the production of knowledge. It may seem counterintuitive to assert that emotions, abstract by nature, influence the construction of knowledge. Yet, the emotional entanglement with and co-creation of facts stand as a central thesis of this discourse. Historically, emotions have been entwined with science, albeit complexly, as they have not traditionally been acknowledged as analytical faculties. Instead, they have been relegated as

subjective and irrational, leading to their marginalisation in scholarly discourse (De Sousa, 1987). In the quest for objectivity of facts and science, the concept of the 'Scientific Self' was rendered impersonal, leading to the dismissal of emotions as unscientific (Daston & Galison, 2007: e.g. 199). The disregard for their quality and fruitfulness for science finds a brief pause in the so-called *Emotional Turn* starting in the 1980s (Hitzer & Gammerl, 2013), a movement that persisted for over two decades[5] and has quietly existed ever since. However, it is occasionally taken up anew in the academic debate.

Despite this, a unified canon among the disciplines still needs to be discovered, resulting in ambiguity regarding the precise implications of the Emotional Turn. This imprecision is hardly unexpected, given the historical side-lining of emotions as either analytical tools or research prerequisites—a viewpoint already critiqued by Alexander von Humboldt (Humboldt, 1845: 5 f.). Contemporary studies on emotions almost invariably reference the Emotional Turn, advocating for a renewed focus on their significance.

Throughout the latter half of the 20th century, efforts to incorporate emotions into scientific dialogue led to pivotal shifts in thought. The Linguistic Turn at the 1960s' close marked a departure from sporadic references to emotions, establishing them as a key analytical category. Figures like Richard Rorty and Gustav Bergmann played significant roles during this period. Post-World War II saw the rise of Neo-Pragmatism in the United States, which diverged from traditional philosophical paradigms by focusing on everyday experiences and their linguistic articulations. This movement rejected the pursuit of an ideal language, as previously sought by language philosophers, and instead embraced the empirical study of language's everyday use.[6] It was unique that no ideal language, as demanded previously by the philosophy of language, was to be developed, but rather the empiricist exploration of language and its everyday expressions. This demand reintroduced a novel form of subjectivism. In this regard, the change conferred a new status on language use and elevated thinking and feeling as subjective elements of experience expressed through language, word choice, and prosody. Consequently, pragmatism may be considered a precursor to more recent studies on emotion.

5 There are some scholars from psychology (e.g. Klaus R. Scherer, Harald A. Euler, Heinz Mandl) and the neurosciences (e.g. Antonio Damásio, Joseph LeDoux) who date this turn around the 1980s (Hitzer & Gammerl, 2013). However, in the cultural sciences, it is dated around the millennium.

6 During the development of this newly interpreted school of thought, Rorty distanced himself in 1967 in the preface to the anthology 'The Linguistic Turn' from the analytical philosophy and, in particular, from the so-far-established philosophy of language. For Rorty, the turning away from the still-existing epistemology, and thus the attitude that one could interpret from theory to practice, was decisive.

During the 1980s, the field of emotion research gained substantial momentum. In social and human sciences, researchers have recognised a phenomenon known as emotional blindness, both within their subjects and beyond. They perceive this phenomenon as a deficiency that requires rectification. Subsequently, emotion research has significantly risen, solidifying its position in the hard and soft sciences. This progression indicates the importance of understanding and addressing emotional blindness in scientific studies (Schneider, 2016: 7). Psychology, in particular, identified this deficiency early on. During the 1980s, various congress contributions highlighted this unfortunate situation, advocating for a solution. The primary focus was to explore the interdependence of cognition and emotion further. This indicates recognising the intricate relationship between thinking and feeling in psychological studies (Schneider, 2016: 7).

Starting from the late 1980s, researchers began integrating emotion research with evaluation (De Sousa, 1987),positioning emotions not merely as external entities for evaluation but also as foundational elements for decision-making. This integration fostered the development of new rationality arguments, which catalysed a breakthrough in emotion research. The potential lay explicitly in the *rationalisation of the irrational*—a concept long deemed inconceivable—which attracted interest beyond psychology, including anthropologists and other humanities scholars. This interest led to the rediscovery of a field that historical studies have explored since the 2000s (see, for example, work by Max Planck Institute for the History of Science in Berlin from 2008). Consequently, studying the history of emotions experienced a boom, attracting considerable external interest and expanding a previously limited research field. Psychology, as applied science, has since popularised lay literature in guidebooks (Illouz, 2007), and the private self, inner life, and emotions have emerged as new products of capitalism. There is a heightened interest in the exposition of the body, soul, and emotional self, which has also attracted criticism.

