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Enactive Planning in Rock Climbing: Recalibration, Visualization and Nested Affordances

Abstract

This paper analyzes the skilled performance of rock climbing through the framework of Embodied and Enacted Cognitive Science. It introduces a notion of *enactive planning* that is part of one mindful activity of ongoing responsiveness to the affordances of the wall. The paper takes two distinct planning activities involved in rock climbing – route-reading and visualizing – and clarifies them through the enactivist and ecological concepts of nested affordances, prospecting, recalibrating, marking, and corporeal imaginings, as well as Rylean concept of heeding. The paper shows that an enactive approach to planning can make sense of both the planning done in preparation of the climb, and re-planning done during the mindful performance, without invoking additional cognitive architectures.

Keywords

rock climbing, planning, enactivism, affordances, visualization, Ryle

1 Introduction

Rock climbing is a skillful activity that is best performed thanks to active reading or previewing of the route, and visualizing one's bodily position, in anticipation of the climb. It is mostly a slow and controlled activity (aside speed climbing), where climbers can spend almost two-thirds of the time in stationary positions during the climb (Billat et al. 1995). As rock climbing requires controlled activity and can be characterized as a "slow" sport, there is a lot of time for the climber to plan and re-plan their performance. Climbers often choose to move methodically, placing their feet carefully and moving with intention. Even in the context of a competition, climbing is performed in a reflective, slow fashion, with time taken to study the route. This makes rock climbing an interesting case of skilled performance. Can planning in

rock climbing be part of the ongoing climbing performance, or does it take place only prior to the climbing activity? And if it can be part of the ongoing climbing performance (in the shape of re-planning), does it take place in a special cognitive architecture in detachment of the action?

This paper will approach planning done in rock climbing from the perspective of Embodied and Enactive Cognitive Science (EECS). EECS is a framework that has been applied successfully to account for various dynamic, *high-speed* sports, like baseball, basketball, cricket, table tennis, or squash (for an overview, see Cappuccio 2019). In such high-speed sports, the action takes place so fast that the intellectualist approaches to expert engagement are said to become less tractable.¹ However, slower-paced sports like outdoor rock climbing or competitive bouldering, which leave time for thinking about the movements to come, have not been explicitly addressed through the EECS framework, which makes the analysis of rock climbing through this framework an interesting and needed addition.

This paper will offer a new way of making sense of planning that occurs in rock climbing, both before the climb (before the climber starts to ascend the climb), and during the climb (when the climber pauses mid-climb to adjust to the environment and takes on a new climbing strategy). It will show that planning activities, which, in the context of rock climbing, includes activities such as route previewing or inspection (what I will collectively call "route-reading"), and visualizing one's body in anticipation of the performance, can be best explained in terms of acting on nested affordances and prospecting future actions. It will introduce the notion of *enactive planning*, where planning in rock climbing is part of the ongoing embodied, situated and mindful climbing activity, both during and before the ascent, where one is prospecting one's performance in the ongoing interaction with the environment. I argue that planning in skilled performances like rock climbing should be thought of as embodied, enactive and world-involving activities, because planning (both before and during the climb) takes place in dynamically unfolding intelligent action in ongoing response to the affordances of the environment.

The paper will unfold as follows. Section 2 describes the activities that take place during rock climbing in theory-neutral ways. Section 3 describes planning as part of a reflective

¹ For example, Sutton et al. (2011, p. 87) write: "We note, as has Dreyfus, that fast and rapidly-changing dynamic domains like open-skill sports or improvisatory jazz make intellectualist approaches particularly hard to credit. There is no complete specification of the task domain available to be internalized, and even if there was, it could not be searched and applied in time: with little more than half a second to react before the cricket ball reaches you, how could you think first, then act?"

thought process separated from skillful coping (Dreyfus 2002), and one that is achieved in a special cognitive architecture ("Type 2 processing" – Evans and Stanovich 2013). It then introduces the EECS alternative of enacted planning. Section 4 explains the motivation behind proposing an account of planning that is not separated from the ongoing action, by relying on Gilbert Ryle's (1949) analysis of heedful action. Section 5 discusses the available affordance-based descriptions of rock climbing and introduces the concepts of nested affordances and prospecting. It clarifies the difference between expert and novice climbers. Section 6 homes in on the details of enactive planning prior to the climb and enactive re-planning during the climb. It expands on the re-planning activity as involving exploration of nested affordances and ongoing recalibration of action, and introduces further explanatory tools such as the notion of corporeal imaginings and marking to account for enactive visualizing done prior to climbing. Section 7 concludes the paper with an insight that enactive planning can take place both during and before the skillful engagement, as in both cases it involves the same motoric resources, only executed in different timescales.

2 Rock climbing as a skilled performance

2.1 What happens during rock climbing?

Rock climbing is a form of a skillful activity performed by a climber when ascending natural rock formations or artificial rock walls. According to the definition of rock climbing,

The goal is to reach the summit of a formation or the endpoint of a usually pre-defined route without falling. Professional rock climbing competitions have the objectives of either completing the route in the quickest possible time or attaining the farthest point on an increasingly difficult route.²

Rock climbing has also turned into a distinct sport category. The Tokyo 2020 Olympic Games in Japan will see for the first time variations of rock climbing in its repertoire (the competition will be called *Sport Climbing*), where bouldering, lead and speed climbing techniques will be

² Rock climbing. 2020, January 15. In *Wikipedia*. https://en.wikipedia.org/wiki/Rock_climbing

assessed.³ While there are differences between these forms of climbing,⁴ for the purposes of this paper, they will not be relevant. I will focus on the key similarity between them, which is making strategic use of a rock wall in order to ascend it. Below, I will focus on the typical set-up of these rock climbing activities that these climbing variations share.

Firstly, in indoor rock climbing, the rock walls feature differently numbered or colored holds to indicate the route that should be followed to reach the top. An easy route may have a cluster of holds that are close to each other and are easy to grasp, forming a smooth climbing path to the top. A difficult route has fewer holds, smaller holds, or no holds at all; ascending such a route requires various techniques, such as grasping the holds from the side or the bottom, or finding creative ways to keep balance on the rock by using one's whole body, making dynamic swinging motions to reach the holds, etc. Secondly, typically for climbing competitions, the athletes climb a fixed route within a specific time constraint. When a climber grabs the final hold at the top of a route with both hands, they are deemed to have completed said route. The climber should not use holds other than the designated ones (ones that are differently color coded do not belong to the route), but the climber is also free to use the surface of the rock for balance, and to grasp the designated holds in any way he/she pleases.

Rock climbing entails many skills, including bodily strength and balance, perseverance and poise. It is not a mindless activity. A big part of successful rock climbing is played by the climber engaging in planning of the route, which entails processes such as route reading and visualizing, as will be described below.

