




# Dreyfus is right: knowledge-that limits your skill

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Received: 5 July 2021 / Accepted: 29 June 2023 / Published online: 31 August 2023

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## Abstract

Skilful expertise is grounded in practical, performative knowledge-how, not in detached, spectatorial knowledge-that, and knowledge-how is embodied by habitual dispositions, not representation of facts and rules. Consequently, as action control is a key requirement for the intelligent selection, initiation, and regulation of skilful performance, *habitual* action control, i.e. the kind of action control based on habitual dispositions, is the true hallmark of skill and the only veridical criterion to evaluate expertise. Not only does this imply that knowledge-that does not make your actions more skilful, but it also implies that it makes them less skilful. This thesis, that I call Radical Habitualism, finds a precursor in Hubert Dreyfus. His approach is considered extreme by most philosophers of skill & expertise: an agent –says Dreyfus– *does not perform like an expert* when they lack the embodied dispositions necessary to control their action habitually or when they stop relying on such dispositions to control their actions. Thus, one cannot perform skilfully if their actions are guided by representations (isomorphic schemas, explicit rules, and contentful instructions), as the know-that that they convey disrupts or diminishes the agent’s habitual engagement with the task at hand. In defence of Radical Habitualism, I will argue that only the contentless know-how embedded in habitual dispositions fulfils (i) the genetic, (ii) the normative, and (iii) the epistemic requirements of skilful performance. I will examine the phenomenological premises supporting Dreyfus’ approach, clarify their significance for a satisfactory normative and explanatory account of skilful expertise,

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I am extremely thankful to the handling editors and three anonymous reviewers for their patient reading and detailed comments and to Wayne Christensen, Shaun Gallagher, Dan Hutto, Jesús Ilundáin-Agurruza, John Sutton for some conversations that inspired this project. The earlier versions of this paper have benefitted from the helpful feedback received from the investigators of the Minds in Skilled Performance ARC-funded research project, the participants of two conferences held on 15–16 February 2022 and 12–13 December 2022 at the University of Wollongong as part of that project, and the attendees of the webinar organized by Edoardo Fugali at University of Messina (26 January 2023). I am grateful to Shaun Gallagher for the Norwegian conference’s anecdote and his precious help with the references.

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and rebut the most common objections raised by both intellectualists and conciliatory habitualists, concerning hybrid actions guided by a mix of habitual and representational forms of control. In revisiting Dreyfus anti-representationalist approach, I will particularly focus on its epistemological implications, de-emphasizing other considerations related to conscious awareness.

**Keywords** Skilful expertise · Habitual disposition · Intellectualism about know-how · Radical habitualism · Enactive and embodied cognition

[...] Rules are like training wheels. We may need such aids when learning to ride a bicycle. But we must eventually set them aside if we are to become skilled cyclists. To assume that the rules we once consciously followed become unconscious is like assuming that, when we finally learn to ride a bike, the training wheels that were required for us to be able to ride in the first place must have become invisible.

Hubert Dreyfus, *Overcoming the Myth of the Mental*, 2005

To see victory only when it is within the ken of the common herd is not the acme of military expertise. Neither is it the acme of military expertise if you fight and conquer and the whole world congratulates with you [...]. What the ancients called a skilful warrior is one who not only wins but excels in winning without effort.

Sun Tzu, *The Art of War*, Chapter 4

## 1 Introduction

### 1.1 A challenging legacy

In this paper, I will defend “Radical Habitualism”, a rather strong anti-intellectualist thesis: skilful expertise is grounded in practical, performative knowledge-how, not in detached, spectatorial knowledge-that, and knowledge-how is embodied by habitual dispositions, not contentful representation of facts and rules. Consequently, as action control is a key requirement for the intelligent selection, initiation, and regulation of skilful performance, *habitual* action control, i.e. the kind of action control based on habitual dispositions, is the true hallmark of skill and the only veridical criterion to evaluate expertise. Not only does this imply that contentful (e.g., propositional) knowledge does not make your actions more skilful, but it also implies that it makes them less skilful. In defence of this thesis, I will argue that only the contentless know-how embedded in habitual dispositions fulfils (i) the genetic, (ii) the normative, and (iii) the epistemic requirements of skilful performance.

