Innovative action as skilled affordance-responsiveness: An embodied-mind approach

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Innovative action has often been regarded as the preserve of the deliberate mind and the outcome of individual explicit thought processes. In this regard, the material context within which innovative action occurs is considered as a passive container or at best a modifier of innovative action. Although recent studies have witnessed an interest in relating innovation to issues of embodiment, space and materiality, mainstream research remains largely grounded in a cognitivist, psychological idiom. The present paper takes an embodied-mind perspective and focuses on the individual–environment system as a whole to suggest that innovative action emerges from an agent's skilful responses to unconventional environmental affordances (or action possibilities). Rather than viewing innovation as occurring within material contexts, we offer a new understanding of context as a rich landscape of affordances that is partly constitutive of innovation. The paper concludes with discussions of the proposed approach, its implications for studying innovative action and suggestions for further enquiry.

1 | INTRODUCTION

Researchers have recognized that work environments influence organizational creativity and innovation through, among other things, influencing individuals' innovative thinking and intrinsic motivation (Amabile, 1997). Work environments may involve organizational motivation (including financial resources, time availability and personnel resources), managerial practices (such as challenging work and supervisory encouragement, and autonomy) (Amabile, 1996; Amabile & Conti, 1999) and material, physical design features of the environments (such as flexible workspaces) (Alexander, Ishikawa, & Silverstein, 1977; Kristensen, 2004; Moultrie et al., 2007). Although organizational, managerial and contextual features have warranted much research interest, the physical environment has not been recognized to the same extent until recently. For instance, in the architectural literature, Alexander et al. (1977) claim that a carefully well-designed workspace can foster innovation and creativity. Moultrie et al. (2007) posit that physical environments can facilitate and support the delivery of a firm's innovation strategy through inscribing that strategy in the features of the design of the environment. The general understanding is that physical environments affect workers'

morale and productivity, and enhance employees' inspiration, thereby influencing performance (Moultrie et al., 2007). Viewing the physical environment from this perspective would assume that agents would respond to it in relatively identical ways. Furthermore, there is a tendency in this literature to adopt methodological individualism, that is, individuals are taken to be the unit of analysis (with its emphasis on psychological features, such as motivation and mood).

The material context is merely framed as a static, passive site or place where innovative activities take place (Bledow, Frase, Anderson, Erez, & Farr, 2009). Agents are considered as coherently-bounded entities, as separate from their material context, rather than being part and parcel of it. Accordingly, several critics have pointed out this failure to generate research designs that depict actively interacting perceivers and environments that shed light on the links among (innovative) action, perception and interaction (Valenti & Good, 1991). Several researchers from various disciplines are arguing that this dualism of agent and environment is problematic because it ignores the point that agent and environment are bound up by transactional exchanges. It is in these mutual transactions that innovative behaviour emerges (Malafouris, 2015).

Innovative behaviour is neither the property of individuals alone, nor that of the environment alone, but a feature of the agent–environment viewed as a unit. In an effort to understand this relationship between agent and environment, as a unit of analysis, we adopt the concept of affordance, as suggested by Gibson (1979) and further developed by other ecological psychologists (Chemero, 2003, 2009; Heft, 2001; Michaels, 2003; Rietveld & Kiverstein, 2014). The concept of affordance cuts across several traditional dualisms: subjective-objective, social-material, realist-nominalist, emphasizing instead their co-constitution. What an agent perceives is largely dependent upon that agent's skills and history of interactions in and with the world. Agents do not respond to affordances in an ad hoc way; rather, their elicited responsiveness tends to be regulated thanks to their past experience, habits, familiarity, socio-cultural setting and acquired skills. For a tired body, a chair would normally afford sit-on-ability. A chair invites sitting for somebody who is tired and who understands that chairs are for sitting, that they can relieve tiredness for a human, etc. Once the agent has learned that chairs have those aspects, sitting becomes an inviting possibility upon perceiving a chair (when tired). Such a response can occur unreflectively yet adequately (Rietveld, 2008a).

Furthermore, aspects of the environment can be responded to in a variety of ways, in more less innovative ways, and more or less unconventional ways. Whereas a chair would normally afford sitting for a tired body, an agent may perceive it as affording standing on to get down a book from the top shelf in a library. As Latour says, in the context of tools: "those who believe that tools are simple utensils have never held a hammer in their hand, have never allowed themselves to recognize the flux of possibilities that they are suddenly able to envisage" (Latour, 2002, p. 250). For a child, a computer may afford play-ability, but for an accountant, it may afford word or figure crunching, storing, retrieving and processing information.

One of the questions that has preoccupied researchers is how, given the variety of affordances available in their surroundings, do agents find a particular affordance as that which feels appropriate to pick up in a specific context. For as noted above, affordances contribute to regulating agents' behaviour in ways that are appropriate to a particular situation, and in accordance with the socio-cultural norms and values prevailing in their practices (Rietveld, 2008a). If affordances invite skilled responsiveness according to agents' past attunement to their environment, innovative behaviour could be regarded as flexible adjustment to the exigencies of the specific situations. Depending on the particularities of the situation, this adjustment may vary from habitual, conventional responses to relatively novel and unconventional.

In this paper, we depart from an ecological embodied mind perspective to develop a new framework of how innovative action can be conceptualized. In this regard, we take the agent–environment system as a unit of analysis, thereby underscoring the complementarity and reciprocity between them. We assume that the body (through its perceptual abilities, such as visual, tactile, auditory, olfactory, etc.) is both a material and socio-cultural product. By virtue of its openness to the world (Merleau-Ponty, 1962) the body is in an intimate relationship with it.

In pursuing the aim of this paper, we make the following assumption. In line with several researchers from various disciplines ranging from cognitive science (Hutchins, 1995), to philosophy (Dreyfus, 1992, 2002) and sociology (Bourdieu, 1977; Giddens, 1986; Swidler, 1986), we adopt the idea that humans interact with the world largely in two modes of engagement: the first is referred to as "skilful coping", "practical", "habitus-based", "unreflective", and the second as "conscious", "reflective" and "discursive". What seems to emerge from these scholarly efforts is the notion that body and environment become mutually entangled in the practical, skilful coping mode; they become integrated in a process of affordance-responsiveness.