Aside speed climbing (where the climbing time is limited), rock climbing is also not essentially a fast sport: climbers often choose to perform their movements at a slow pace (Billat et al. 1995).⁵ Even though speed is becoming a strong component of many climbing

³ Sport climbing. (2021, January 4). *The Tokyo Organising Committee for the Olympic and Paralympic Games*. <https://tokyo2020.org/en/sports/sport-climbing/>

⁴ "Sport climbing is a form of rock climbing that relies on permanent anchors fixed to the rock for protection, in which a rope that is attached to the climber is clipped into the anchors to arrest a fall. This is in contrast to traditional climbing where climbers must place removable protection as they climb". Sport climbing. (2020, January 15). In *Wikipedia*. https://en.wikipedia.org/wiki/Sport_climbing#cite_note-11

"Bouldering is a form of rock climbing that is performed on small rock formations or artificial rock walls without the use of ropes or harnesses. While it can be done without any equipment, most climbers use climbing shoes to help secure footholds, chalk to keep their hands dry and provide a firmer grip, and bouldering mats to prevent injuries from falls". Bouldering. (2020, January 15). In *Wikipedia*. <https://en.wikipedia.org/wiki/Bouldering>

⁵ There are many other kinds of cognitive activities involved in successful rock climbing. In this paper I will not be interested in accounting for the additional pressures for the climber during a competition (stress, pressure to win a competition, or pressure to perform in front of an audience), nor will I discuss the type of mentality needed to get hold of the life-threatening aspect of specific types of climbing activities like free soloing (for such an account, see Ilundáin-Agurruza (2017)). My analysis aims to be relevant to rock climbing instances outside of competition dynamics of indoor rock climbing as well.

performances, and the static phases might be seen as becoming increasingly rare,⁶ rock climbers and boulderers can and still do opt for relatively long sequences of stillness as part of their climbing strategy.⁷ The possibility of moving slowly and justified choice to be at times static suggests that there is room in this sport for contemplative planning of what moves to execute, in detachment of the ongoing activity, as the body is, for some periods of time, not in motion *per se*.

In what follows, the focus of this paper will be on the planning of the ascent as understood through EECS, which is that both prior to the climb, and even in the moments of stillness during the climb, the planning that takes place is an ongoing, embodied and enactive act. Specifically, this paper will propose new tools to make sense of enactive planning, and provide some insights on the nature of planning, looking at whether "real" planning takes place only before the ascend, and if planning must take place in a special cognitive architecture. I will deny both of these assumptions. To make my point, I will provide examples from indoor rock climbing and indoor bouldering competitions.

2.2 Planning the ascent: route reading and visualizing

An important part of rock climbing is preparing the climb by taking the time to study the route prior to its ascent in order to figure out how to most efficiently complete the route. I will refer to it as *route reading*, a term used in practice by climbers and boulderers. In the literature, sometimes route reading is discussed under the terms *route previewing* (Seifert et al. 2017; Seifert et al. 2018) or *route visual inspection* (Sanchez et al. 2012; Seifert et al. 2017). Route-reading involves studying the holds and surfaces of the wall. Man-made walls for indoor climbing compose of holds of different shapes and sizes. The shapes of the holds usually go in pair with a specific way they should be used. For example, a hold that is smooth from the top side and forms a pocket at the bottom is best grabbed from underneath; a hold that is small and has a hole in the middle is best grabbed with one or two fingers. The types of grasps of handholds include "jug", "pinch", "crimp", "sloper", "pocket", and these grasps best match certain shapes of the holds. Reading of the route involves recognizing these correspondences.

⁶ I'd like to thank the anonymous reviewer for highlighting this point and indicating that recently there was a shortening of the time that is allowed for route completion in lead climbing (from 8 to 6 minutes) and in bouldering (the route, in competitions, must be completed within 4 minutes).

⁷ For example, we can see boulderers in a competition at the start of their 4-minute mark taking about half a minute to read the route, brush the holds from chalk, and hang or rest in strategic places of the wall during the climb, to save energy. See USA Climbing. (2019, September 27). *2019 USA Climbing: Bouldering Open National Championships | Finals* [Video]. YouTube. <https://www.youtube.com/watch?v=lr6zkUmcaoE&t=6306s>

The climber takes time to engage in route-reading in order to try to work out what the route-setter intended for them to do, and to figure out how to best tackle the route.⁸ Hence, route-reading can be conceptualized as analysing the "meanings" of the holds, and "deciphering" them (as though reading a book that is coded in a special language) in order to plan the most optimal way of ascending the wall prior to the climb.

This does not mean that the climber is not allowed to grasp the hold in a different way (e.g., grasp a "pocket" hold with a whole hand, or by utilizing a different body part like a foot to push oneself off the "pocket"). Seeing those atypical possibilities for action can also be part of the route reading process, even though these may not be the most optimal ways of using the holds. According to Sanchez et al. (2017), route previewing involves seeing the available transitions between the holds that help to visualize what sequence of actions should be made on the wall. The capacity to see "unobvious" possibilities for grasping the holds in advance of the climb is a capacity attributable to expert climbers, whose background in climbing influences their route reading skills.

As route reading is a part of preparing for a climb, it can be seen as an activity that takes place prior to ascending the wall. It involves making use of the prior training in how to interpret the holds, on the basis of which one carefully puts together a plan for ascending the wall.⁹ The performance itself, however, will not always follow the plan: during the ascent the climber might realize that they need to apply extra force, or use a different body part, and so, "re-think" the plan by adapting to the current needs. Route (re-)reading can therefore also be seen as an emergent feature of the climbing activity that takes place during the climb.¹⁰

Visualizing is a related technique described as part of the planning process taking place mainly before the climb. Visualizing the sequences of climbing actions can be seen as an aspect of route-reading and the overall planning process, because visualizing the climbing sequence involves imagining one's body and its position on the route. Visualizing the planned moves is said to help the climber to get a sense of whether they will "flow" into the climbing sequence

⁸ Some tips for route reading include: taking a step back and looking at the whole wall (looking at where the route starts, where it finishes, if it goes to the right or to the left); identifying hand holds from foot holds, usually by their shape, and deciding on which hand should go first and what the sequence of the climb should be. If a hold is not "readable", one can reverse-engineer the moves to be made by looking at the top hold, and plan the sequence of their movements backwards. Bouldering Bobat. (2019, May 3). *Instantly CLIMB better with Route Reading (Visualisation)* [Video]. YouTube. <https://www.youtube.com/watch?v=VTInD0tGdn0>

⁹ For example, according to the official website of the Japanese Olympic Games, bouldering requires the climbers to "plan each move carefully, thinking about which hand and foot to place in the next holds." Sport climbing. (2021, January 4). *The Tokyo Organising Committee for the Olympic and Paralympic Games*. <https://tokyo2020.org/en/sports/sport-climbing/>

¹⁰ It might be thought that adapting or adjusting to the environment is not part of the planning activity. See section 6 for an argument to the contrary.

envisioned. The concept of imagery has been particularly successful in sport psychology, as it has helped researchers in focusing on the techniques athletes use to prepare for a motor performance in a controlled atmosphere. As Sanchez-Garcia et al. (2019, p. 517) write,

Imagery in climbing (...) has been used as the practice of fictionally rehearsing the path of the climb, in which the climbers, before actually starting the ascent, visually inspect the wall or the crag in search of the most effective approach. The use of imagery, that is, a mental dry run of the actual exercise, is seen as a key aspect to better accomplishing the real ascent in terms of efficacy or performance optimization (...).

The fact that the visualizing of the climb is understood as a "mental dry run" resonates with the layman's description of preparing for the climb by "climbing in your head".¹¹ This indicates that visualizing is an act detached from the interaction with the world.

These descriptions resonate with an idea that climbing, as any skilled activity, requires two processes – the act of planning the activity that takes place prior to the climb, and the execution of the plan that makes the bulk of the act of climbing. Sometimes the planning activity is seen as the cognitive act, and the execution of the plan and ongoing adjustments to the environment are seen as a behavioral, mindless response. However, we can challenge the idea that in rock climbing, the climbing performance involves a "mere execution of a plan". This challenge is inspired by the fact that the climbing activity seems to be thoughtful throughout all stages of climbing: both prior to the climb and during the climb. Since, aside speed climbing, the climbing activity is often slow, there is sufficient time for the climber to engage in route-*re*-reading and *re*-visualizing of his/her strategy during the ascent. Climbers hang on the walls in strategic spots that allow it, where they can re-evaluate their choices about how to engage with the next part of the route: whether they should do it in a dynamic fashion (with a gusto, a swing, a jump), or by carefully placing their limbs on the wall. Thus, the identification of the route seems to take place not just before the climb, but also during the climb. Once engaged in the execution of the plan, the climber is still intelligently making creative adjustments to their strategies. This indicates that the planning and re-planning may be an ongoing cognitive activity taking place not just prior to, but throughout this sport.