Defending Radical Habitualism means clarifying and expanding some views attributed to Hubert L. Dreyfus (1929–2017), who can be considered its precursor and inspirator. The legacy that he and his key co-author (and brother) Stuart E. Dreyfus (1931–) have left to the field of philosophy of skill & expertise is as influential as it is divisive (Wrathall, 2014). Revisiting this legacy today –after amending it from certain inadequacies recurrently underscored by the philosophical literature– is paramount, inter alia, to better appreciate the theoretical solutions that it has prefigured, like those proficuously advanced during the last decade by *enactivists* (Varela et al., 1991; Di

Paolo, Buhrmann & Barandiaran, 2017; Gallagher, 2017; Hutto & Myin, 2013, 2017; Hutto & Satne, 2015; Noë, 2005; Thompson, 2014), *neo-pragmatists* (Gallagher, 2014; Caruana & Testa, 2020; Heras-Escribano, 2021; Miyahara, Ransom & Gallagher 2020; Miyahara & Robertson, 2021; Legg & Reynolds, 2022; Paolucci, 2021), and *affordance theorists* (Araújo et al., 2006; Bruineberg et al., 2019; Magri, 2019; Rietveld & Kiverstein, 2014; Rucińska, 2021).

Dreyfus (2002a, 2002b) vigorously argued that skilful expertise, the ability to perform competently in a specialised domain of practical activity (like sport tasks, trade jobs, and arts & crafts) relies on the immediate responses produced by embodied habitual dispositions (i.e., “pre-reflective” knowledge-how, or “know-how”), not the detached appreciation of facts and explicit rules (reflective knowledge-that, or “know-that”). Unsurprisingly, his approach attracted the criticisms of the philosophical views committed to the cognitivist idea that the control of skilful actions involves the manipulation of *semantic content* (typically construed as propositional and/or conceptual –albeit “practical” in nature and “motoric” in format– representation, e.g. Brozzo, 2017; Ferretti & Zipoli Caiani, 2021; Springle & Humphreys, 2021). These views notably include: *instructionist theories of action*, which claim that skilful performance is mediated by stored representations of action, such as conceptual and rule-based models (Fodor 1968, ; McDowell, 1981, 2007); *intellectualism about skill*, which emphasizes the role of reflective cognitive processes (such as attentive self-monitoring and explicit inference) in expert control (Fridland, 2013, 2014; Montero, 2010; Toner et al., 2014, 2015); and *intellectualism about know-how* (Pavese, 2019; Stanley, 2011; Stanley & Krakauer, 2013; Stanley & Williamson, 2017), which argues that all practical competences (know-how) are ultimately reducible to propositional knowledge (know-that).<sup>1</sup>

Perhaps more surprisingly, Dreyfus’ approach is regularly antagonized by several theorists of embodiment, who –despite their post-cognitivist and non-intellectualist posture– have distanced themselves from Dreyfus’ habitualism (Sutton, 2007; Sutton et al., 2011; Gallagher, 2016, 2018; Cappuccio & Wheeler, 2010a, 2010b; Cappuccio, Miyahara & Ilundáin-Agurruza 2020). Why is it the case that Dreyfus’ perspective appears alarmingly radical not only to his most obvious opponents but also to his nominal allies? Neither did Dreyfus simply claim that *action automatization* is one of the distinctive marks of skilful performance and a prerogative of expert agents (Dreyfus & Dreyfus, 1980, 1988); nor that experts perform better when their movements are automatized, in comparison to when movements are chosen deliberately and executed