Accordingly, we advance a view that locates innovative action in the interaction between embodied individuals and their socio-material environment (associated with the skilful coping mode), rather than just stemming from thinking processes that are supposed to result largely from antecedently planned ends (characterizing the reflective mode of being). Innovative action is an engagement that exploits this rich variety of action possibilities that aspects of the socio-material environment offer. For instance, a tree may afford a person cooling in the shade on a hot day, sheltering from rain on a rainy day, hiding from a tiger, eating if one is hungry, etc. Furthermore, the same tree may afford different action possibilities to different agents such as providing wood for making a fire, etc. Although the properties of the tree remain constant, action possibilities vary depending upon the agent's practical knowledge regarding what trees can be edible, physical skill to climb these trees, to cut them down, etc.

In the context of built-in environments, our approach is informed by Kirsh's (1995), and Clark's (1989) ideas that humans "off-load" their cognitive processes onto the environment. Such man-made creations, which are materialized in the structures of the environment, artefacts, institutions, etc., will subsequently afford possibilities for action. Clark (1989, p. 64) claims that "in general, evolved creatures will neither store nor process information in costly ways when they can use the structure of the environment and their operations upon it as a convenient stand-in for the information-processing operations concerned. That is, know only as much as you need to know to get the job done". Clark's approach emphasizes the centrality of the body, as off-loading cognitive activities requires sensorimotor capacities (such as visual lookup, pattern recognition and object manipulation; Robbins & Aydede, 2009) and other social, cultural skills (Rietveld & Kiverstein, 2014).

Following this introduction, the paper proceeds by first making a concise and critical review of the literature on innovation, tracing the shift from an understanding of innovation as the preserve of individual cognition towards viewing it as a situated and context-sensitive event. It is neither shaped by the individual alone nor by the environment alone, but by their interaction. Rather than looking at what is inside the individual's head, we look at what the individual's head is inside of, as ecological psychologists like Gibson (1979) and Mace (1977) advised. Based on this transition, the section that follows outlines a framework predicated upon a philosophy of skilled innovative action

as affordance-responsiveness, as developed in the field of embodied cognitive science. Starting from this philosophy of skilled action, we develop a tentative framework for understanding the mutual relationship between the (socio)material environment and the body, as well as the role affordances play therein. Finally, implications of the suggested approach are discussed, ending with conclusions and suggestions for further research.

2 | INNOVATIVE ACTION IN "CONTEXT"

Conventionally, innovation is understood to consist of two phases: a creative, exploratory phase and an implementation phase (where the latter may pertain to adoption, adaptation, translation, production or commercialization of the idea created) (Anderson, Potočnik, & Zhou, 2014). Bledow et al. (2009) have questioned this dichotomous thinking. Not only are these two processes treated as separate, but they are also regarded as temporally sequenced phases. This is most obvious in connection with technological products where the creative stage is assumed to be prior to, and separated from, that of the implementation or production stage (Anderson et al., 2014; Meyer, Mudambi, & Narula, 2011). Although this phasic, sequential view may have some analytical benefits, it glosses over some important aspects related to the dynamic interplay between the two processes. One of its shortcomings is that it fundamentally ends up segmenting human experience into a deliberate, thinking, generative phase, on the one hand, and a mechanical, practical, executing phase, on the other. Missing is the point that implementation is rarely free from innovation (Anderson et al., 2014), and innovation can be thought of as activity influenced by prior activity, experience and learned behaviours (Bledow et al., 2009). Furthermore, the existing literature is not inconsistent in that it treats the generation of ideas as mainly intra-individual, cognitive processes (that can be attributed to specific agents), and the implementation process is considered a chiefly social process involving activities by several individuals (such as designers, marketers, brand managers, producers, suppliers, builders, etc.) that occur in the context of the workplace (Rank, Pace, & Frese, 2004).

Whereas both processes, the generation and implementing of novel ideas, are claimed to be impacted by the social and physical context, little is said about the nature of that impact. Thus, the significance of contextual features has been variably accounted for. In Guildford's (*The structure of the intellect*) work in the 1950s, a groundbreaking study set the tone for the cognitive approach to innovation. Guildford stressed the point that innovative action is a mental activity, as "thinking that goes off in different directions" (Guilford, 1950). In this sense, the phenomenon of genius is closely linked to an innovative disposition. This research tradition has fallen prey to intense criticism by several researchers (Runco, 2008). Critics have questioned Guilford's (1950) assumption, arguing that there is no substantial evidence to support any relationship between intelligence (IQ) and innovation (Feist & Barron, 2003). The general understanding underlying this line of criticism is that innovative capacity is a basic feature of human cognition, where cognition is regarded as a necessary but not a sufficient condition. However, in studies that have recognized the role contextual features play in the innovation act, such as domain-specific expertise based on contextual knowledge, there is some evidence that such link between expertise and innovation exists (Amabile, 1996; Bledow et al., 2009; Mascitelli, 2000). Although Csikszentmihalyi and Sawyer (1982) support the idea that immersion in domain-specific activities fosters innovation, they also add that too much or too little familiarity with a specific area impedes innovation.

A fruitful contextual feature that has fostered increased theoretical insights as an antecedent to innovation is the role that social resources (such as networking, cultural climate) play in the innovation process (Bledow et al., 2009). By the same token, research indicates that organizational innovation is influenced by a number of organizational features, such as leader's vision and creative goal setting (Anderson & King, 1991; Bledow et al., 2009; Tierney, 2008), operating principles (organic structure, autonomy), team climate (task orientation, support for innovation, team structure, diversity), team processes (participative decision making, minority influence, constructive controversy, intra-group safety), and team member characteristics (Bledow et al., 2009). In these terms, researchers have posited that the way jobs are designed is crucial for innovation. Among other things, jobs designed to be complex and demanding (featuring high levels of autonomy, task challenge, feedback, significance, identity, as well as task and skill variety) are positively related to creativity and innovation (Oldham & Cummings, 1996; Shalley, Zhou, & Oldham, 2004). More specifically, good job design is thought to impact intrinsic motivation, self-efficacy and self-determination (Parker, 2006)—all of which are assumed to have a positive impact on innovation.

Researchers have further invoked the significance of emotion and mood (Bledow et al., 2009), which are an increasingly attractive area of research. For instance, several studies have suggested a link between positive mood states and innovation (Amabile, Barsade, Mueller, & Staw, 2005; Ashby & Isen, 1999; Bledow et al., 2009; Kahn & Isen, 1993). Within organizational contexts, for instance, it is posited that job dissatisfaction and negative moods and feelings (including emotions like anger and fear) have been found to have a negative impact on innovation and creativity (George & Zhou, 2007). Although promising, this scholarship is still too coy about considering emotions in their own right, that is, as a *doing*, a bodily engagement with the world (Solomon, 1976).