¹¹ See Bouldering Bobat. (2019, May 3). *Instantly CLIMB better with Route Reading (Visualisation)* [Video]. YouTube. <https://www.youtube.com/watch?v=VTInD0tGdn0>

To sum up, route-reading and visualizing that make up the planning activities are important components of the rock climbing and bouldering competitions. They are said to be done in advance of the climb, though we have reasons to believe that both forms of planning could be seen as part of the ongoing mindful process. It is worth looking at the descriptions of skilled performances from sport psychology to further understand these possibilities.

3 Accounting for planning in rock climbing: proposals

3.1 Planning as part of reflective thought

Classical way to conceptualize planning is as part of decision making processes, analyzed through rational normative models, where optimal solutions can be reached if rational processes are followed. Planning is typically seen as a slow, conscious decision-making process necessarily separate from, and causing, the activity, forming a "blueprint encoded in the brain" (Sutton et al. 2011). Planning has been further conceptualized as

a representation of the action goal, the selection of the means necessary to achieve it, and the calculation of its consequences for the organism and the external world ", generated by our brain that "anticipates the effects of our actions and those of others, becoming able to articulate its own goals and plans (Maldonato et al. 2019, p. 699).

Rational, normative models define *a priori* what is an optimal solution and prescribe what should be a putative optimal performance. Thus, problem-solving in the sports literature is often characterized as a cognitive process of reflective thought that evaluates the situation and aims at the best possible maneuver. Planning seems to belong to the domain of reflective thought, and only after these explicit cognitive steps are taken, the performance can follow. Hence, on this classical model, both route reading and visualizing are acts of reflective thought done prior to the performance, in order to facilitate the climbing flow during the ascent. Planning can only take place prior to performance, which is itself "mindless".

That a skilled performance is sometimes seen as requiring two distinct processes (one of engaging in deliberate intelligent action, another of being in a flow of the activity), is a

known proposal already captured by Dreyfus. Dreyfus's (2002) *absorbed coping* was a counter idea to McDowell's proposal that intelligent actions always involve conceptual capacities for deliberation. Dreyfus proposed that expert performers in the midst of their activities do not need to represent what they are doing or in any demanding way *think* about their actions. Instead, they are "directly immersed in the *flow* of the activity, utilizing their embodied *know-hows*" (see Rucińska and Aggerholm 2019, p. 681). However, the picture of absorbed coping understood as unreflective, semiconscious, embodied routine, of which "mindedness is the enemy" (Dreyfus 2007) and "the agent "ceases to be a subject" (Dreyfus 2007, p. 373) and is "in a way like a sleepwalker" (Dreyfus 2013, note 43), has gained a lot of criticism for being an over-reaction to intellectualism (Sutton et al. 2011; Cappuccio et al. 2019). It has led to an association of the theory of absorbed coping "with the categorical claim that conscious control (or "reflective thought") and expert performance (or "skillful action") are mutually exclusive" (Cappuccio et al. 2019, p. 105). Sport philosophers and psychologists have for a long time emphasized the embodied, dynamic nature of skilled performances found in sport context, arguing that "it is an unnecessary constriction on the dynamics of thought to assume that what is done from force of habit must be done without thinking" (Sutton et al. 2011, p. 88). Hence, they have been stepping away from the dichotomy between reflective and skillful action, proposing different ways to bridge the gap.

3.2 First alternative: Planning as part of Type 2 processing

One way to bridge the gap is to step away from the dichotomy between basic and complex cognition and to invoke a *dual cognitive architecture*. The idea behind this solution is that proceduralized execution (skillful action) does not exclude forms of reflection and conscious control. This means that the performance is not mindless and that planning (and re-planning) can take place during action, but it does happen "offline", in a distinct cognitive architecture. According to Cappuccio (2019, p. 106), "automatic execution of proceduralized action routines can be implemented during peak performance with the concurrent involvement of reflective strategic control, consistently with a dual cognitive architecture governed by virtually independent causal and informational systems (as theorized, for example, by Evans and Stanovich 2013)." This solution does not require explicit linguistic or conceptual representations to be involved, but retains a dichotomy between non-cognitive and cognitive processes, calling them Type 1 and Type 2 processes, respectively. Evans and Stanovich's (2013) theoretical approach is one in which "rapid autonomous processes (Type 1) are assumed

to yield default responses unless intervened on by distinctive higher order reasoning processes (Type 2)" (p. 223). The defining feature of Type 1 processing is autonomous processing, while the key feature of Type 2 processing is "the ability to sustain the decoupling of secondary representations",¹² which is "a foundational cognitive requirement for hypothetical thinking" (p. 237). On this model, Type 2 processing will be responsible for planning, visualizing and other decision-making aspects of climbing, as Type 2 processing "enables uniquely human facilities, such as hypothetical thinking, mental simulation, and consequential decision making" (p. 235).

However, invoking two cognitive architectures is a solution that seems to have replaced the dualism between reflective thought and skillful coping for another dualism within one mindful activity: the action is driven by either autonomous or representational causal processes. While the first process may be captured as a sensorimotor activity, the second one manipulates representational contents *decoupled* from the world. As such, this proposal implies that it is thanks to the Type 2 process *only* that the (re-)planning or decision-making within the mindful activity can take place. But this in essence preserves the dichotomy between intelligent and non-intelligent action. The difference seems to have shifted from personal to sub-personal level of processing, where the planning is again separate from the performance. Hence, invoking dual process theory is not an adequate solution to the dualism found in Dreyfus.

3.3 Second alternative: Introducing enactive planning

Another way to bridge the gap between reflective and skillful action is a "middle position" endorsed by Embodied and Enactive Cognitive Science (EECS). EECS theorists have been proposing to account for skillful action in a way that bridges the gap between intelligent action and absorbed coping.

Hutto et al. (2019, p. 37) clarify their embodied-enactive take to skilled performance:

Skilled performance is explained in terms of embodied activity that involves dynamic processes that span brain, body and environment. Accordingly, cognitive processes (...) are identified with nothing short of bouts of extensive,

¹² The concept of secondary representation refers to a copy of the primary representation decoupled from the world so that it could be manipulated in a mechanism for simulation of future possibilities (Stanovich and Toplak 2012). Secondary representations decoupled from primary representations allow for simulations to occur, as they are representations of potential actions that leave primary representations intact, and so, do not confuse the possible world with what the world is really like (Stanovich and Toplak 2012, p. 9).

embodied activity that take the form of more or less successful organism-environment couplings. (...) Through sustained, context-sensitive, active engagements with worldly offerings, organisms are changed to be able to (...) "get a grip on the patterns that matter for the interactions that matter." Getting a grip on the patterns that matter is not mindless, blind, or automatic; rather, it is context-sensitive in ways that reveal it to be "highly disciplined mental activity" (Sutton et al. 2011, p. 78).

EECS theorists have contrasted the idea that absorbed performance is *mindless*, and they reject explanations that invoke special cognitive architectures that manipulate mental representations. EECS captures philosophical approaches that understand cognition as embodied, enactive, and always situated, bringing together insights from phenomenology and ecological psychology to stresses the role of the body in its environment in co-constituting the cognitive processes.