<sup>1</sup> The position normally referred as “intellectualism about know-how” famously dates back to Ryle (1949/2009), while the notion of “intellectualism [about] sporting skills” was first introduced by Papineau (2015) to map the opposition of “habitualists” and “intellectualists” in philosophy of skill & expertise: “on the habitualist side are Dreyfus (2005, 2007a, b), Beilock (2007, 2010) and (Beilock and Carr 2001, 2004; Beilock et al., 2002a, 2002b); intellectualism is defended in various ways by McDowell (2007), Stanley (2011), Sutton (2007), Sutton et al. (2011), Montero (2010) and Fridland (2013)” (Papineau 2015, p. 295). I find it useful to distinguish between these two philosophical varieties of intellectualism because some authors (e.g., Ellen Fridland) defend arguments in favour of the latter but refrain from endorsing the former, while other authors (e.g., Jason Stanley) wholeheartedly advocate the former without explicitly committing to the latter. Note that, unlike me, some authors, for example Springle and Humphreys (2021) and Robertson & Hutto (forthcoming), use “intellectualism about skills” simply to indicate the specific application of “intellectualism about know-how” to the domain of skill & expertise.

reflectively, in accord with explicit judgement (Dreyfus, 2002b). In fact, these two claims seem at least reasonable, if not uncontroversial, to performance scientists: most kinesiologists agree that a skill develops when the automatization of motor behaviours ensues (Fitts & Posner, 1967); and several performance psychologists maintain that self-focused and/or declarative processes can be detrimental to optimal skilful performances (Baumeister, 1984; Beilock & Carr, 2001; Masters, 1992; Wulf et al., 2002).

Dreyfus' signature view on skill and expertise is more demanding and inflammatory: an agent *cannot act like an expert* (thus, their performance *is not truly skilful*) when they lack the embodied dispositions necessary to control action habitually (e.g., due to insufficient practice), when they don't rely on such dispositions to control their actions (e.g., when reflective thoughts conveyed by instructions and rules impose self-attention, interfering with habitual control), or when the dispositions they must rely on are temporarily disrupted or inaccessible (e.g., due to anxiety undermining the agent's confidence in their own habits).

## 1.2 A remarkable anecdote

This view is illustrated by an anecdote that sees Dreyfus arguing, at a conference,<sup>2</sup> that downhill skiers are pre-reflectively absorbed in their performance when they skilfully negotiate a ski track during a competition (Gallagher, 2007, 2009, 2016). When faced with the evidence that professional skiers obviously *can*, typically *do* and, moreover, often *must* carefully scrutinize and deliberately adjust their posture, predict the condition of the snow, and make on-the-fly strategic decisions to maximize their skying effectiveness, Dreyfus imperturbably answered that, as soon as a skier starts to explicitly monitor the details of the situation or modify their own behaviour in accord with verbal instructions and maxims, they stop performing *as experts*, in that their reflective stance interrupts their pre-reflective absorption into the task at hand. Most authors vehemently disagree with this conclusion (Breivik, 2007; Fridland, 2014; Gallagher, 2016, 2017; Gottlieb, 2015; Montero, 2010, 2016; Sutton et al., 2011, to mention but a few).

I shall contend that Dreyfus had excellent reasons to reach this conclusion, which becomes compelling once his motives are elucidated. I have elsewhere argued that Dreyfus' approach suffers from the tendency (that, in fairness, he shares with some of his philosophical adversaries) to conflate too many and too general conceptual dichotomies: mindful/mindless, conscious/automatic, embodied/cognitive, etc. (Capuccio, 2017). Once this terminological inadequacy is addressed and overcome, we realize that the kernel of Dreyfus' controversial statement on expertise resonates with the habitualist perspective on skill that enactivism, neo-pragmatism, and affordance theory have been recently advocating and that Dreyfus' phenomenology contributed to inspire. Conversely, as I shall argue in this paper, a correct appreciation of Dreyfus' thesis urges these embodied approaches to coherently accept the most far-reaching

<sup>2</sup> The conference is "Phenomenological approaches to Moral Philosophy and Education" hosted by the Norwegian School of Sports Sciences, University of Oslo, on 6–8 June 2006 (Shaun Gallagher, personal communication).

ramifications of their own habitualist wager, finally embracing the markedly anti-intellectualist approach to skill & expertise that I call “Radical Habitualism”. My inquiry primarily aims to provide a sound and viable formulation of such an approach, not an apologia of Dreyfus, which is why I will emphasize the spirit more than the letter of his work, prioritizing hermeneutical efficacy over philological rigor.