Finally, aside from the cognitive and social (emotional) resources, researchers are increasingly paying attention to how physical resources stimulate innovation. This line of thinking finds its origin in Wallas (1926), according to which he conceives of the innovation process as consisting of four phases: preparation, incubation, insight, and elaboration and evaluation. Out of these stages the preparation phase is particularly relevant, as it focuses on the physical arrangement, including tools, such as computers and bulletin boards, which are considered as mere facilitators of the flow and retrieval of data and information (Dorfman, Shames, & Kihlstrom, 1996; Kristensen, 2004).

Shipton, West, Dawson, Birdi, and Patterson (2006) tend to support the idea that purpose-built physical environments (e.g., Creativity Retreat Centers) can significantly enhance the potential to innovate.

For instance, the use of electronic brainstorming software by groups can significantly amplify the amount of ideas generated, as it reduces some of the negative social factors in paper-based group brainstorming, such as evaluation apprehension (members withhold ideas as they fear negative evaluation), and free riding (where members rely on others to accomplish the task). Accordingly, innovation is taken to thrive on and flourishes best in a context featuring specific environmental layouts, unconventional architectural designs, judicious placing of artefacts (such as water coolers, coffee machines, meeting places, whiteboards, virtual technologies, idea elicitation tools, e.g., pictures, lego-style toys). Kristensen (2004) has come close to capturing this relationship by applying concepts of spatial embodiment that accompany the various phases of the creative, innovative process. For instance, whereas the preparation and elaboration stages require a combination of communal and private spaces, the incubation and insights stages will tend to favour private spaces.

These studies consider the physical, spatial layout as important mainly in so far as it helps the organizing and retrieval of "information" (Kristensen, 2004, p. 90). Above all, spatial arrangements are meant to support information flows and absorption resulting from the use of "tools, like personal computers, bulletin boards and general access to information" (Kristensen, 2004, p. 90). Although most researchers gloss over the link between the cognitive and the material, Kristensen (2004) makes an opening in rethinking this relationship. Invoking earlier criticisms levelled against an all-too cognitive view of innovation associated with Newell (1973) and Simon (1973) (for ignoring the context, and referring to Clark, 1997; Haugeland, 1995; Hurley & Hult, 1998), Kristensen suggests that "cognition and emotion integrate body and mind, and that it cannot be regarded as an activity apart from the physical reality and body of the thinking and feeling subject" (p. 91). In spite of this significant move, Kristensen (2004) falls short of providing a framework whereby the mind, body and physical environment can be understood in an integrated way. One of the major questions left unexplored by Kristensen's (2004) study is the question of why the same physical context may impact agents differently apart from resorting to their psychological make-up, motivation, mood, etc. In other terms, it does not take into consideration the inseparably mutual relationship between agent and environment such that they form an integrated system, as discussed subsequently.

The present study seeks to build on this embodied cognition approach that links the mind, body and socio-material environment by viewing the skilled, innovative body as the link between these realms, emphasizing the co-constitution of body and the physical space (Thrift, 2003). In other words, physical spaces are brought to life through agents' bodily multisensory, corporeal and active engagement with them over time. Embodied agents, in turn, develop their abilities over time by engaging with their environment and becoming responsive to the affordances the dynamically changing environment offers. From this perspective, it is agents' skilled bodily motility that produces and is produced by the physical space. These considerations are fleshed out in the following sections where we argue for a view of innovative action as emerging from the dynamical exchanges between an agent and environment, as affordance-responsiveness.

3 | AN EMBODIED-MIND APPROACH TO INNOVATIVE ACTION

The human body is the source of all invention. All the tools and engines of this earth are but extensions of its limbs and senses (Emerson, 1922, p. 157).

As noted above, innovation is often understood in a dualistic way, as consisting of two separate phases (Anderson et al., 2014). Although, a dialectical perspective may be conceptually helpful, in agreement with Bledow et al. (2009), we believe that such a dichotomous thinking poses difficulties (both theoretically and practically) for our understanding of innovation. Reserving creativity to the work of the mind overlooks the complex dynamics of the intertwinement between the two moments, the simultaneous interaction between the so-called "internal", psychological processes and the "external" material environment of creativity (Glăveanu, 2015). Given that even the implementation phase can imply a great deal of creativity (Bledow et al., 2009) and improvisation, it is difficult to draw the line between what constitutes the one or the other phase. Although laudable, the dialectic approach still remains beholden to a cognitivist view, paying little attention to the role of the material environment—an environment viewed by a dialectic approach as separate from individuals', groups' and organizational mode of thinking and acting. In the present article, we use the expression "innovative action" to integrate composition and performance (Weick, 1993), fusing the creation (of ideas) and the activities required to implement those ideas, much along the lines suggested by Moorman and Miner (1998, p. 702): "the more improvisational an act, the narrower the time gap between composing and performing, designing and producing, or conceptualizing and implementing". By fusing the thinking and acting processes into one process—a process which we call "innovative action"—we seek to transcend the divide between the "internal", psychological processes and the "external" socio-material context.

The present paper seeks to suggest that innovative action is *skilled affordance-responsiveness*, implying that it is not only "a handmaid of consciousness, transporting the body to that point in space of which we have formed a representation beforehand" (Merleau-Ponty, 1962, p. 161). Innovative action is not determined by a reflective consciousness (*I think*), but rather, it is the outcome of a primary human, dialogic process between, on the one hand, bodily skills (*I can*), and relevant possibilities for action offered by the environment, i.e., affordances, on the other. We use the concept of "affordance" in line with Gibson's (1979) original meaning as possibilities provided to us by the environment (Chemero, 2003, 2009; Heft, 2001; Michaels, 2003; Rietveld & Kiverstein, 2014). Furthermore, consistently with the socio-materiality approach (Mol, 2002; Orlikowski, 2007; Rietveld & Kiverstein, 2014; Suchman, 2007; van Dijk & Rietveld, 2016), we consider the material lived environment, including spatial designs, objects and material artefacts, not as part of the context abstractly understood, but rather as actively implicated in shaping the nature of creativity and innovation.