Following phenomenologically-inclined theorists, EECS proposes an account of embodied rationality that involves implicit and non-intentional bodily self-awareness (Zahavi 2013). Embodied rationality is also enactive and intersubjective: *thinking-without-thinking-about-it* is a form of intelligent, embodied and situated reflection, that is embedded in a context and may be accomplished with others (Gallagher 2015). On this model, skilled performances like rock climbing can be thought of as involving processes of planning and re-planning activity, both prior to and during the climb, that are embodied, embedded and situated in a specific context. There is no need to think of planning as an intelligent process happening solely in the head, involving a distinct cognitive architecture, or taking place only prior to the performance, in detachment from the ongoing worldly interaction. Following the enactive approach to planning, rock climbing should be thought of as a skilled performance that involves embodied and enacted planning and re-planning as part of the ongoing mindful engagement with the world.¹³

EECS can also account for ecology in a way that the classical way of conceptualizing planning through rational normative models cannot. EECS proposes that cognition should be best modelled directly on dynamic relations between the organism and its environment, not on computation or manipulation of mental representations, or mental stand-ins that harbor semantic contents. This will hold for planning activities as well. According to the EECS

¹³ On this model, even speed climbing is not a mindless execution of a climb. It involves the same motoric processes activated in response to the environment, in a faster timeframe.

framework, to analyze the cognitive process of a skilled performer like a rock climber is to study the climber's interaction with his/her environment, which serves as the explanandum. Climbing techniques, including planning techniques, will be learned and exercised in the context of the opportunities and constraints of a given environment. Hence, EECS can refer to ecological dynamics model and the notion of affordances to account for decision-making taking place in action (Araujo et al. 2019) as well as characterization of route previewing strategies as relying on perception of nested affordances, as described in Seifert et al. (2017).

These authors conceive of affordances as relations that change with respect to interaction. In the context of rock climbing, the optimality of the climb is not a static property of the environment to be picked up and processed (even if the environment itself is unchanging); the decision about what the most optimal move is, is made in action.¹⁴ The suggestion is that the optimal way of climbing is not a piece of information dependent on representing or calculating the parameters of the wall and bodily factors. The decision-making process, including planning, re-planning of the route, and visualizing oneself on the route, is a dynamic activity, relating to the ongoing interaction of the agent with his/her environment. The details of how such account works will be described in sections 4 and 5. EECS can therefore offer an alternative to the reflective thought-absorbed coping dichotomy other than the dual process theory, motivated by the worry that Type 2 processing does not provide an adequate solution to the dualism found in classical decision-making literature.¹⁵

In line with the description of skilled performance as an activity involving active engagements with worldly offerings, I propose in this paper to re-conceptualize Moldonato et al.'s definition of planning and propose a notion of *enactive planning*:

an embodied and situated activity involving ongoing responsiveness to the environmental affordances, directed at optimal performance, without manipulation of mental representations of action goals.

¹⁴ As Araujo et al. (2019, p. 560) propose, "Conceptualizing such landscapes of action possibilities for sport performers shows how difficult it is to prescribe the existence in advance of 'the optimal' decision for a particular performer. This is because affordances are dynamic and differ in stability (i.e., they emerge and dissolve momentarily in landscapes within dynamic performance environments), dependent on interactions of intrinsic dynamics of an individual performer, as well as task dynamics and environmental constraints."

¹⁵ The *radical enactive* branch of EECS will also be motivated by the introduction of contentful representations in Type 2 processing. Radical enactivism cautions against solutions that invoke contentful states like secondary representations, as they face the challenge of the hard problem of content: accounting for a naturalistic, non-correlational theory of content to sustain the idea that processes taking place in the brain are representational in the relevant sense (Hutto and Myin 2013). The idea of two distinct information processing mechanisms occurring in the brain is not problematic *as such*, but it becomes problematic when they involve contentful representations for hypothetical thinking as suggested in the Type 2 processing.

Enactive planning captures the idea that one can be engaged in ongoing route reading and visualizing both prior and during the ascent, without invoking special cognitive architectures, but making use of concepts such as *nested affordances*, *protention*, and *corporeal imaginings* instead. The sections below will develop the EECS alternative in more detail. Section 3 below will begin with reinforcing the idea that planning can be thought of as part of a mindful engagement, by referring to Gilbert Ryle's framework of heeding.

4 Gilbert Ryle's heeding

Gilbert Ryle has proposed a conceptual argument against two process theories in *The Concept of Mind* (1949). *Heeding*, or minding, one's own actions,

refer to the concepts of noticing, taking care, attending, applying one's mind, concentrating, putting one's heart into something, thinking what one is doing, alertness, interest, intentness, studying and trying (1949, pp. 118-119).

Ryle argues that the concept of heed is not a cognitive concept in the traditional sense of that term, as "investigations are not the only occupations in which we apply our minds" (p. 120). Heeding also refers to the intelligence of embodied action that phenomenological studies have captured: it is being mindful of one's engagement. Heeding occurs when one is paying attention to what one is doing while absorbed in that activity. The concept of heeding captures the idea that when focused on performing an action, one is simultaneously paying attention to one's own embodiment and affective states.

All activities can be either heedful or not heedful. For example, climbing of stairs can at times be heedful, when one is paying special attention to what one is doing. Conversely, typical "cognitive" engagements (such as performing a mental calculation) need not always be heedful, when performed out of habit.¹⁶ What follows is there could be instances of rock

¹⁶ As Ryle (1949, p. 95) explains, "I certainly can run upstairs two stairs at a time from force of habit and at the same time notice that I am doing so and even consider how the act is done. I can be a spectator of my habitual and of my reflex actions and even a diagnostician of them (...) Conversely, actions done from motives can still be naive, in the sense that the agent has not coupled, and perhaps cannot couple, his action with a secondary operation of telling himself or the company what he is doing, or why he is doing it."

climbing that are not heedful, and ones that are, though expert rock climbers always climb in a heedful, controlled fashion (Seifert et al. 2018).

Crucially, Ryle argues that heeding is only "one operation with a special character and not two operations executed in different 'places'" (p. 121). Inspecting and monitoring are themselves special exercises of heed; they are no two systems working in parallel, but one. Ryle's conceptual argument against two process theories goes as follows:

Doing something with heed does not consist in coupling an executive performance with a piece of theorising, investigating, scrutinising or 'cognising'; or else doing anything with heed would involve doing an infinite number of things with heed (pp. 120-121).

Ryle's worry is with proliferation of sub-personal activities responsible for cognition, and postulating that there are "real" cognitive processes that run behind the scenes, causally responsible for otherwise mindless behaviors. Such picture of cognition promotes the Cartesian "ghost in the machine" worldview that Ryle objected to. Hence, paying attention to what one is doing is not a mental process taking place "in the background" or occurring "prior" to the act. Ryle objects to the need for subpersonal processes where cognitive acts *really* take place.¹⁷

To summarize, Ryle provides a compelling framework of heeding as a feature of a skilled mind that questions two process accounts and resonates with EECS approach to skilled performances. The concept of heeding captures two important ideas. First, there are no two *parallel* activities (cognitive and not-cognitive) occurring during an intelligent, embodied act. Second, there is no *second mental process* causing the intelligent act. In this way, the concept of heeding applied to rock climbing serves as an alternative to the ideas that rock climbing involves two distinct activities (cognitive planning of the climb and mindless execution of the climb, *ala* Dreyfus), or that mindful rock climbing must involve a special second process in a cognitive architecture where planning *really* occurs (*ala* Evans and Stanovich). Heeding can help us think of rock climbing as one mindful activity, where planning (including route-reading

¹⁷ "The sense in which a person is thinking what he is doing, when his action is to be classed not as automatic but as done from a motive, is that he is acting more or less carefully, critically, consistently and purposefully, adverbs which do not signify the prior or concomitant occurrence of extra operations of resolving, planning or cogitating, but only that the action taken is itself done not absentmindedly but in a certain positive frame of mind. The description of this frame of mind need not mention any episodes other than this act itself, though it is not exhausted in that mention" (1949, p. 95). Phenomenological tradition can again help with capturing the "positive frame of mind" idea. Phenomenologists have described it as a special type of consciousness. For example, Heidegger's "ready to hand" attitude, which includes a network of pragmatic functioning of objects, is a kind of consciousness one has with respect to objects that makes one particularly sensitive to their use.

and visualizing) are themselves qualities of that activity. The only difference is in the focus of what one is heeding to, which depending on whether the planning is done prior to the climb (during the previewing process), or during the climb. Prior to the climb the focus might be stronger on the perceived affordances of the wall, and during the climb the focus might be stronger on the bodily feel and balance. However, dual focus within an action does not mean that the action itself should be seen as "mindless" or as taking place in a different cognitive architecture.¹⁸

More can be said now to clarify how these climbing activities get to be heedful. How does climbing get to be planned without invoking a mental plan? EECS can provide an answer to this question that does not return to proposing subpersonal cognitive architectures or "mental plans". EECS goes *wide* in its explanation, as it incorporates the structure of the environment and our dynamical interaction with it to account for heedful engagements. In the next section I will discuss the literature that refers to acting on affordances for rock climbing and show how the notions of nested affordances and prospecting can be used to account for enactive planning in rock climbing.