Emotions, feelings, or affect serve as testimonies to social structures. This value of the statement wants to be applied here and made fruitful, albeit not to expose the subsequent guarantors, but to understand processes of change.

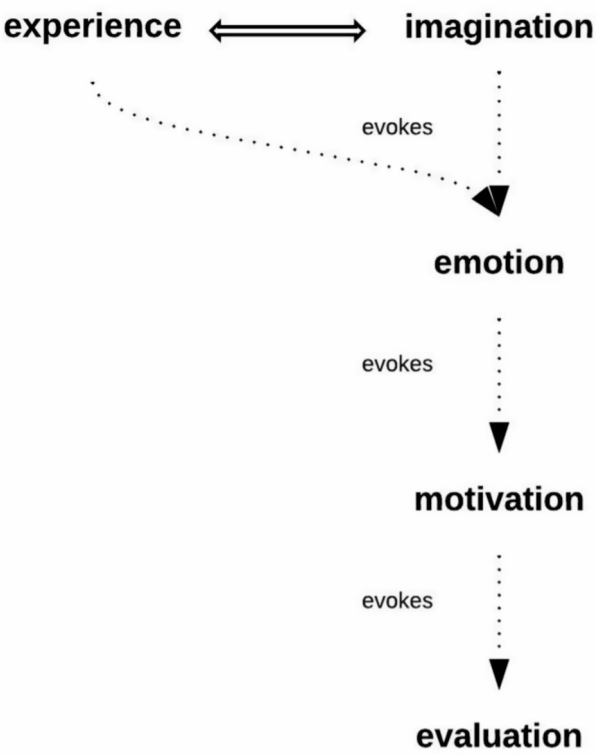
Therefore, understanding innovation processes and identifying the (emotional) social understanding of innovation in this context is crucial. Knowing the emotional status of a group helps to understand how it is socialised with and thinks about technological developments.

3.3.1 Emotionality with Things

As already highlighted by pragmatism, we experience ourselves as *thinking, acting*, and *feeling* human beings. All three aspects are central to our human existence and social (inter-)actions. The latter, namely feelings, is especially necessary to understand social order and social change (Barbalet, 2005: 178; 2006: 51). This indicates

that some feelings only arise through interaction and need provocateurs. Therefore, it is clear that a feeling refers to the nature of a relationship and its structure and imbalances. Feelings convey their *own* 'grammar': they refer to their vocabulary, syntactic forms, and meanings (Oatley, 1993: 341). Emotions give structure and, therefore, construct social practices and convey a way of thinking and feeling in a society or culture. Therefore, this subchapter emphasises the role of emotional construction in developing an artefact, focusing on the central question of how individuals bring it into being.

Figure 2: From Experience to Evaluation



Imagination and daily experiences, as previously described and depicted in *Figure 2*, generate ideas that inherently convey emotions due to their unique nature. In simpler terms, our socialisation and everyday lives shape a specific emotional reference system, a product of our reactions to our surroundings. Concurrently, emotions can also catalyse action (Döveling et al., 2010). Emotion, while not directly perceived as an actor, indirectly influences through its motivational force and can later

serve as a unifying element at a collective level (see subchapter 3.4). Materiality assumes the role of an emotion carrier, allowing the emotion to gain autonomy.

The idea thus creates an emotionally conceived prototype, a (technological) artefact. In this context, we interpret these artefacts as non-verbal signs that signify their materiality. Emotions emerge from social, material, and, ultimately, sociomaterial relations. Depending on the viewer or actor, interpretations of the idea and the artefact vary, as both provide spaces for projecting the hopes and desires of their creators, viewers, or users. The attributed meaning is situational and depends on the potential representation of the prototype, whether it be a cure, facilitation, or enjoyment. This situational representation ultimately forms the reference system of feelings, similar to what we know from Ludwig Wittgenstein's Private Language Argument (Hintikka & Hintikka, 1986: 244; Wittgenstein, 1977: I, sec. 243).