As rightly stated by Kristensen (2004), body and world are not separate in the context of innovation activities. Rather than regarding moving around in space as an experience that structures representations of that world in our mind (Barsalou, 2008; Niedenthal, Barsalou, Winkielman, Krauth-Gruber, & Ric, 2005; Spellman & Schnall, 2009), we aim to develop an account of creativity that avoids reliance on the concept of representations. Therefore, we build on the work of researchers who put premium on the primacy of perception and action, regarding the body not merely as a transmission mechanism of sense impressions, as a passive intermediary between world and mind. Rather, the skilled body, by virtue of being both a material object and a socio-cultural product and producer thereof, is considered to provide a new perspective that shuns a separation between the two realms. In the same way, while previous studies considered material space as a fixed phenomenon, preformed by humans, such as innovation managers and designers, we understand material space as something to be performed, or, better, enacted through our perceptual, bodily motility in unpredictable ways (Thrift, 2003). The body is not separate from, or prior to the action spaces it dwells in; rather, each presupposes the other (Duff, 2007; Merleau-Ponty, 1962, p. 140). Accordingly, situations that promote innovative action are brought to life through skilled agents' bodily multisensory, corporeal and active engagement with their socio-material environment.

As noted above, we assume the skilful coping mode is characterized by direct perception, requiring a minimum of reflection. Perception is direct (Gibson, 1979) in that it does not require manipulations of internal representations, for it occurs simply as part of coordinating the ongoing activities of "agents in an integrated system encompassing both organismic and environmental activities" (Burke, 1994, p. 93). A high-profile example of this intimate relation between person and world can be captured in Foucault's (1973) *The birth of the clinic*, in which he makes an account of the emergence of medical knowledge in the eighteenth century. Modern medicine, he claims, was the result of new spaces in which patients were placed, in contrast to visiting patients at home. Locating patients in a single, visual space afforded practitioners the opportunity to observe them, compare their symptoms, classify and follow their progress, etc. The clinic as a new space for treating patients has made a great difference. On Foucault's view, medical knowledge became based on a simultaneous combination of *seeing* (involving perceptual skills), experimenting (involving skills of manipulating bodies and tools), and saying (linguistic skills), such as describing and classifying. Medical knowledge had arrived at the level of the immediate use of the senses. As Foucault (1973, p. 120) put it: "For what are observation and experience based on if not the relation of our senses?" Foucault's visual space, as a new environment, provided us with a crucial clue as to how the social and the material are entangled, by establishing an immediacy between the perceptual (here mainly vision, but not confined to it) and bodies, tools, built-in structures, etc. Although direct, perception is informed by previous encounters and experiences of similar affordances and the related responses, and over time that experience recedes to the background, becoming part of practical, unreflective knowhow; an embodied habitus (Bourdieu, 1977).

In this skilful coping mode, we understand these relations as follows: an agent's action results from an interactive relationship between bodily skills as culturally generated, on the one hand, and environmental possibilities for action (affordances), on the other. This mode of skilful action is epitomized in Merleau-Ponty's (1962) example of a craftsman, a wallet maker, engaged in his everyday activity, perceiving the world as a tangle of possibilities for action. The body's abilities are immediately potentiated by the perception of the possibilities for action afforded by the situation. Affordances demand or evoke from the body the activities that need to be done in the particular situation. In this view, the world is "a collection of things which emerge from a background of formlessness by presenting themselves to our body as 'to be touched', 'to be taken', 'to be climbed over'" (Merleau-Ponty, 1962, p. 512).

Affordances, note Rietveld and Kiverstein (2014), are relations between aspects of the socio-material environment, and the culture-based abilities available in a form of life (cf. Chemero, 2003; 2009). The human "form of life" or "ecological niche" includes a large variety of socio-cultural practices. Responses to relevant affordances in a particular situation—such as shaking an extended hand, lowering one's voice in a library, or taking a seat on a bench—will be relative to the cultural skills possessed by the individual and to what he or she cares about; entailing that such responses are neither simply spurred by automatic actions nor reflexes beyond control (Rietveld & Kiverstein, 2014). Rather, they involve a readiness to act in a way that is attuned to the demands of a particular situation and appropriate given the related socio-material practices the person in involved in.

3.1 | Affordances, readiness for action and the tendency towards optimal grip

Gibson's (1979) concept of "affordance" as a mediating concept between the material environment and the human body emphasizes the interactive process between the body and its environment. As Gibson (1979, p. 127) puts it:

> The affordances *of the environment are what it* affords *the animal, what it* provides *or* furnishes, *either for good or ill. The verb to* afford *is found in the dictionary, but the noun* affordance *is not. I have made it up. I mean by it something that refers to both the environment and animal in a way that no existing term does. It implies complementarity of the animal and the environment.*

Affordances refer to opportunities for action, such as grasp-ability or sit-on-ability. Our experience of the socio-material environment is co-constructed, on the one hand, by our bodily, abilities (including perceptual abilities), and the physical context soliciting and prompting action from the body. Thus, the concept of affordances enables us to transcend the subjective-objective dichotomy, being both a fact of the environment and a fact of an agent's propensity to act. An

affordance "points both ways, to the environment and the observer" (Gibson, 1979, p. 129).

From this ecological perspective, it is thus possible for us to treat the situated individual's material context as a field of relevant affordances (Rietveld, 2012) that reflects the connection between the socio-material environment and the skilled body. Both are necessary, implying a continuity and co-dependence between them. For no matter how tangible or visible an environment may be, and no matter how many possibilities for action it may offer, these possibilities are revealed and made sense of by the person only through our bodily enactment of them. But where does this motivation to respond to affordances come from? Why do we care about some affordances rather than others? Researchers (such as Bruineberg & Rietveld, 2014; Kiverstein & Rietveld, 2015; Rietveld, 2008a, 2008c; Rietveld & Brouwers, 2017) have suggested that affordance-responsiveness moves the body towards an 'optimal grip' (Merleau-Ponty, 1962) on the situation—a grip which is a relative and ephemeral grip that can never be fully achieved. The tendency towards an optimal grip, originally introduced by Merleau-Ponty (1962) and further developed by Dreyfus (2002) and Rietveld (2008c, 2012), refers to an incessant movement towards a person–environment equilibrium given that living beings are always in a state of inherent disequilibrium, which can be phenomenologically experienced by humans as tensions, concerns, disharmony, a threat or desire for something. Hence, what motivates agents to respond to the calls of an environment is a primary drive, an intentionality in action, which is neither the expression of explicit norms or rule following (*homo sociologus*), nor a deliberate pursuit of self-interested goals (*homo economicus*), but rather a continuous striving to maintain a temporary equilibrium or harmony between the skilful body and the relevant affordances offered by the socio-material environment. An affordance (such as, for example, a glass of water that offers the possibility to drink from) gains relevance normally when it matters to someone in a given situation (e.g., when one is thirsty).