5 Affordance-based description of rock climbing

There is a rich body of literature on rock climbing that utilizes the concept of affordances (including but not limited to works of Boschker et al. 2002 (a); Fajen et al. 2009; Wagman and Morgan 2010; Seifert et al. 2017; Seifert et al. 2018; Wagman et al. 2018; Hacques et al. 2020). In this section I will highlight some of the key aspects of the affordance-based analysis of route previewing process in rock climbing, before returning to the role of affordances for planning in rock climbing. Affordance-based descriptions of rock climbing usefully capture the dynamic decision-making process of the climber in his/her environment. They also help to explain the difference between expert and novice climbers.

According to Seifert et al. (2017), "the role of route preview is to optimize the picking up of information for the perception of *nested affordances*" (p. 19). Nested affordances are those affordances functioning as means to the next actions. In *Technology Affordances*, Gaver (1991) has described nested affordances as affordances that are grouped in space and unfold in

¹⁸ Gallagher and Gallagher (2019) has referred to this phenomenon as "twofoldedness of one experience" referring to the example of theatrical play.

spatiotemporal activity.¹⁹ Seifert et al. (2018) conceptualized nested affordances as sequences of possibilities of action, while Hacques et al. (2020, p. 4) have further clarified that the concept of affordances emphasizes the fact that "seemingly discrete behaviors are better understood as a continuous flow of actions distributed across different temporal and spatial scales".

Seifert et al. (2018) proposed to test experimentally the climbers' experience on the routes they designed, following the idea that "individuals shift toward variables for the perception of affordances that support more fluent climbing" (p. 3). They studied how climbers *attuned* to affordances, or how they perceived the *climbability* of the wall separate to the *graspability* of the holds, and compared it to the time they took to engage in exploratory activity. They found that "less skilled climbers use a hold-to-hold approach as they exhibit simple grasping patterns (i.e., dual- hand grasping on a hold) whereas skilled climbers exploit more complex grasping patterns (i.e., arm crossing between holds)" (p. 11). The difference between perceiving climbability of the wall and graspability of the holds can be further cashed out as a difference between being attuned to the nested affordances of the wall as a whole vs. paying attention to the immediate meanings of the holds. The latter can be described through classic information-processing paradigm: knowing how to read the holds, the novice puts together this information in a detached way, and seeks affordances by engaging in outward exploratory activities (which are improvised). Skilled performers, on the other hand, perceive affordances across a larger range (Fajen et al. 2009). As suggested by Seifert et al. "skilled climbers appear to perceive a cluster of holds rather than multiple separate holds, suggesting that they perceive one continuous (prospective) opportunity for action" (p. 11).

The route previewing process differs between the expert and the novice climber, as expert climbers pause less frequently and took shorter periods at rest regions. Findings of Sanchez et al. (2012) indicate that route previewing might contribute to climbing fluency (i.e. climbing by minimizing the number and duration of saccades and stops). Boschker et al. (2002a, p. 25) have further hypothesized that "inexperienced climbers exclusively perceived structural features of holds when looking at a climbing wall (e.g., location, shape, and orientation) whereas experienced climbers mainly focused on the functional features, such as the grasping, reaching, and standing opportunities of individual holds as well as the chains of

¹⁹ Gaver's example involves seeing a door handle as affording further action. For instance, a handle alone only appears to afford pulling. A door alone may suggest an affordance for manipulation due to its partial separation from the wall, but not what sort of manipulation will be effective. Only by seeing the affordance of pulling the handle as nested within an affordance of pulling the door can the opening of the door be a perceptible affordance (1991, p. 82).

climbing moves using multiple holds"²⁰ (see Seifert et al. 2017, p. 14). Inexperienced climbers were further reported to use a "hold-to-hold" approach and not cross their arms, and were unable to decide consistently which type of grasp was required for given holds (*ibid.*, pp. 16-17). While expertise in climbing clearly involves being able to recognize the "meanings of the holds" that are not apparent for a novice,²¹ the interesting difference between them that I want to highlight in this paper is the capacity of the expert to be directed at reaching, grasping or standing possibilities for action "perceived as one (clustered) affordance". Boschker et al. (2002a) capture this difference between the expert and the novice climber as a difference in their skill to perceive *clustered or nested* affordances, where "'clustered' implies a purely spatial conceptualization of information, whereas a term like '*nested*' addresses temporal issues (such as prospection, i.e., forward-looking)." According to Hacques et al. (2020, p. 4), Seifert and colleagues' climbing studies have found that expert climbers are able to perceive "a chain of movements offered by the properties of the holds and layout on the wall", and so the concept of nested affordances may "help to understand how individuals efficiently chain their actions to achieve a task-goal."²²

Nested affordances capture the idea of prospecting a performance. Prospection is an act of anticipation. According to Wagman and Morgan (2010, p. 905), perception of affordances is already an act of prospection:

Given that affordances are possibilities for behavior (i.e., potential or future relationships between action capabilities and environmental properties), perception of affordances is necessarily a prospective (i.e., forward-looking) act (...). Such prospectivity is highlighted by the fact that, in general, behaviors (and thus affordances) are nested over a number of different spatial and temporal scales (...).

Perception has also *nested prospectivity*, as "perception must reflect the (future) fit between the perceiver–actor's *current* action capabilities and behavior-relevant environmental

²⁰ Expert climbers recalled more information and recalled clusters of information and that they focused on the functional aspects of a climbing wall, whereas they neglected its structural features. Inexperienced participants did not recall such clustered information, and they reported almost exclusively the structural features of the holds" (Boschker et al. 2002a, p. 25). This difference could be even more visible in outdoor rock climbing, where the holds are not even marked but have to be found.

²¹ Thanks to the anonymous reviewer for the suggestion to clarify this point.

²² According to Hacques et al. (2020), prospective control of action occurs "through the information-movement coupling, which enables to continuously adjust the relation between individual and environment to achieve the task-goal" (p. 4).

properties" (*ibid.*, 906). Perception of affordances for a given behavior further "reflects the (future) means by which that behavior is to be performed" (*ibid.*, p. 908).²³ This indicates that perception of nested affordances for action can be seen as a goal-oriented prospective act that occurs in the dynamical interaction of the performer with his/her environment.

To summarize this section, we can say that expert climbers are skilled at perceiving and acting on nested affordances of the climbing wall. The route-reading involved in the planning activity of rock climbing can be usefully described as a skill of acting on nested affordances. While a novice may learn to read the meanings of the holds, infer what movements should be done, and then find out if the holds really afford the movements in exploratory actions, for an expert climber, whole possibilities of action unfold in the perceiving of the rock. This suggests that route-reading is part of the perceptual-motor exploratory action of the active agent, whose past bodily interactions shape their perception (and prospecting) of the optimal movements to come. As Hacques clarifies, "expertise may reside in the continuous exploratory activity of performers that enables them to maintain an active prospection of the available information to act effectively (2020, p. 4). What the expert is attuned to is not just what should be done with respect to the holds, but how his/her movements on the wall should unfold, in prospection of the most optimal performance. How this affordance-based view of rock climbing further informs the notion of enactive planning will be addressed below.