This reference system of feelings is something learned, formed by the outside and the inside (see subchapter 3.1.1). It is partly established but can evolve, leading to the emergence of a highly differentiated reference system accessed during situations of 'emotional labour' (Hochschild, 2012: 3). What is meant by this is that it is reflective work; one resorts to this system, although this emotional work partly occurs unconsciously because the feelings are not permanently consciously processed but rather express themselves in a way, or we manage them, as Arlie Hochschild indicates:

> Feeling rules are standards used in emotional conversation to determine what is rightly owed and owing in the currency of feeling. Through them, we tell what is "due" in each relation, each role. We pay tribute to each other in the currency of the managing act. In interaction we pay, overpay, underpay, play with paying, acknowledge our dues, pretend to pay or acknowledge what is emotionally due [to] another person (Hochschild, 2012: 4).

It is thus a matter of assessing what we are willing to show or how controlled or uncontrolled we want to be. It is an assessment of the situation and an evaluation of the situation in which we are interacting. However, it is not only a question of what we are willing to give, in the sense of an emotional concession, but also what we consider necessary. It is the exchange of 'goods' whereby the currency, as Arlie Hochschild mentions, is the feelings. The situation is the marketplace of the reference systems developed in each case. Thus, in every situation, we evaluate what something is worth to us and invest our feelings accordingly. This assessment applies to every negotiation situation under the aspect of what outcome the actors hope for. These negotiation processes occur within teams working on a technological artefact. It starts with the idea and the projected expectations of the product's final capabilities. As indicated, this makes the product the result of this emotional negotiation in various situations. Ultimately, it is a process of negotiating what the

team around the prototype deems 'valuable': which ideas to implement, what should remain in the final result, or what they can achieve within the given time frame or budget (see subchapter 4.3).

> We always fight [laughs]. If we were a married couple, we'd probably be seeing a therapist. We are in some way because we're constantly being counselled, we're taking courses, and we also have to explain ourselves. Everyone is given space. I think that's a good thing because, in the end, everyone values something different, and we have to somehow work together to get the thing finished and also to make it "sellable". So, emotions are always there, but it doesn't work without them; they are definitely what drives us. If everything was so neutral, ha [laughs], then maybe we would be faster sometimes, but certainly not as creative. *(Interview from 30/01/2020, Bahar, Physician & Innovator at Health Hub, own translation of the German transcript)*

> The "interactional" theorists assume, [...] that culture can impinge on emotion in ways that affect what we point to when we say emotion. [...] I think of emotions as more permeable to cultural influence than organismic theorists have thought, but as more substantial than some interactional theorists have thought [...] [An] emotion is a bodily orientation to an imaginary act [...]. As such, it has a signal function; it warns us of where we stand vis-à-vis [an] outer or inner event [...]. Finally what does and does not stand out as "signal" presupposes certain culturally taken-for-granted ways of seeing and holding expectations about the world – an idea developed [...] on the naming of emotions (Hochschild, 2012: 16).

Several methods can validate this statement, such as examining the diverse terms for 'fear' or 'joy' in various cultures or exploring different narratives within specific disciplines that relate a feeling to their work. For once, it is societies and their cultures that develop a particular language with which we collectively manage our everyday lives. Nevertheless, the many small disciplinary cultures or thought collectives (Ger. *Denkkollektive*), as Ludwik Fleck (Fleck, 1935) calls them, develop their language and, based on this language, bring different expectations to bear on an artefact, in this case. Ludwik Fleck, a microbiologist, medical scientist, and science theorist, posits that a collective forms knowledge and its production. It has no individualistic character, and if so, only in a gathered, collected sense. 'Denkkollektiv' is defined as '[…] as a community of people who exchange ideas or interact in thought, we have in it the bearer of the historical development of a field of thought, of a certain body of knowledge and state of culture, i.e. of a particular style of thinking' (Fleck, 1980: 54–55). How people communicate and their socialisation within their subject or group aligns them in their thought direction or how they perceive something. They adopt a particular perception that makes up their style of thinking. However, with Fleck, there is the distinction between the eso- and exoteric circles in

and around a thought collective whereby the esoteric circle consists of experts while so-called 'informed laymen' form the exoteric circle. The informed laymen thus do not form part of the 'inner circle' but rather are an informed group around the thinking collective that knows part of the thinking style or language. This distinction will be important later in the empirical part since these group structures also exist in the context of prototyping labs and makerspaces, namely an inner circle and a group that is indirectly informed or made aware where the latter know part of the content or are informed about the 'spoken language'. It goes even further as these circles are permeable; they can be transgressed and do not have to be self-contained.