My point is articulated through the six sections and fifty subsections that follow this Introduction. Section 2 analytically presents Radical Habitualism, illustrating its distinctive theses (Sect. 2.1), its characteristic assumptions about performance (Sect. 2.2) and control (Sect. 2.3), and the three pillars that sustain its theoretical foundation (Sect. 2.4). Section 3 presents three arguments supporting Dreyfus’ view: the first argument builds on the structure of skill development (Sect. 3.1); the second on the phenomenology of background pre-comprehension and pre-reflective control (Sect. 3.2); the third on the epistemic qualities of expert know-how (Sect. 3.3). Sect. 4 clarifies Dreyfus’ view about hybrid scenarios, i.e. performances involving a mix of automatized and reflective control, and identifies three contentious hybrid cases that are erroneously believed to disprove Radical Habitualism (Sect. 4.1). To dispel this common misunderstanding, I prove that Radical Habitualism can perfectly account for such cases because it relies on a robust “Skill-No-Skill” approach to hybrid scenarios, which represents a preferable alternative to the “Knowledge-No-Knowledge” approach typically endorsed by intellectualists (Sect. 4.2). Section 5 examines three objections that challenge the Skill-No-Skill approach: the “Scope” objection focusses on the apparent disembodiment of intellectual activities (Sect. 5.2); the “Efficacy” objection on the competitive advantages allegedly offered by contentful knowledge (Sect. 5.3); and the “Modality” objection on certain content-manipulating practices that seem linked to skilful execution (Sect. 5.4). I rebut them systematically: against the first objection, I argue that all forms of expertise originate from a constitutive agent-environment interactive coupling; against the second objection, I develop a three-step strategy to demonstrate, in the first place, that contentful knowledge is only rarely beneficial to performance (Sect. 5.3.1), in the second place, that contentful representation is causally impotent and contextually irrelevant when it comes to benefitting performance (Sect. 5.3.2) and, in the third place, that performance outcomes are not sufficient evidence of expertise (Sect. 5.3.3); against the third objection, I argue that verbal reporting (Sect. 5.4.1), creative improvisation (Sect. 5.4.2), and strategic decision (Sect. 5.4.3) can effectively contribute to skilful execution only in the form of contentless habits. Section 6 illustrates these points with the example of barbecue skills and meat thermometers. The conclusive (Sect. 7) briefly summarizes how Radical Habitualism unveils aspects of skilful performance to which other theories are largely blind.

## 2 Defining Radical Habitualism

### 2.1 A controversial thesis

Dreyfus’ Controversial Thesis [DCT] states (more or less).

DCT: The more a performance is controlled reflectively the less it is skilful, and vice versa.

To clarify the meaning of DCT we will assume that “performing like an expert” is synonymous of “performing skilfully”. From Dreyfus’ perspective, what distinguishes pre-reflective and reflective control is that the former is grounded in *embodied habitual dispositions* (thus incorporates know-how) while the latter is grounded in *contentful knowledge* of facts and rules (thus conveys know-that), the former being irreducible to the latter. The latter includes the rules of thumb, explicit verbal instructions as well as the non-verbal representations (such as tactical schemas and diagrams, step-by-step protocols and standardised recipes for action) that novices (such as junior athletes) are often asked to rehearse for acquiring their basic abilities, or for maximizing the outcomes of their performance, or for ensuring that the form of their execution complies with some conventional standards (including the sport discipline’s distinctive praxical and ethical norms, see Sánchez García, Cappuccio, and Ilundáin-Agurruza, forthcoming). Conversely, performers increasingly rely on their embodied habitual dispositions as they progress in the acquisition of skill and expertise. Dewey (1983, p. 32) famously stated that habits “predispose” the performer to intelligently perceive, interpret, decide, and act in familiar (but not stereotyped) “ways or modes” when facing familiar situations or tasks. Additionally, habits make the performer ready to cope with unfamiliar scenarios, equipping them with a “special sensitiveness or accessibility to certain classes of stimuli, standing predilections and aversions” (*ibidem*).