6 Enactive planning and re-planning in rock climbing

The mindful engagement of rock climbers includes an on-going route reading and route re-reading. We can conceive of both of these activities as planning done in action, achieved thanks to acting on nested affordances.²⁴ In this section I will discuss the planning taking place in the previewing time of rock climbing activity, and re-planning taking place during the climb itself.

²³ Wagman et al. (2018) propose further that "perceiving whether a given goal can be achieved requires perceiving higher-order affordances extended across multiple levels of the means-end hierarchy" (p. 6). The discussion of the structure of nested affordances through means-end hierarchy is beyond the scope of this paper.

²⁴ I have distinguished planning before the climb from re-planning during the climb, to capture that climbing involves two types of engagement, one focused on perceptual assessment of the climb and one focused on bodily movement during the climb. E.g., in the planning activity during the climb, one can make use of additional tools, such as sensorimotor and kinesthetic information gained from the tactile engagement with the holds, and be more focused on one's bodily positioning (gained from the proprioceptive information), than in the planning done before the climb. This is still consistent with the idea that both of these forms of planning are aspects of one enacted, ongoing planning activity. Planning that takes place right before a specific action execution, and re-planning taking place during that same action, are aspects of the same planning activity, taking place in different timescales (see section 7). Re-planning can also take place when the climber rests on the wall and is not actively moving.

6.1 Enactive re-planning during the climb: dynamic exploration and recalibration of movement

During the climb, one engages in exploratory actions (Seifert et al. 2018). Exploratory actions in rock climbing mainly refer grasping the holds without moving the rest of the body, but they can also be visual explorations. As Seifert et al. (2018, p. 3) explain, "exploratory movements occurred when grasping actions oriented toward a particular hold did not subsequently lead to the use of that hold during the ascending climb, whereas performatory movements corresponded to hand grasping actions performed with simultaneous ascending hip motion". Even though climbers spend 63% of the time in stationary positions during the climb, and 37% of the time ascending (Billat et al. 1995), being stationary does not mean being still. During stationary positions climbers engaged in exploratory actions that supported their climbing performance. Being stationary also involves action. In exploratory movements, the climber "(co-)constructs information through her/his actions", since the perceived patterns of stimulation are contingent on his/her motion (Seifert et al. 2018, p. 2). The key idea is that exploratory action, an equivalent of a "dry run", is executed by the agent in the world, not in some mental sphere. This provides a good basis to understand how further re-planning of the climb is achieved in the action. Engaging in exploratory action is a way of responding to and acting on the affordances of the wall. Such exploration, even if only visual, is an act that makes a practical difference as, for instance, it regulates the climber's posture (Nieuwenhuys et al. 2008).

Hacques et al. question whether the distinction between performatory and exploratory action is useful given that a central tenet of ecological psychology is that perception is embedded in the continuous flow of action. They argue that "in many complex sporting environments such as climbing (...), exploratory and performatory actions can appear tightly linked in tasks where performers need to continuously adjust their relationship with the environment to guide on-going and future activity" (*ibid.*, p. 2). They instead propose a two-step process of the affordance-based control framework: attunement to ecological information, and calibration, or "finding an appropriate scaling between information and action capabilities" (*ibid.*, p. 2; see also Brand and de Oliveira 2017).

This case is also a case of enactive planning, as even when the climber has temporarily stopped moving on the wall, that pause is still a meaningful part of the ongoing climbing activity (and the act of climbing), as it involves sensorimotor and kinesthetic processes, and may involve gestures such as marking.

My proposal is that route re-reading can be usefully seen as an act of ongoing recalibration of one's action on the wall. Recalibration has been defined as an action that "facilitates continuous adaptation that supports the visual control of action," in response to the change in individual's action capabilities (as caused by fatigue, for example) (Hacques et al. 2020, p. 2; see also Fajen 2007). Enactive planning captures the idea that the climber has an ongoing responsiveness to the environment, as he/she is attuned to it. It also captures the idea that in this environment the climber is *calibrated*, or finds appropriate scaling between information about the environment one is provided with in the climb (such as the perceptual information one gains about the affordances of the rock when facing the rock, and the tactile/sensory information one gains about the affordances of the rock when touching the rock), and one's own action capabilities (such as the ability to grasp, reach, or hold onto a grip, related to one's affective needs). Enactive planning considers the role of affective states of the climber that influences his/her perception of affordances in that environment.

Enactive planning can also suggest that re-planning occurring during the climb is an ongoing act of responding to nested affordances and anticipating a chain of actions by *recalibrating*, or re-finding, the most optimal scaling between information and action capabilities. Recalibrating occurs once we receive more (visual, tactile, kinesthetic) information, and gain new affective states or feelings of power (or powerlessness) to execute a move, as can happen during the exploration of the wall and in the period of the rest.²⁵

Is it still planning during the climb, or is it simply adjusting to the wall? Why call it enactive (re-)planning, not simply adapting to the environment?²⁶ As Seifert et al. (2017, p. 2) rightfully stress,

Adaptability is a key component for climbing because it provides insights into the on-going co-adaptation of a climber to a set of changing and interacting constraints, which are individually perceived and acted upon. Adapting to

²⁵ Brand and de Oliveira (2017) acknowledge that "calibration" and "recalibration" have been used interchangeably "because they are thought to be similar processes of scaling information to perception and action" (p. 55). However, they opt for a more specific notion of recalibration as occurring "only after a disturbance in either perception or action renders the perception-action link inaccurate, thereby initiating the rescaling of that link (rearrangement). For example, when a player's throwing requires an updated scaling of the perceptual-motor coupling due to fatigue" (*ibid.*, p. 55). While it is an open question whether the period of rest, and exploration of the rock, occurs due to a "disturbance" of the climber such as fatigue, recalibration can still be seen as a useful concept to make sense of enactive re-planning of the route, as it captures the affective dimension of the interaction dynamics as emphasized by the enactivist approach to cognition.

²⁶ Thanks to the anonymous reviewer for this insightful challenge.

different grasping possibilities for a given hold reveals perceptual attunement and calibration of informational variables specifying functional actions.

Indeed, there is co-adaptation process taking place once the climber is on the wall, and it should be seen as a feature of the recalibrating process. However, it is a mistake to think that the climber is only engaging in "real" planning of the activity prior to the ascent, and in the case of the plan "going wrong", improvising a new route on the spot by adapting to the environment. We can meaningfully think of the recalibrating process as "re-planning" of the route because it involves mindfully attending to, and co-construing, new possibilities for action mid-climb, where the new affordances become available for action – there is no improvising taking place. The enactive notion of planning is already body and world-involving, and dynamic responding to the emergent possibilities for action should be seen as part of the ongoing planning and re-planning activity.

This might be another difference between the expert and the novice, to be explored in future research. My hypothesis is that while the novice tries to follow the route as read in the previewing stage and, in the case of the climb not going well, makes improvised adjustments on the wall by looking for new affordances (the fact that novices engage more in exploratory actions on the wall attests to this hypothesis), the expert performer mindfully re-plans the route during the ongoing interaction with the rock, tracking newly discovered optimal nested affordances that invite further possibilities of climbing action.²⁷

6.2 Enactive planning prior to the climb: marking and visualizing

While some planning (including visualizing) can happen in contemplation, prior to and *detached from* the ongoing action, EECS has the resources to make sense of the idea that there can be active planning taking part also during the previewing process, which is not done in detachment from the environment. That is because the climbing activity involves active visualizing of one's prospected performance, even if the climber is not yet touching the wall.