Bearing this in mind, how can we exclude the possibility that they do not feel differently based on their expert language and project different attitudes, expectations, and desires onto a product or apply them to it?

> This is a microcosm here. Everyone wants to get something specific—me, a product that corresponds to my idea. Health Hub wants to know that we are developing something worthy of being funded here. The insurance companies want a safe product, which is why we have the Johner Institute on our side [...]. *(Interview from 04/12/2021, Ryan, Physician & Innovator at Health Hub)*

In a moral economy, as we will see with Lorraine Daston, we again encounter Ludwik Fleck's idea of thought collectives. Daston describes the negotiation processes of the esoteric and exoteric groups mentioned above. Furthermore, these negotiation processes and their confounding moments have the potential for emotional conflicts.

To understand how we arrive at value judgements, I will discuss below how emotions help us make judgements in the first place and how the coming together of different emotional cultures in a common place can also determine what we feel.

3.3.2 How Emotions Lead to Judgement

The difficulty with emotions is that they are often devalued as irrational, even though they can influence our decisions daily. In the complex decision-making dynamics, emotions often operate behind the scenes, subtly influencing the process. As a result, attributing decisions to specific emotions can be an intricate task due to their less overt visibility. However, it is essential to take a step back and not expect that a given decision is prompted and determined by a situational emotion. Instead, it is the case that we continuously perceive the world around us through our emotions, and we can thus also make a judgement based on long-term feelings and sometimes on the ideals that arise as a result—furthermore, starting from emotions as feelings are complicated, as I can name a feeling but not necessarily an emotion. Thus, I can feel anxious, sad, or happy, whereby these expressions are feelings. We often assume that emotions are the already processed perceptions of our consciousness, which is

why we are all too often familiar with the supposedly conscious handling of naming a feeling. In this respect, it is unsurprising that psychology has been trying to bring order into this emotional chaos for a long time. Three terms frequently cross our path: emotion, affect, and feeling. In addition, there are first and second-order feelings (Archer, 2000: e.g. 197 f.) or 'factive' and 'epistemic' emotions (Gordon, 1987: 45 f. and 65 f.). All these are attempts to distinguish the mere description of a headache from lofty romantic feelings or to have generally explanatory patterns for people's actions. However, as elucidated in subchapter 3.3.1 and reiterated here, emotions, encompassing both affects and feelings, articulate aspects of our attitude, delineating our boundaries, beliefs, values, and objectives (Sartre, 2015; Solomon, 2004). Since Immanuel Kant's time, diverse philosophical and psychological theories have emerged to address individual (value) judgements and decision-making processes. Building upon Franz Brentano's Theory of Judgement, philosophers posit that emotions exhibit *intentionality* (Brentano, 2015; Robinson, 2005). As described in subchapter 3.1, emotions are directed at something, and therefore – according to philosophy – so is judgement (Gordon, 1981; Lazarus, 1991; Nussbaum, 2003; Solomon, 1993). Love and hate, as exemplary emotions, necessitate an object for their direction; such feelings cannot exist without a focal point. Moreover, judgement itself requires a subject of evaluation; there is always something upon which I pass judgement.

The perspective proposing that emotions constitute evaluative judgements may appear extreme, given the necessity of other components, such as action tendencies and physiological changes for the experience of emotion. Nonetheless, emotions must inherently encompass some form of judgement (Robinson, 2005: 11).

Whether phenomenologists, existentialists, or psychologists, all are certain of at least one thing: judgements are always situational statements. If they involve emotions, they are evaluative judgements that indirectly name desires, values, interests, and goals. Judgements are situational because individuals consistently evaluate situations in different ways. However, evaluations occur in a moment of interaction with my surroundings, representing a convergence of inner and outer dynamics. Thoughts, associations, and memories intersect with the external world, prompting an immediate confrontation. The perspective that emotions constitute evaluative judgements might seem extreme, given the additional components required for the experience of emotion, such as action tendencies and physiological changes. Nevertheless, emotions must inherently involve some form of judgement.