Merleau-Ponty (1962) refers to the feedback loop between the environment and the skills of an individual as the "intentional arc", by which he means an agent's tendency to make finer and finer discriminations in the environment thanks to a history of engagement with similar situations. Typical instances where humans skilfully find themselves responding to affordances made available by their material environment are referred to as skilful coping mode (Dreyfus, 2002). In the flow of skilful coping, people are responding to solicitations. Solicitation responsiveness strives to move us towards an optimum grip on the situation—a grip, which, as mentioned above, is transient and can never be fully reached. In this flow, people often experience the world pre-reflexively. In attempting to maintain body–environment attunement, habitual skills and learned behavioural patterns are often activated in the presence of relevant affordances.

However, habitual, skilled ways of responding to affordances does not amount to a replication void of any difference. Rather, as Crossley points out, habits are principles of action that "form the practical-social basis for innovative and improvised action" (Crossley, 2001, p. 88). Such intelligent, habitual ways of responding to affordances "consists of forms of competence, skill, and multi-track dispositions, rather than fixed and mechanical blueprints for action" (Crossley, 2001, p. 81). Accordingly, the habits we will focus on below in this discussion of innovation are flexible, *intelligent habits*. Given that no two situations are identical, responses are bound to manifest a certain degree of innovation and improvisation. Although habitual or skilled behaviours may normally shape the nature of action to be generated, they may also produce novel responses—responses that are not usually associated with specific affordances.

For instance, some artists deliberately explore the use of new affordances through unconventional art installations (Rietveld & Rietveld, 2017; Rietveld, Rietveld, & Martens, 2017). An example of such an art installation is "The End of Sitting" by RAAAF|Barbara Visser (Rietveld, 2016; Rietveld, Rietveld, Mackic, Van Waalwijk van Doorn, & Bervoets, 2015). The art installation explored what it would be like to live in a world without chairs where not sitting but standing was the norm. It explored an office landscape of the future, of 2025, without chairs or tables, in which many different affordances for supported standing and leaning were incorporated. Through the absence of classical affordances for sitting and working, this landscape of affordances invited people to move around more and assume a healthier variety of working positions. The varying height and many different angles of the landscape meant that many different positions were possible based on the basis of one's personal (physical) abilities and skills. Empirical research (Withagen & Caljouw, 2016) showed that "The End of Sitting" might be able to generate behavioural change in real-life situations by offering an innovative local landscape of affordances that supports standing—though more studies are needed to investigate its impact, in particular over longer periods of time and with older subjects.

More generally, at any one time the affordances available within a socio-cultural practice by far exceed the number of those that any particular member of a socio-material practice is able to perceive, discriminate and respond to. When new affordances are introduced into an environment, agents are challenged to upgrade their pool of skills available (Rietveld & Kiverstein, 2014), that is, by generating responses that differ from the habitual ways of responding to affordances within a given socio-material practice. Skilled selective openness can lead the person to respond to affordances in unorthodox ways, such as seeing a tree branch as offering the possibility to be used as a bow, as can be exemplified in the following story, written in old Chinese texts:

> Once upon a time, Huangdi went out hunting armed with a stone knife. Suddenly, a tiger sprang out of the undergrowth, Huangdi shinned up a mulberry tree to escape. Being a patient creature, the tiger sat down at the bottom of the tree to see what would happen next. Huangdi saw that the mulberry wood was supple, so he cut off a branch with his stone knife to make a bow. Then he saw a vine growing on the tree, and he cut a length from it to make a string. Next he saw some bamboo nearby that was straight, so he cut a piece to make an arrow. With

his bow and arrow, he shot the tiger in the eye. The tiger ran off and Huangdi made his escape. ("How Huangdi Invented the Bow and Arrow", https://en.wikipedia.org/wiki/History_of_weapons; accessed October 5, 2016).

The extract depicts how bow and arrow were invented as a result of an innovative response to the "weaponability" of a branch (Schmidt, 2007), by perceiving the supple mulberry branch as a bow and the wine growing on a tree as a string. Although a branch may offer many possibilities, the agent picked up the one that fits best their concerns or intended function on that particular occasion. Although the embodied history of an agent builds on past experience, on skills and habits, responding to affordances is not completely determined by them, it is open-ended, being oriented towards the future and driven by affect or emotion, such as interest, curiosity, suspense, joy or disappointment (Fuchs & De Jaegher, 2009). Rather than determining actions, agents' culture-based abilities and habits to respond to affordances are flexible, which afford chances for improvising when responding to the calls of the situation. The embodied culture-based skills and habits of an individual involve a moving equilibrium, which generates new ways of feeling, thinking and acting. These engagements with the world, in their turn, generate new and enriched abilities for detecting relevant affordances and for responding to them adequately.

3.2 | Illustrations

Our first illustration of the shift from one environment to another with a view to gaining access to more and variegated affordances can be captured in Latour's (1988) *Pasteurization of France* which accounts for how Pasteur came to invent the anthrax bacillus vaccine (Golinski, 1998; Longino, 2002). Rather than confining his technicians' workplace to a laboratory environment, Pasteur first takes his technicians out to the farmers' environment, the farms, where they encounter new affordances, material from infected animals, usually not found in laboratory environments. For a moment, the farmers' environment became the technicians' laboratory. Subsequently, elements from the farmers' environment were moved to the laboratory to be compared and combined with laboratory elements, providing a unique combination of affordances. This allowed Pasteur to create an outbreak of anthrax. Responding to these new affordances resulting from combining materials usually encountered in two distinct environments was enabled by previously learned skills about variations in virulence from working with chicken cholera, and based on his ability to regulate the weakness or strength of the microbe, and to ultimately create the vaccine.