That said, to capture the specificity of Dreyfus’ position, we still need to differentiate Radical Habitualism from the generic habitualist view on skilful performance (Cappuccio, Miyahara, K., Ilundáin-Agurruza, J. 2020). All habitualist views, including DCT, share the same Baseline Habitualist Assumption [BHA].

BHA: embodied habitual dispositions are a necessary component of expertise and action control is skilful only if embodied habitual dispositions contribute to it.

BHA specifies that habit is a necessary non-sufficient condition for skilful control. However, BHA may or may not be accompanied by the following Disjunctive Clause [DisC].

DisC: the more the control of an action (or action component) is grounded in embodied habitual dispositions the less it is grounded in contentful knowledge, and vice versa.

BHA motivates two different strands of habitualism, distinguishable by whether or not they endorse DisC.

Conciliatory Habitualism ( $BHA \wedge \neg DisC$ ): embodied habitual dispositions are a *necessary constituent*, but not necessarily the main or the sole one, of skilful expertise. Both embodied habitual dispositions and contentful knowledge can positively contribute to skilful control.

Radical Habitualism ( $BHA \wedge DisC$ ): embodied habitual dispositions necessarily are the sole constituent of skilful expertise. While embodied habitual dispositions can positively contribute to skilful control, contentful knowledge cannot.

Conciliatory Habitualism is utterly popular nowadays for its ecumenic aspiration to integrate representational (contentful) and habitualist (embodied) explanations. Versions of it are endorsed by many supporters of the embodied/enactive cognition theory and some amongst the most liberal intellectualists. Regrettably, this position is vitiated by cognitivist and rationalist premises no less than the more intransigent intellectualist position from which it ineffectively tries to distance itself (Cappuccio, Miyahara & Ilundáin-Agurruza 2020).

Unlike Conciliatory Habitualism, Radical Habitualism rigorously captures the notion that a skill is an embodied ability formed through practice and based on know-how (i.e., *how* to obtain X in a Y way), not erudition formed through detached understanding and based on know-that (i.e., *that* Y is a way to obtain X). Some performances may involve elements of contemplative and non-situated knowledge about the relevant actions and their execution but acting skilfully in real life is more of an art than a science: like a performing art, skilful expertise is the ability to execute a *performance* endowed with certain positive qualities.

## 2.2 Defining skilful performance

A performance is a particular kind of *pragmatic action*, that is an instance of *purposive* (Butterfill & Sinigaglia, 2014; Kruglanski & Szumowska, 2020), *agentive* (Brownstein, 2014a, 2014b; Swann, 2016), and *intentional* (Fusche Moe, 2016; Cappuccio, Miyahara & Ilundáin-Agurruza 2020) engagement that (unlike, for example, epistemic actions) aims to fulfill concrete, tangible expectations by bringing about valuable outcomes (e.g., complete a task, produce some transformative effects, solicit certain reactions in the bystanders, or preserve an existing condition). Both *performances* and *instrumental actions* are subtypes of pragmatic actions. Crucially, skill pertains to the former, not the latter. That is because the value of instrumental actions prototypically consists in bringing about a desired outcome regardless of the means employed to do it. For example, compiling forms: both handwriting and typewriting can be skilful activities in their own respect, but form compilation, whether done using handwriting or typewriting, is an instrumental action, not a skilful performance, precisely because the details of the writing practice adopted by the compiler are entirely irrelevant to the goal of form filling.