²⁷ It might also be contested that planning does not reflect the co-adaptation process or the the individual-environment coupling, because it refers to an asymmetric relationship between the individual and the environment (thanks to the anonymous reviewer for this insight). However, organism-environment coupling is asymmetric to begin with. Human agents have more possibilities for action on their environments than the environments have on them. Consider Malafouris' (2008) example of the potter and his clay, who dynamically co-constitute the act of pottery. Even though the state of the clay makes a difference to how the potter responds to it, it is clear that the potter has more power over the clay than *vice versa*. In the case of rock climbing, prior dispositions, skills, but also current moods and affect (e.g., being rested), influence to what extent the affordances are found "inviting" or "soliciting" our actions (see Rucińska 2017).

Both route reading and visualizing are not separate acts from climbing, standing "outside" of the action, but are part of the action, done in the immediate presence of the wall. Visualizing is part of the planning of how rock climbing should unfold. Assuming that visualizing is not an act of forming a mental image occurring in its own cognitive architecture, visualizing how to ascend the route prior to the climb will also be part of the heedful climbing preparatory process.

Visualizing often implies the notion of simulation. For example, marking in rock climbing has been described by Seifert et al. 2017 as an act of visualizing the movements to come through a simulation process.²⁸ Simulation process, in turn, is often seen to be a passive act that takes place on the subpersonal level (for critique of this view, see Gallagher 2020). But as Sanchez-Garcia et al. (2019) notice, the notion of imagery is problematic when it is a characterization of inner conditions of athletes. It "implies disregarding the careful analysis of how the route preview works (or, in other words, what it means to *imagine* a route)" (p. 518). Saying that expert climbers benefit most from route preview by visually inspecting a climb does not capture what it is that the climbers are doing in practice, which is often to mime the movements they will do before climbing the wall. What is particularly interesting about the visualizing process amongst climbers is that it is explicitly embodied: it is often coupled with explicit gesturing done right before the climb. Climbers engage in explicit *marking* to visualize how the climbing sequence should unfold.

Marking is therefore better understood as an exploratory gestural movement (see Gallagher and Rucińska, 2021). It fits EECS approach to planning as it is an embodied engagement in spatial simulation. Marking provides us with the idea that to imagine the climb is to explore the upcoming grasping sequences through gestural movement; this movement allows for better visualization of one's bodily position to be taken during the climb. Marking of the movements is therefore seen as part of the cognitive task of planning the route. Sanchez-Garcia et al. call this visible and public process "*corporeal enacting* of the actual movements as if they were already engaged with the material effort of vertically progressing up the wall" (2019, p. 519).

This can be further explicated by Ilundáin-Agurruza's (2017) notion of muscular or *corporeal* imaginings, which are "fully embodied, animate processes" (p. 97), especially catered for making sense of how imaginings work in "sports and movement activities (dance,

²⁸ "During route previewing, climbers might simulate how to grasp each hold and sequences of holds, to find the route. Whilst simulating climbers move along the climbing wall to look at the hold shape from different points of view (2017, p. 3).

martial arts)" (p. 93). As Ilundáin-Agurruza clarifies, corporeal imaginings "originate in and are expressed by our corporeal involvements with the environment (...). They involve actual performance, manifesting variously in the distinctive ways sportspeople and performers solve kinetic problems" (p. 97).²⁹ Corporeal imaginings bring forth imaginative solutions as performers interact with their environment. They can account for how "dynamic, corporeal, non-representational imaginings—expressed kinetically—structure performance" (p. 93).

Visualizing the route has also an intersubjective aspect to it. In discovering the route, climbers look at the wall together and discuss it with each other. This even takes place at climbing championships, during which collective observation period is allowed. Climbers simulate the progression on the wall in overt bodily configuration. Planning behavior that this activity forms is thereby "not an isolated, subjective, and individual activity: it is a social and shared chain of anticipatory actions" (Sanchez-Garcia et al. 2019, p. 519), which results in "a kind of dynamic bodily configuration, a sort of synchronized dance, a shared choreography of steps, which are jointly performed and practically displayed" (*ibid.*, p. 520). In short, the socially-observable sequence of public marking suggests that the visualizing is an act performed not individually in the head, but one that is overtly performed, sometimes achieved together.³⁰

The visualizing involved in the planning of the climb need not be explicitly embodied in marking or joint activity. Visualizing can be embodied and enacted even without explicit action (Gallagher and Rucińska, 2021). Consider the case of the famous free soloist Alex Honnold, who before his first solo climb of Moonlight Buttress's sandstone wall spent the prior two days "sitting and thinking, hour after hour. Visualizing every single move, everything that could possibly happen (...), every handhold and foothold on the long way to the top of the wall" (Ilundáin-Agurruza 2017, p. 100). Ilundáin-Agurruza stresses the fact that even such detached visualizations are preceded by generative corporeal imaginings. As he explains,

Even in Honnold's exhaustive visualization, generative [corporeal] imaginings precede representational [eidetic] imaginings, whether these be fanciful dreams or goals of veridical imagined possibilities. (...) [One reason is that] such

²⁹ "Vitality, [corporeal imaginings] *generate* and do not merely replicate: they expand performers' personal kinetic repertoires (PKRs)—patternings of 'owned' movements commensurate in depth and breadth with skills. In fact, this generative facet is what inspires and precedes [eidetic imaginings]. In these ways, [corporeal imaginings] are more fundamental than [eidetic imaginings] or conventional views of the imagination" (*ibid.*, p. 97).

³⁰ Stukenbrock (2017) has also captured this phenomenon with the concept *intercorporeal imagining* in self-defence training, where the participants were observed to kinesthetically align with jointly imagined bodies.

exacting visualizations are not merely pictorial. Surely, they are visually complex, but more importantly, they are densely textured in a cross-modal way: kinetic, tactile, kinesthetic, nociceptive, even olfactory and gustatory dynamics are pertinent. These are acquired and felt in the midst of performance" (p. 101).

From the EECS perspective, such visualizing without overt action is also a kind of a *doing*, integrated with perception and action in an ongoing dynamical pattern (Gallagher 2017). Like exploration, visualization can be motoric, haptic, and involving kinesthetic processes (see Gallagher and Rucińska, 2021). This resonates with mental imagery as reconceived through phenomenological account, which is an activity not done in the head, but a construction defined by the movements of the body that can also inform perception (Gallagher 2019).³¹

That the imagining involved in planning of the rock climbing is of the corporeal, not eidetic kind, becomes clear when we consider the alternative. Eidetic imaginings are achievable without being tied to the actual possibilities for action in the environment. This means that unconstrained by true beliefs about the environment, perceptual simulation of the environment or a desire to "get things right", almost any imagining could take place (Kind 2018, see also Rucińska and Gallagher, under review). They could lead to wishful imaginings, such as imagining that a grip has graspable affordances it does not, that one can hold onto a flat surface when they cannot, or even that one possesses bodily qualities they do not (one of Spiderman, for instance). None of these imaginings are useful for the climbers to achieve their goals, which is to complete the route in an optimal way, without losing energy, and of course, without falling down. Corporeal imaginings, tied closely to the environment and body schemas, secure the visualizations of the climber as un-detached from the dynamic coupling of the climber with his/her environment, without involving additional cognitive processes like believing, desiring or simulating. Since the visualized route is constrained by what the climber sees and how the climber has been affected by his/her past bodily engagements on various rock walls, corporeal imaginings explain in the most straightforward way how accurate, non-wishful planning activity can be achieved in rock climbing.