Second, Pasteur had to recreate in the farmers' environment (the field) the laboratory conditions that supported the vaccine's effectiveness. Notice that both parties, the French farmers and the scientists, are driven by different though convergent interests or concerns: for example, economic success for the former, the glory of scientific achievement for the latter. The innovative response to the natural and created environment was not just the creation of the vaccine, but crucially has led to the transformation of the socio-material practices in the human ecological niche. It also generated new skills regarding how to identify and respond to similar affordances that would eventually lead to the invention of new vaccines. As stressed above, affordances are relational to the skills of the agents. If Pasteur's technicians did not possess skills previously learned in comparable environments, they would not have been able to identify the possibilities offered by the farmers' environment. The innovative outcome, Pasteur's anthrax bacillus, can be said to both have and have not pre-existed Pasteur's attempts to isolate it (Longino, 2002, p. 36).

Our second illustration involves the arrangement of commercial spaces and seeding them with new affordances. In one of the banks studied by one of the authors of this paper, a shift in the design of their brick-and-mortar branches has brought along new affordances for both customers and service personnel. The bank has 60 branches in Sweden, employing around 1,000 employees. Following the advent of new technologies, the bank noticed that fewer customers were using their branches. To adapt to that shift, the bank closed down some of its branches, redesigning some in new ways, adopting an open space featuring round tables, where customers and bank employees can sit and interact face-to-face. This represents a great shift from the traditional design of branches with a counter separating bank employees from customers (for reasons of security). The daunting counter originally aimed to guarantee and support transaction processing and the handling of money. The area where customers used to wait before being served today provides comfortable sofas, a high table with high chairs (reminding us of a bar table), a coffee machine, a 'playground' for children and daily newspapers and magazines sprawled on the coffee table. General meetings with customers took place at some of the employees' desks that were placed adjacent to the waiting area. For meetings with customers that require more privacy, there are meeting rooms with glass walls where the customer and the teller can sit down in comfortable sofas over a cup of coffee. The upshot of this example is that the new design offered new possibilities to both customers and bank employees to behave in new ways. Thanks to the affordance to sit down, customers can now interact more comfortably with employees, being more willing to share their economic concerns and needs and ask for advice. This was an affordance to employees to become more alert to customers' demands, and also challenged to upgrade their skills so as to provide satisfactory, and more specialized services than previously.

Indeed, the re-design has created several unexpected outcomes, which illustrate that the spatial design tends to have a logic of its own. First, a new rule emerged stipulating that the bank tellers sitting in the front-office were now obliged to be more structured and orderly with regard to their paperwork due to the constant, observing gaze of the customers. The employees stated that they have now come to devote more time to keeping their desks clean and tidy. Furthermore, the employees were not allowed to post personal artefacts such as family photos or gifts in their workplace as this would risk projecting "a less professional image". Some associated this with a negative feeling of

losing their privacy, and their ability to express their personality. Employees are expected to look more professional and to manage their facial expressions, bodily gestures and the way in which they talk to one another. Furthermore, since the re-design fostered longer service interactions with customers, the bank had to re-visit its reward system from focusing mainly on quantitative measures such as the sales figures towards becoming more oriented vis-à-vis the service quality of the interactions. Finally, since the spatial re-design afforded longer and more intense customer–employee interactions than before, new demands on employees' social skills have emerged. As expressed by a branch manager: "This re-design encourages customers to spend more time in the branch. The mere fact that they are invited to sit down changes the interaction completely. It has become more of a social exchange, than a transactional interaction. So, for the bank teller, the role has changed and it is imperative to have social skills such as being able to understand the customer and to conduct a conversation more professionally." In this case, we notice that there is a cascade of affordances: the new design afforded sitting, sitting and interacting afforded deeper interactions between customers and employees, more and deeper interactions afforded possibilities for both parties to learn to know each other more intimately, leading to a better understanding of customer needs, which, in its turn, afforded a more customer-oriented approach.

From the perspective presented here, it is skills and habits that make affordance-responsiveness possible and are thus the bodily basis for improvising and generating adaptive actions. This view of skills as a moving equilibrium, as in the case of Latour's (1988) technicians, suggests that the ability to respond to affordances is a creative and generative process (Dalton, 2004) but typically realized in tandem with an inviting environment. Furthermore, ethnographic studies of architectural design processes (Rietveld & Brouwers, 2017; van Dijk & Rietveld, 2018) have shown that in innovative episodes such as the creation of an architectural art installation, new possibilities unfold in a process of anticipation and exploration of new affordances. The creative process is marked not by a simple idea (a prior image one has in mind) that gets "realized", but rather it is seen as an aspect of the complex dynamical "skilled agent–environment" system: a multi-scale unfolding process that, by inviting skilled individuals to participate, sets up the conditions for its own continuation (van Dijk & Rietveld, 2018; cf. Withagen & van der Kamp, 2010). As noted by Bourdieu (1977, p. 261), responses to emerging circumstances are neither the "mechanical precipitate of structural dictates nor the result of the intentional pursuit of goals by individuals but rather the product of a dialectical relationship between a situation and a habitus".

From our perspective, a habitus is a dispositional state that gets activated in the presence of related cues in the environment. It involves a dimension of *action readiness*, which is a state in-between performed action and latent ability; it is a form of action preparation (Frijda, 1996, 2007). The tendency towards an optimum grip on the situation makes certain affordances stand out as salient, inviting, or soliciting the individual to act. These relevant affordances generate bodily states of action readiness. For example, when an architect at work sees that the door of the building they are working on is not

good (e.g., "too low", Wittgenstein, 1978), she will immediately get a readiness for action possibilities that will improve her grip on the situation (Rietveld, 2008a). Responding to the affordance of increasing the height of the door simultaneously reduces the lived experience of directed discontent (Rietveld, 2008a; Wittgenstein, 1978).

A person's experienced solicitation by an affordance is the phenomenological equivalent of a bodily action readiness: the readiness of an affordance-related ability (Rietveld, 2008c). This tendency toward an optimum grip can be understood as the skilled agent's *attunement* to the dynamics of an environment which is in flux (Bruineberg & Rietveld, 2014). What is experienced by a person as a state of adequate grip on available affordances varies depending on what matters to that person (e.g., the dimensions of the door in its context), and on the skills that have been acquired through engagement in the socio-material practices where doors are used. More generally, lack of optimal grip initiates a process of exploration in the ecological niche, of available affordances that aim to resolve the person–environment disharmony, which means that agents may elicit innovative actions in order to re-establish a sense of sufficient grip.