Conversely, the fine-grained details of execution (including its sensorimotor and morphological contingencies) are constitutive of performances and contribute to determine their value (Beilock, 2015; Gray, 2014, 2021). Whether on the sport field, on the stage, or in the workplace, a performance is neither merely instrumental nor value-neutral because its execution can and must be evaluated qualitatively or quantitatively in comparison to executions of the same kind. All performances are not equally skilful and, in some competitive domains, such as agonistic sport, stringently regulated measuring practices are specifically adopted to normalise their comparison. Assuming sufficiently similar background conditions, our comparative assessment of the value of a performance is based on two aspects:

- (1) *the outcome* X resulting from the form Y of performance execution (e.g., a theatrical role interpreted by an actor, a handmade vase, a perfectly done steak);



- (2) *the form of execution* Y aiming at the production of performance outcome X (e.g., acting with a particular theatrical method, modelling the vase with a certain crafting technique, grilling a steak using a particular piece of equipment or procedure).

In most cases, outcome and form of execution are entirely distinguishable (e.g., the fact that a football team scored a certain number of goals during a match versus the quality of the actions performed to score those goals). In some cases (dance is a paramount example), the outcome produced by the performance coincides with the behaviours executed to produce it, hence the performance's desired outcome is entirely exhausted by the *execution of a distinctive form of behaviour* (often, the expected outcome is nothing else than a certain measurable quality of the execution, e.g. the time necessary to run a certain distance, the height of a jump, etc.).

Either way, the modality or *form* of execution, more than its outcome considered in isolation, reveals the kind of knowledge (how/that) and the modality of control (habitual/reflective) that underpin a performance (Foerster et al., 2015). Thus, that an agent "does not perform like an expert", in Dreyfus' sense, means –primarily or essentially– that their performance is *not executed in a habitual modality* and –only secondarily or incidentally– that their performance *did not produce the outcomes normally expected from an expert*.

### 2.3 The qualities of habitual control

To distinguish between more and less skilful ways of performing the same action we need to look at how the execution of that action is controlled by the agent. As emphasized by the recent philosophical literature, *control* is a quintessential feature of skilful execution. Default abilities (including innate talents and knacks) are profitably exploited by skilled performers and acting skilfully means, among other things, making the most of such abilities, but no ability without control could be considered evidence of skilful expertise (Bermúdez, 2017; Carr, 1979; Beilock & Carr, 2004; Christensen & Bicknell, 2022; Fridland, 2017; Toner Montero & Moran 2014). Perfectly controlled performances display well-coordinated, purposeful configurations of movements initiated and executed with consistency, timeliness, sensitivity, and responsiveness to all the environmental solicitations that are relevant to the agent's purpose (Fridland, 2020; Mylopoulos & Pacherie, 2021).

We immediately recognize finely controlled performances because they are executed in a confident, spontaneous, richly flexible, and intelligently adaptive manner. Control is not simply the agent's power to reliably produce certain outcomes: expert performance is also characterised by certain qualities of the execution (such as accuracy, precision, velocity, efficacy, and parsimony), which are neither secondary nor merely instrumental to produce the desired outcomes but constitutive of the performative process (Fridland, 2014, 2017; Toner et al., 2014).

While everybody acknowledges the importance of control, its nature is disputed (Cappuccio & Ilundáin-Agurrúza, 2020): intellectualist and cognitivist philosophers see habit as competing with control (Fridland, 2014; Wu, 2013) or consider these two



concepts orthogonal (Toner, Montero & Moran 2021; Toner & Moran, 2021)<sup>3</sup>; on the contrary, neo-pragmatists, enactivists and dynamicists recognize that *control can be habitual* because the degree and the extension of action automatization are measures of how the agent is familiar to their complex world-environment (Cappuccio & Ilundáin-Agurruza, 2020).