'Richard Lazarus, for example, has claimed that the relevant "judgement" that forms the "core" of an emotion is always an "[a]ppraisal of the significance of the person-environment relationship"' (Robinson, 2005: 12–13). However, there is no consensus concerning the relationship between emotions and judgements. 'Some think that emotions are identical to judgements, others that judgements are sufficient for emotions, and others again that judgements are a necessary condition for emotions but not sufficient' (Robinson, 2005: 14). Still, regarding emotions, as judgements

seem misguided, simply transferring emotion directly into a judgement proves inadequate. Individuals can judge situations independently of their feelings by consciously distancing themselves from them. Subscribing to an 'objective' rationale, contradictory to personal feelings, is also possible. However, a direct relationship between emotion and evaluation persists, as consciously distancing oneself from emotions requires effort, albeit inherently linked to the self, albeit inverted. Such efforts entail reviewing one's emotions to facilitate evaluation. Without this, one may assume a linear relationship between emotions and resulting judgements.

Furthermore, it is crucial to recognise that emotions inherently convey a value-based understanding, shaping everyday decisions. However, as previously outlined, this does not automatically justify every action; instead, it involves individually considering the environment and one's perception of it, as elucidated by Arlie Hochschild.

3.4 Interim Conclusion: The 'Moral Economy' Around the Artefact

In 1995, Lorraine Daston, a historian of science, proposed a solution to the paradox of science with her concept of 'moral economies' (Daston, 1995). This paradox relies significantly on the idea 'that science depends in essential ways upon particular constellations of emotions and values (Daston & Galison, 2007: 3)', although there exists an expectation for science to embody rationality and objectivity. This entanglement is what she later picks up again together with Peter Galison:

> All epistemology begins in fear – fear that the world is too labyrinthine to be threaded by reason; fear that the senses are too feeble and the intellect too frail; fear that memory fades, even between adjacent steps of a mathematical demonstration; fear that authority and convention blind; fear that God may keep secrets or demons deceive (Daston & Galison, 2007: 372).

It thus becomes apparent that neither sciences (nor scientists) are free from subjectivity and, therefore, neither from emotions nor emotional attachment. In this regard, it exposes evidence as a 'child of our time'. The categories in which we think, the schools and styles of thought we develop, and maybe even the evidence we create (see also Latour's concept of *Factish*) are born out of time and the way of knowledge production of a specific group (as in Fleck's *Denkkollektiv*). Through empirical investigation, the concept of objectivity appears elusive. Yet, in a positive light, there exists a set of objective principles that have been developed and persistently applied, albeit subject to potential debate.

Nevertheless, the name Daston chose, namely the *moral economy,* might need some clarification. To understand what a moral economy means, we must refrain

from using the term economy and its understanding in the economies themselves. Instead, we have to go back to the word's original sense, which refers to a forum where people exchange 'moralities' or rather 'moral values', which generally refers to our expectations. Precisely, it 'is a web of affect-saturated values that stand and function in well-defined relationship to one another' (Daston, 1995: 4); an assemblage of diverging affects and emotions (hopes and fears) that animate their development and politics. *Moral* in this regard refers to both affective and normative dimensions, and *economy* is used in its expanded sense as a 'balanced system of emotional forces' (Daston, 1995: 4), that is, the system of emotional forces and affect-saturated values that surround and constitute a 'thing'.

This definition is a contingent and, at the same time, dynamic system, not a means to an end, and yet, the structure and the modes of action of a moral economy underlie a certain logic. 'Not all conceivable combinations of affects and values are, in fact, possible. Much of the stability and integrity of a moral economy derives from its ties to activities […] which anchor and entrench but do not determine it (Daston, 1995: 4).' This is when actors of knowledge production become relevant, whereby it does not yet indicate anything about their motivation to 'do' science. Moral economies are a relevant and indispensable part of science. They significantly influence scientists in terms of how and what to think and what topics to work with, including their decision-making and the objects they examine. Moral economies tell us how and why scientists pick or choose particular objects, which explanations they trust, and which habits and methods they use or develop. In the history of science, several examples demonstrate how much disciplines depend on the abovementioned aspects. At this point, one can refer to the so-called 'Science Wars', which repeatedly serve as an example to illustrate disciplinary differences within the sciences and argue about schools of thought, methods, and language. Frequently cited examples are the positivism dispute between Karl Popper and Theodor W. Adorno or the Sokal affair, or rather crisis, which was caused by and named after Alan Sokal. The latter, in particular, triggered a debate on intellectual standards for the social sciences, specifically devoted to the 'Science Wars'. As it turned out, this was a fundamental clue as it could not have demonstrated better how great the differences between the hard and soft sciences were.