The question that follows from this analysis is whether enactive imaginings underlying planning of the movement before the climb have the same (or different) effect on the motor behavior of the climber during the execution of the climb, as enactive imaginings gained with

³¹ This is also consistent with Ryle's take to imagination as an act that does not involve an "inner" process that occurs in the head that must be prior to the imaginative act like pretend play. See Ryle (1949), chapter 8.

movement, in the re-planning of the climb done in the physical interaction with the wall.³² This question can be properly answered once we better understand the enactive view of mental imagery and how it affects physical behavior – see Gallagher and Rucińska (2021).³³

7 Conclusion

What is the climber doing when he/she is planning to climb the rock? This paper has proposed that instead of conceptualizing planning in rock climbing as a skill of reflective thinking taking place in detachment from the environment, planning done prior to and during the performance should be seen as part of the ongoing mindful activity of the climber. We need not invoke a special cognitive architecture with Type 2 processes to explain ongoing planning. Instead, we can understand planning as an enactive capacity to act on nested affordances and utilize corporeal imaginings. Both *nested affordances* and *corporeal imaginings* are concepts that can be understood without referring to mental representations, and so, need not to be placed as part of representational cognitive architectures.³⁴

Introducing enactive planning based on affordances and corporeal imaginings serves as a conceptual proof of an EECS-inspired account of rock climbing, but it also has a practical impact. It can make new hypotheses about the differences between expert and novice climbers. Affordance-based descriptions of rock climbing suggest that experts are better than novices in finding nested affordances (e.g., cracks affording jamming a foot in), and are overall better at making use of the resources of the environment. We can further hypothesize that experts will see the wall less as "constraining" and more as "full of nested possibilities" for action (Seifert et al. 2018), which will affect their planning of the route. The expert climber does not just

³² A version of this question has been posited by Boschker et al. (2002b), where the authors look at differences between the effects of real actions and imagined actions, or actions involving movement execution vs. movement imagery (described as imagining action possibilities), on subsequent motor behaviors. These authors hypothesized that participants engaging in movement imagery that lacked access to action-evoked information experienced modulated preferences for action (p. 789). Thanks to the anonymous reviewer for highlighting this point.

³³ One potential answer might focus on the fact that enactive take to mental imagery shows that mental imaginings, even those taking place without explicit action, are rooted in motor processes and activate neural substrates of movement, which can make them relevant to improving explicit motor performances in climbing.

³⁴ To count as mental representations, affordances and corporeal imaginings would have to have contents that satisfy truth, correctness or accuracy conditions of satisfaction. Neither affordances nor corporeal imaginings fulfil these criteria. Affordances do not specify correct ways of engaging with the environment. One cannot go wrong in acting on affordances, one just acts on various affordances. Similarly, corporeal imagining grounded in an ongoing bodily activity does sufficiently count as a form of contentless sensory imagining. They are "enactive and non-representational in the sense that, whether propositionally or even formally, there are no conditions of truth, functionality or veridicality that need obtain" (Ilundáin-Agurruza 2017, pp. 93-94).

interpret the meanings of holds, but sees what he/she can do with regard to a hold, or what the affordance of the hold is for him/her specifically. Corporeal imaginings also affect which nested affordances are relevant in the field of expert's affordances, thereby aiding in route-reading and overall planning. For example, experts can start seeing the potential of performing an embodied move on different parts of the rock, ultimately being better at shaping their action space.

Enactive planning can take place both during, but also before the climb. To recap, the classic rational approach to skillful action proposes that the planning in climbing is a fundamentally different activity from any process taking place during the ascending of the rock wall, which counts as the execution of the plan. The cognitive and imaginative decision-making processes involved before touching the wall are seen as different from the perceptual processes that take over during the execution. But what grounds do we have to think that the planning activity done before the ascent is different from the one done during the ascent? Why is it *imagining* before the climber's leg touches the foothold, and *perceiving* the moment the climber has touched the foothold? The difference supposedly lies in the fact that touching provides sensory stimulation, which provides sensorimotor information, whereas not touching does not, and so, absent information must be produced that "stands in for" the perceptual information. This "before and after" picture of climbing signifying two processes is a dichotomy that was challenged in this paper. The paper has allowed to look at two different times in which planning occurs: before the climb, and during the climb, and has acknowledged that one of those activities is more connected to movement than the other (see footnote 24). However, this does not mean that there are two distinct cognitive activities involved, or that one of those activities is not truly enactive. It simply means that enactive planning dynamically integrates different timescales: the time taken to plan the route right before the climb, and the time taken during that same climb (and potentially the time taken right after the climb).³⁵ This proposal is consistent with the enactivist proposal that cognitive processes occur on several timescales (Gallagher 2018), and is compatible with other enactivist theories that have proposed to incorporate different timescales in the explanatory analysis of phenomena, such as in the

³⁵ "Planning right after the climb" refers to the idea that climbers sometimes also engage in route-*post*-viewing (thanks to the anonymous reviewer for this point). It could be seen as meaningful part of the climbing activity when it is followed directly after the completing of the climb and is still part of the same event or competition. However, as not all post-viewing activities are done with the intention of re-planning the climb in the future (some post-viewing is done simply for the sake of contemplation or analysis of the accomplished climb in detachment of the activity), they need not always be seen as meaningful aspects of the climbing activity. Drawing a sharp distinction between when the climbing process begins and ends is needed to specify if post-viewing activities can be meaningfully counted as enactive planning activities.

analysis of intelligent action and motor control (Gallagher 2017) or situated imagination (van Dijk and Rietveld 2020).

Following up with the ecological notion of information at play, we can make sense of the idea that climbers are already picking up relevant information and acting on affordances even before the ascent (seeing nested affordances of the wall, visualizing completing the route through marking, etc.). Hence, we have reasons to believe that seeing the affordances of the rock wall immediately *prior to* climbing it (during route-reading), and seeing the affordances of the rock wall *during* the mid-climb, are the same kinds of affordance-based activities. In the first case, perception of affordances is done on the ground; in the second, it is done on the wall. Although there is no material resistance in the first case, the process of perceiving possibilities for action is the same prior to and during the touching of the wall, even though it is possible that new affordances for interaction come forth thanks to the material engagement.

Consider a basketball analogy: practicing the free-throw with a ball vs. practicing the free-throw with a gesture. Does having a ball in the hand make it a different activity? Although new affordances are present with the materiality of the object, the practice based on gesturing is not an activity separate from the environment, detached from perceptual information, and done in some mental sphere. Gesturing is a kind of embodied thinking. As Gallagher (2017, p. 201) argues,

The hand not only facilitates perception and action; it transforms its movements into language (via gesture) and into thinking. (...) In this regard, however, there is no break, no discontinuity, no ‘stepping back’ that comes between this kind of movement (gesture) and spoken language—nor between manual thinking and thinking proper—they are part of the same system, the same Gestalt.

This gives us reasons to propose that the enactive planning can take place both during and before the skillful engagement.

To conclude, EECS approach to rock climbing does not recourse to special cognitive architectures. It sees planning as an ability to act on nested affordances and corporeal imaginings. Planning is a form of prospective act that involves perception of possibilities or action in a temporal scale, or acting on nested affordances. The difference between the planning activities taking place prior to the climb and those taking place during the climb is not categorical, but simply involves different timescales. When in front of the wall before the climb, route reading involves tracking of affordances by paying attention to the "graspability"

of the holds and visualizing how the environment should be interacted with. When on the wall, re-planning involves seeing new affordances unfold in action, which is not simply an improvised adaptation to the wall. One can also recalibrate and pay extra attention to the "usability" of the holds, or how useable they are for the climber in this very moment (considering the climber's bodily states like tiredness or pain in the hand). This shows that enactive planning, as Rylean heeding process, is one cognitive process just taking place in different timescales. This model broadens the boundaries of what counts as planning, and makes room for future research on planning that is also embodied, dynamic and non-representational.

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