This kind of performative familiarity consolidates through recurrent interactions, like those based on deliberate practice, targeted exercise, and (to a lesser extent) direct observation (Araújo & Davids, 2011; Egbert & Barandiaran, 2014; Freeman, 2000). A history of rich and varied (and, for some activities, also lengthy and repeated) interactions produce a dynamical coupling between the agent and the context of their habitual activities, establishing a continuing relation of diachronic co-constitution (Kirchhoff & Kiverstein, 2020) and reciprocal co-belonging (Barandiaran, 2017) that can be characterized in terms of “metastable attunement” to multiple concurrent systems of nested affordances (Bruineberg et al., 2021). This coupling, or attunement, combined with a reward system and appropriate hedonic stimulations, solicits the formation of articulated patterns of purpose and motivated interest that bring the agent to develop fundamental capabilities like cross-context saliency detection, engaged attention, circumscriptive interpretation, and projective anticipation (Di Paolo & Iizuka, 2008; Di Paolo, Buhrmann & Barandiaran, 2017), which are constitutive of skilful control.

Ultimately, action automatization coincides with the formation of a robust agent-environment coupling that derives from the history of their adaptive interactions. Carr (2015) gestures at an analogous form of coupling when referring to “action-situation combinations” that reflect the sensitivity to contextual conditions acquired by an expert through automatization (the notion of coupling is further explored in Section 3.2.3 and 3.3.2; the notion of automatization in Section 3.1.1, 3.1.2, 3.1.3). This account captures at once the dispositional and the relational/interactive character of skills, as auspicated by Chemero (2009) and Magrì (2019). The agent-environment coupling embodied by the agent’s habitual dispositions is both constitutive and irreplaceable for controlling a well-executed performance: control is skilful to the extent it reflects the rich executive know-how acquired through practice, exercise, and direct observation. The best way to construe this know-how is not as a power, entitlement, or function but as *the qualitative profile of the performance’s mode of execution*, which in turn reflects the holistic form of the performer’s attunement to the performance’s environment (Dreyfus, 1996, 2000, 2002a). By explicating the theoretical pillars of Radical Habitualism, I will progressively explain why such an attunement must necessarily be based on habit and

<sup>3</sup> Fridland (2014, p. 2732) argues that Dreyfus lacks “an adequate account of control” and that automatization replaces control with a “passive, mechanistic” process that is incompatible with intelligence and person-level intention. My impression is that this kind of objection to Dreyfus overlooks how, far from being merely reactive, automatized actions predictively anticipate the ever-evolving context of action (Araújo et al., 2006; Hipólito et al., 2021; Robertson & Kirchhoff 2020): automatized control is, in fact, exactly the contrary of a blindly mechanical form of control because it responds adaptively to complex circumstances (Cappuccio Miyahara & Ilundain Agurruza, 2020). The idea that automatized action is blind and mechanical seems originating from the common misconception (of which falls victim, among others, Fridland 2014, p. 2720, note 1) that sees intentionality as necessarily contentful and reflective, ignoring that motor intentionality (while pre-reflective and contentless in nature) has distinctively agential and personal features (that I summarize in Sect. 3.1 and Sect. 3.2.3). I agree with Christensen that a more “sophisticated” appreciation of automaticity can be found in Fridland (2017), where it is argued that “automatic processes show complex sensitivities to cognitive states.”

thus why (in accord with DisC) only the mode of execution based on habitual control is truly skilful.

## 2.4 Radical Habitualism's three pillars

This analysis should suffice to a preliminary clarification of DCT. However, to characterise Dreyfus' view on skill as Radical Habitualism we need to recognize the Three Pillars that underpins his approach. The Three Pillars are introduced in the following sub-sections (Sect. 2.4.1, 2.4.2, 2.4.3) and will be further unpacked throughout the rest of the paper, also via the discussion of their most common objections (Sect. 5).