By examining the moral economy of an artefact, questions about the thought patterns of stakeholders and actors can be answered, including: How are relevant actors emotionally shaped? What do they see as relevant? When do they judge something to be relevant to research, or how and when do they promote an idea?

Before initiating an initial analysis, it is imperative to pose two key questions. Firstly, how do the actors locate one another and mould their negotiation procedures assuming a shared interest in accommodating their respective ideas? Secondly, after reaching an agreement and commencing collaborative efforts, how does an artefact emerge as the cohesive force among these transdisciplinary actors? In other words,

how does the prototype, akin to Durkheim's notion of a social glue, facilitate the navigation of milestones, overcome obstacles, and mitigate discord within the team?

3.4.1 The One and the Many Ideas

Before empirically addressing the aforementioned questions, I aim to contextualise them within a theoretical framework that initially engages with a philosophical problem—a quandary that arguably stands as one of the most substantial of all time and continues to hold prominence in philosophical discourse (Savransky, 2021a: 4). The problem of 'the one and the many' discusses the question concerning to what extent we speak of a reality, whichever and whose it may be, i.e. that of the 'West or the "rest"' (Savransky, 2021a: 4) as a unity or a plurality and how the two relate to each other—or not. We cannot rule out that '[…] we base our conventional notions of what is real on a belief that we interact with the world as individuals separate from that world (Escobar, 2020: 2).' We typically examine our world ontologically, relying on our received teachings and formulating our ideas and conceptions accordingly. Even on a small scale, I would like to illustrate how the problem of 'one and the many' can become visible in an idea as an act of individual access to a world and why it remains a problem.

It is precisely in developing ideas and the subsequent development of prototypes that it becomes evident to what extent *one* idea may become *many* or vice versa. However, in the end, a given narrative tells us about a unified one, in which one cannot necessarily divide the plural aspects inherent to it. In this subchapter, two starting points have one thing in common: a problem—a problem unifying both points.

On the one hand, this refers to a problem that we detect in everyday life, through – as described earlier – our experience as William James, in a little anecdote in his talk from 1907, 'The One and the Many', indicates:

> I have sometimes thought of the phenomenon called "total reflexion" in optics as a good symbol of the relation between abstract ideas and concrete realities, as pragmatism conceives it. Hold a tumbler of water a little above your eyes and look up through the water at its surface – or better still look similarly through the flat wall of an aquarium. You will then see an extraordinarily brilliant[ly] reflected image say of a candle-flame, or any other clear object, situated on the opposite side of the vessel. No candle-ray, under these circumstances gets beyond the water's surface: every ray is totally reflected back into the depths again. Now let the water represent the world of sensible facts, and let the air above it represent the world of abstract ideas. Both worlds are real, of course, and interact; but they interact only at their boundary, and the locus of everything that lives, and happens to us, so far as full experience goes, is the water. We are like fishes swimming in the sea of sense, bounded above by the superior element, but unable to breathe it pure or penetrate it. We get our oxygen from it, however, we

> touch it incessantly, now in this part, now in that, and every time we touch it we are reflected back into the water with our course re-determined and re-energised. The abstract ideas of which the air consists, [are] indispensable for life, but irrespirable by themselves, as it were, and only active in their re-directing function. All similes are halting but this one rather takes my fancy. It shows how something, not sufficient for life in itself, may nevertheless be an effective determinant of life elsewhere (James, 1922: 127 f.).

This quote illustrates William James's abstract way of explaining that we are, after all, limited by our perspectives. Although new experiences constantly enrich these, we are ultimately unable to see a 'problem' other than the one we recognise, with which we are already familiar. For this, we need others to replenish our worldview or access the world through their world.