Innovative actions are a contingent outcome of an agent's responsiveness to affordances in more incrementally varied or unorthodox ways, which introduces changes in the socio-cultural, material practice, small though these may often be. Affordances are relational to the skills available in a given practice but at the same time, they are resources that exist independently from any particular individual (Rietveld & Kiverstein, 2014). They are the preserve of the socio-cultural, material practices in which individuals are immersed. In Latour's case, without the skills of the technicians the infected material would not have seen the light of the day.
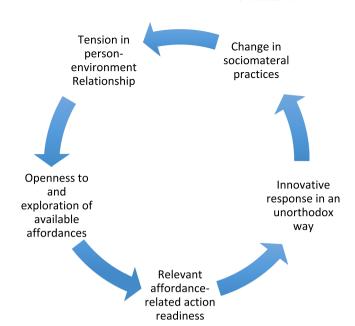
3.3 | Conceptual framework

Crucial to our understanding of the role of affordances is how skilled actions unfold in concrete, everyday practices. The notion of affordance helps us understand how environments and agents come together. In situations of innovative action, people "join forces" (Ingold, 2013) with relevant affordances available in their socio-material practices. Although the environment may be replete with affordances, individuals will normally be solicited by mainly those that are salient or relevant to their specific activities, those that matter to them most in that particular moment (Rietveld & Kiverstein, 2014). Affordances typically are not "right" or "wrong" for they afford possibilities; only the enacted response may be appropriate or inappropriate, good or bad, justified or unjustified given the particular circumstances. For instance, a knife offers several possibilities for action but it is only in the particular situation that actualizing one of these can be regarded as appropriate or not. What may foreground itself as what needs to be attended to may vary from agent to agent. Accordingly, depending on the particular mood, skills and habits of the agent, a relevant affordance potentiates action readiness. Action readiness is a relation between the acquired skills and habits and its activation in the presence of the related cues in an environment. As noted

above, affordance-responsiveness is an attempt to move towards an optimal grip on the situation, such as to satisfy a need, to reduce an experienced tension, or redress a challenge or a disequilibrium. This disequilibrium in the person–environment relationship generates a *selective openness* towards those affordances that could help us temporarily regain a sense of equilibrium or to gain an optimal grip. Depending on the skills of the individual and the character of the disequilibrium, the individual would selectively respond to those affordances that most likely release the affective tension, namely those relevant affordances in this particular situation (Rietveld & Brouwers, 2017). Attempts at discovering these relevant affordances may require an exploration of the landscape of affordances available in individual's socio-material practices and even beyond. Exploration may involve experimentation with socio-material aspects of the environment, including manipulating substances, changing the arrangement of the physical layout, trying out new ideas, etc., in unconventional ways. Whereas traditionally, office workplace environments afford sitting, designers may see them as affording standing instead, by changing the physical layout. In connection with the example mentioned above, the bank case and "The End of Sitting" illustrate how unconventional physical layouts can be designed to direct agents to engage with workplace environment in novel ways. Unexpected and even surprising patterns of behaviour can emerge as a result of the discovery of and engagement with novel affordances.

The process of selective openness—including exploration and experimentation results in the detection of relevant affordances that generate *action readiness*. As noted above, action readiness has to do with preparation for action coupled with the salient, significant affordances. The ability that brings forth action readiness when relevant affordances are detected has been acquired by an individual through his/her embeddedness in a socio-material context. In sum, striving to improve the situation and establishing an optimal grip on it by being responsive to relevant affordances can be seen as the driver behind action-readiness. Such activity in turn potentially enriches the landscape of affordances available in the individual's socio-material practice. This framework is visually captured in Figure 1.

4 | DISCUSSION, IMPLICATIONS AND CONCLUSIONS

If innovative action is often a spontaneous response to an environmental call and if such a response is framed by an embodied and en-cultured subject, then several theoretical and empirical implications will follow. Most significant is the need to reconsider the phasic creative process model originally developed by Wallas (1926) and which has served as a source of inspiration for several researchers since. As noted briefly, the model assumes four phases: preparation, incubation, insight, and elaboration and evaluation, imposing distinction among these phases. This view overlooks, for example, the point that there is an inherent recursiveness among these phases, such as between generation and implementation (Van de Ven, Angle, & Poole, 1989). In addition, generation is an activity influenced by projective action

FIGURE 1 A framework of innovative action as skilled affordance-responsiveness

anticipating implementation, and implementation is rarely free from creativity and generative components (Anderson et al., 2014). Rather than a divide, there is an inherently complex relation of intertwinement (Glăveanu, 2012).

The first advantage of the present work is that it connects the field of creativity and innovation studies to the-state-of-the-art in embodied cognitive science (Bruineberg, Kiverstein, & Rietveld, 2018; Chemero, 2009; Rietveld, Denys, & Van Westen, 2018; Withagen, de Poel, Araújo, & Peppin, 2012; Withagen & van der Kamp, 2010). This opens up many possibilities, such as, for example, investigating the role of action readiness in creativity by focusing on unconventional responsiveness to affordances. The affordance-based embodied perspective has already been used in various disciplines. Second, it has the ability to integrate the material and social dimension of innovative action, which helps us overcome the divide between the creation of ideas and their implementation, suggesting a continuity between the two realms and their (near) simultaneous co-creation process. As bemoaned by Anderson et al. (2014, p. 1318), there is a lack of integration and of synergy between these "two siblings who fell out at a family gathering in their distant past, the subfields of idea generation and idea implementation remain doggedly disconnected from one another". Our approach suggests that, rather than taking place in the head, innovative action is best considered as an interaction between a background (made concrete as the rich landscape of affordances available in a form of life, which is both social, cultural and material) and the skills of the individual; i.e., a coupling of skills and affordances. This response to affordances can be more or less habitual, or unconventional, but always geared towards improving the relation between person and world.