However, if individuals did not encounter problems in their daily lives, the need for a unification process would not arise. I propose that individuals identify various problems they intend to solve through their own ideas or the ideas on which they collaborate. Therefore, as previously outlined, they anticipate the idea, or ultimately the product, to serve as a solution for the issues they perceive. Therefore, instead, the second problem or extended problem unifies the many ideas, and a development process to find consensus is actually possible.

Thus, as discussed earlier, for the negotiation processes of prototypes, we need to start from a forum where idea contributors, incubators, developers, financiers, consultants, and sometimes insurers –when it comes to medical prototypes – meet. In the case of the latter, med-tech certifiers are also necessary as they are familiar with the regulations that must be adhered to so that a product can eventually reach the market.

In brief, we start from a forum where actors with different professional backgrounds meet and cannot constantly assess each other's work content. For example, some are medical doctors; others are economists, consultants, and developers, to name but a few. They all have different professional knowledge, interests, and goals. Ergo, the developer tends to focus on feasibility in the context of product development. Contrastingly, the medical scientist begins with a concrete, idealistic idea, as the empirical section of this study will elaborate upon in greater detail.

If this serves as the starting point, it also implies that all initially involved parties must first brief each other and are obligated to exchange information about their respective subjects, knowledge, and expectations to initiate collaboration. Theoretically, this constitutes the inaugural 'iteration loop', a term typically reserved for prototypes as they progress through various developmental stages (see Chapter IV). However, we can commence from these developmental phases even before creating the first model, given that we are in a social setting where initial assessments are

made through emotional engagement, as previously mentioned. People encounter one another, react, and evaluate one another.

In his fourth lecture, 'A New Name for Some Old Ways of Thinking', at Columbia University in January 1907 (James, 1922: 127 f.), William James postulated variety instead of one unity to be able to understand the world. He presupposes human curiosity as their will and their power to understand the world and seeks compromise, as before, between realists and empiricists. Hence, we must regard the process of materialising the idea as a multiplicity or pluriverse, culminating in creating a tangible artefact. It involves 'cultivating "a world of many worlds"' (de la Cadena & Blaser, 2018; Savransky, 2021b). To create a cosmos where all experiences converge, forming a realm of experience. It thus remains an 'ongoing and unfinished' (Savransky, 2021b: 143) process.

The assumption presumes that we are dealing with 'problematic' constellations with positions that show discrepancies among themselves. An 'aching gap' (James, 1902: 259), as James calls it, has to be filled, and through the constant effort and endeavour with the affected ones, they resonate, and a 'tensional activity' (Savransky, 2021b: 146) occurs. In this respect, pluralism, however small a role it may seem to play in everyday life, becomes a social risk we cannot avoid taking.

3.4.2 Esprit de Corps in the Moral Economy

Once this space, meaning the pluriverse of many experiences has been created so that there is increasing unity about what the artefact can, should, or must do, the artefact opens up new possibilities. The moral economy, as a place of negotiation, as a group that informs each other and opens up a world of thought and feeling, now finds a new identification in the artefact. The moral economy shows *esprit de corps*. Nevertheless, of course, time is required, and, apart from this, it is also essential to ask how a feeling of solidarity or loyalty comes about and what the nature of this feeling is. Is it because of pure goodwill, sympathy, pressure, or mutual dependence that the group works together long-term, and how stable are these structures?

To examine this, I first refer to parts of Emile Durkheim's social theoretical concept to describe the group dynamics at this moment. First of all, it must be assumed that an initial source of inspiration or an inventor comes from an 'archaic group' (Durkheim, 2013). In the broadest sense, this means that the source of inspiration or person comes from a familiar structure ('archaic group'), which is particularly evident in terms of its clearly defined values, norms, and evaluation patterns. According to Durkheim, the group is also characterised by its members' tight integration, who have little contact with other groups or, in this case, disciplines. It serves as a strut, although it now only initially unites similarities. As Emile Durkheim calls it, this so-called 'mechanical solidarity' (Durkheim, 2013: 57–58) must overcome itself to transform into a moral economy as a field of negotiation and the possibility for

new group affiliation. Group members come from their original area to a new setting, e.g. the incubator. Before they experience and reproduce their values through the original small group affiliation, they are firmly integrated into their system and their group and are rarely in touch with other professional groups. Their original collective consciousness, as Durkheim calls it, describes their belonging through language, morals, customs, etc., in brief, their culture, which as an identity-forming element holds the group together and shapes it. It is handed down and passed on. Collective consciousness creates a framework of mutual feeling and evaluation, i.e. a joint attitude. Durkheim describes the rejection of any threat to the system. If such a dissolution takes place voluntarily and constellations are created anew, the possibility for a moral economy can emerge.

> If you think about it, how many medical students have you met during your studies? Not so many. Most of them have their own campus, usually located in the university hospital. That's usually on the other side of town. And, of course, you also have a circle of friends that is so exclusive. I didn't know any software developers or technical designers when I came out of my studies. I didn't have these people in my circle. I just had other doctors. But you can't found a start-up with five doctors, not for MedTech. And then we started here with external contractors. But that wasn't so ideal. They only want the money, and what they deliver is always the minimum version. And then, by chance, we got Viktor, our technical developer. He studied computer science at MIT and has five years of experience in designing wearables. And then we got someone for the business administration part. My sister is already back in her studies; she dropped out again [of the team]. *(Interview from 30/01/2020, Bahar, Physician & Innovator at Health Hub, own translation of the German transcript)*

Thus, to enter or survive in this new group, a much more intensive form of communication is necessary. The former firm integration of the archaic group no longer exists in the new group; Durkheim calls it 'modern society'. The values that were once clearly outlined are no longer such, and the new members, who come from many fields and disciplines, can determine a new consensus of values. However, in the beginning, the original codes of a group are questioned in the new structure. In this respect, the 'collective consciousness' is no longer a traditional one. We do not find any established structures yet many 'culture clashes' that cause mutual irritation. The new system is comparatively much more fragile, and collective consciousness is not present initially. The possibility of disengagement arises, i.e. the feeling of not feeling bound to the group in combination with wanting to find one's way alone and the urge for individual spaces for action is evident. The potential lack of attachment can become a problem if no 'solidarity' develops, although 'loyalty' might be the more suitable term in this context. The solution to address this challenge is to provide clearly defined tasks for each individual and involves developing harmonious

interaction between the individual team members. Under these conditions, a new 'moral' emerges or a feeling of belonging in the new group. The crisis of the group, or the problem of lack of commitment described above, can be intensified by many different expectations, among other things. The desires and expectations, which are linked to an explicit value system, must be communicated accordingly so that they can finally be united.

The group builds a social bond through the artefact and because of it. Although they still need to be perceived as individuals, as they maintain their background of origin, they might develop an inspiring enthusiasm for each other's work. While this does not mean that there are no longer disputes, quarrels, and anger among the actors, in the best scenario, the actors develop a shared narrative which indicates that they are developing common 'social facts', ergo socially-determined behaviour (Durkheim, 2013: 270) for their group, meaning common morals, values, and norms. While they do not initially share these social facts in the group, this grows over time as they work together. A mutual dependence develops within the group, from which, in the best case, trust can grow, as Emile Durkheim describes it. This esprit de corps can also be distinguished from a collective consciousness or mechanical solidarity since they do not share the same experiences at the beginning. Thus, my starting point is that of individuals who develop and feel a form of group belonging and reliability towards each other. This expresses itself in the ordinary everyday working life, in conversations with and about each other and ultimately, in a narrative and founding myth that is shaped and formulated over time or is told at the end, based on success.

> Relationship of trust. That's great and very positive. And I also find it very emotional. Positively emotional. So, it's simply fun. And that is profitable for both sides. And then it also starts to become a togetherness. It's also a relationship that you enter into over time. I, at least, enter into a relationship for a time. But it can also be negative! That's always when, yes, I would put it down to trust. If the people we are looking after, yes, I called it resistant to advice earlier. This is often coupled with arrogance. With an inability to put one's own personality behind. That can tip over into arrogance. *(Interview from 13/07/2020, Felix, Consultant at Health Hub, own translation of the German transcript)*

An empirical question will be to what extent 'there are very general and indeterminate ways of thought and sentiment, which leaves room open for a growing variety and of individual differences' (Durkheim, 1972: 145). Beyond this, it will be examined whether trust – which is highly relevant in both the entrepreneurial literature and empirical studies – entails the reliability that one may initially assume.