One of the practical implications of these considerations is that combining people possessing specific skills acquired in one socio-

material context with people with skills acquired in a different socio-material practice increases the likelihood of responding to affordances in new ways (such as in Latour's (1988) case). As Rietveld and Kiverstein (2014) note, this understanding of innovative action as relational between affordances offered by the socio-material environment and skills is important for innovative professions as it challenges to keep an eye on both the environment and the skills of the agents. A mere change in one of these will not result in any improvement. By immersing specialists in practices far outside their field of expertise, they can acquire new skills that allow them to analogically discover new affordances. Familiarity with a domain's affordances may help agents discover new affordances in a new domain. However, it is crucial that affordances are discoverable and perceivable by agents. In order to increase our understanding of the discovery of new affordances, Ingold (2000), following Gibson (1979), uses the phrase "education of attention". Education of attention is a matter of learning to attend, to perceive, notice or discover finer and finer discriminations of the features of the environment. The skilful agent is an active explorer of his or her socio-material environment, being a very *rich* landscape of affordances. The more open to unorthodox responses one is, the more likely one is to generate novel courses of action. The landscape of affordances available in a form of life always exceeds what any individual can perceive and respond to. This is so because any one individual can only possess a limited amount of skills (cf. Simon's (1973) concept of 'bounded rationality'). However, the more skills an individual has, the more affordances he or she will be able to perceive and "discover", both new and related affordances (such as Pasteur's reliance on his previous knowledge in the areas of infected chickens). Because the existence of affordances is largely independent of the individual agent and because the number of affordances may exceed any one agent's ability to detect, it can be the designers' role to help make easily perceptible those that are difficult to discover, such as by clarifying where the touch should take place in opening a door (Norman, 2013).

Based on this suggested framework, it can be further assumed that another way to increase the skills needed to gain access to available affordances is by striking alliances with artefacts or individuals/organizations from a different field. In the case of the bank, employees were challenged to upgrade their social and professional skills as a result of having to interact with customers more closely. Bank employees' interaction with customers in a seated position then generated new affordances, such as replying to the many and more intimate financial (or even social) questions. This amounts to creating new skill combinations. One way to influence the selective openness to affordances is by increasing the tension experienced by an individual in her person–environment relationship. Being under the radar of the customers, employees are challenged to explore this new environment to work out new ways of behaving more professionally. In general, organizations may set up longer-term goals and more challenging tasks to sensitize incumbents to new affordances. In addition, developing more skills would lead to a more refined selective openness to affordances which increases the chances of innovative action, such as finding innovative ways of coordinating their practices under

the watchful gaze of customers in the case of the bank. Creativity and innovation will be more radical if the initiator "imports" abilities from a different form of life (socio-cultural practice) than simply using skills already available in that form of life (Rietveld & Kiverstein, 2014). Consistent with the case of Pasteur, radically new actions are the result of the combination of unrelated, and often diverse sources, such as the logic underlying the practice of open innovation (Chesbrough, 2003).

To conclude, the embodied-mind framework presented in this paper conceives the process of innovative action as a dialogue between environmental affordances (available in socio-cultural field of practices) and the embodied skills shaped by the same socio-cultural field of practices. Affordances are not pieces of information to be processed in the head, but the possibilities for action that can invite or call one to act, which can be regarded as a form of situation-specific improvisation. The notion of affordances directs our attention away from thinking about innovative action in terms of cognitive processes in the head, towards activities taking place in the socio-material warp and weft of everyday practices.

According to the suggested framework, the material world is not a passive container in which innovative action takes place, but rather, a landscape of affordances that is partly constitutive of innovative action. Innovative action is best considered as an aspect of a skilled individual's joining forces with an unorthodox affordance that changes an existing practice or establishes a new practice.

Turning to the implications of this perspective for innovation, we can speculate that if we want to be innovative, we should not only focus on matters of psychological, cognitive processes, of various ways of thinking separately from the physical environment, but on their mutual encounter, the relationship between perceptual, bodily activities in places and the structure of the socio-material environment. Innovative action involves an ability to be aware of unconventional possibilities for action, to feel, note or search for new affordances. Typically, more experienced practitioners educate the attention of novices, a process that over time leads to an increased awareness of the richness of the environment and discovery of new affordances (Gibson, 1979), and of fine-tuning

> the ability to perceive the significance of what is already in the world—in other words, to see the paths that have already been made in social practices and to be able to pursue the making of new paths and new kinds of social practices and institutions when these are needed. (Tanggaard, 2013, p. 30)

As such, we offer an understanding of innovative action as forming in a relation between the agent and his or her environment.

Another implication of our research, and in particular the relation between innovation and engagement with the (socio)material environment, is that it is possible to scaffold the discovery of unorthodox affordances by means of the creation of *material playgrounds* (Rietveld, 2019). Material playgrounds are constructed settings (e.g., models on the scale of the body) that set up conditions for processes

of creative exploration of and experimentation with materials. It takes seriously the idea that innovation is not done in the head but by situated embodied engagement with a rich landscape of affordances. In the case of making "The End of Sitting", for example, the makers built a strong metal frame that afforded playful exploration of the potentials of a large diversity of materials, in particular their potential for supporting standing and leaning. In this material playground discoveries were made that led to another art installation (*Breaking Habits*) that explores how people could live in a world without chairs and couches (Rietveld, 2019).

Future research challenges include investigation of how to influence the selective openness to affordances by increasing the tension experienced by an individual in her person–environment relationship by, for instance, combining elements from unrelated forms of life. Moreover, and crucially related to this, the more skills one has, the more affordances one can be responsive to. So selective openness to affordances can be heightened by upgrading one's skills and ability to make finer and finer discriminations. Given that the pool of skills in a certain environment belonging to particular socio-material practices is always dynamical and given that the material environment is always changing, individuals are continuously challenged to increase their level of skills.

A related issue is how innovative actions trickle down from the agent to the socio-material practice, such as in the case of the invention of the anthrax vaccine. The sharing of what is discovered, of those newly identified affordances, can be promoted by educating the attention of other individuals to the relevant aspects of the material environment and their possibilities of use. In a similar fashion, one can pose the question of how a landscape of affordances proper to a form of life can be enriched. Two different ways of doing this can be by introducing new skills, or by importing materials not yet available in the socio-material practice under consideration. A historical example of the latter would be the importation of stirrups from China into Europe, which enriched the pool of tools to be used. The stirrup is considered to be one of the basic factors behind modern civilization, similar to the invention of the wheel or printing press (McClellan & Dorn, 2015). Low tech as it may be, it is regarded as the engine behind many social and technological innovations and the development of Feudalism, with overlords and knights ruling over a peasant class.

The paper has sought to provide a new perspective on the interplay between the material context and innovative action. This tentative framework shifts the focus away from a cognitivist approach (privileging ideas in the head) or a deterministic perspective attributing undue causality to the physical environment, towards an embodied-mind approach that puts premium on both the centrality of the socio-material environment as a source of affordances and the skills of the agents.

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