### 2.4.1 The first pillar of Radical Habitualism: skill and habit are underpinned by the same control system because they share a communal genesis and develop together

The terms “skill” and “habit” have different connotations, but both denote dispositional complexes formed through a rich history of direct experiential engagement (Moya, 2014), which is why Dreyfus (1996, 2014) calls “skilful coping” or “absorbed coping” the modality of expert engagement characterised by habitual control. Of course, not all habitual behaviours are skilful or intelligent: some of them are fixed, compulsive responses resulting from conditioning<sup>4</sup>; yet all skills originate from the acquisition of habitual control, because rich responsiveness to the context and prompt readiness to the circumstances require the kind of practical familiarity that can only be learned through the purposeful accumulation, consolidation, and refinement of direct performative experience.

Pace Pacherie & Mylopoulos (2021), training does not conceptually oppose skill to habit because, at bottom, *skills are just well-trained habits*. Habits are well-trained when they are cultivated *viapractice for a purpose*. The training of habits paradigmatically involves practices that may or may not be deliberately designed but that necessarily include, inter alia: *opportunistically diversified exercises* (aiming to expand one's repertoire of habits and avoid the plateau of skill described by Montero, 2016, p. 84); the careful observation and *imitation of models* (aiming to acquire the habits of more experienced performers); and even what may superficially look like *rote repetition* of standardized sets of movements.<sup>5</sup> The purpose of training does not have to be always entirely evident to the trainee (consider the Miyagi sensei-like training routines illustrated by the Karate Kid movies and examined in Cappuccio, Miyahara and Ilundáin-Agurruza 2020) but it normally aims to the deliberate improvement of action control, inter alia. This topic is further explored in Sect. 4.1.1 and 5.2.

<sup>4</sup> Ramírez-Vizcaya & Froese (2019) correctly point out that even negative habits traditionally considered merely compulsive, like addictions, are in fact governed by complex attractors that, while suboptimal, can nonetheless solicit highly creative and skilful (although not necessarily wise) behaviours (e.g., drug-seeking and drug-taking behaviours).

<sup>5</sup> In fact, from a dynamicist perspective, even prima facie repetitive sequences of identical actions are not a mechanical re-enactment of blindly stereotyped movements but rather the target of a continuous effort of adaptation and adjustment to an ever-evolving horizon of complex micro-sensorimotor contingencies (Button et al., 2020).

#### 2.4.2 The second pillar of Radical Habitualism: habitual control is grounded in pre-reflective intelligence

Dreyfus characterises skilful coping as embodied, dispositional and *pre-reflective* (or “absorbed”, see Dreyfus, 1996). According to Maurice Merleau-Ponty (1945/2012), pre-reflective intelligence does not necessarily prevent reflection but certainly constrains and demarcates it, as these two categories are in a background-foreground relationship: despite their reciprocity, the pre-reflective is more primordial than the reflective, because it operates before and below contentful cognition, as its transcendental precondition (Jackson, 2018; Moya, 2014; Reynolds, 2006). As such, the pre-reflective defines both the ontological boundary and the functional limit of the reflective (Dreyfus, 1996, 2000, 2008; Moe 2007; McManus, 2008; Wheeler, 2008). Dreyfus uses without apparent distinction two different characterisations of pre-reflective intelligence, in a way that is potentially ambiguous: first, as non-conscious, non-cognitive, non-agential, or even “mindless” (Eriksen, 2010; Zahavi, 2012); and, second, as non-representational, i.e. guided solely by the contentless solicitations produced by online experience.

The First Characterization of the pre-reflective is misleading insofar as it suggests that habitual control can be neither rational, self-aware, nor deliberate, while we know that –far from being blindly mechanical– habitual responses are *flexibly adaptive* (Davids et al., 2012; Di Paolo, Buhrmann, & Barandiaran, 2017), *predictive* (Christensen & Bicknell, 2019; Robertson & Kirchhoff 2020; Hipólito et al., 2021), and capable to *reliably detect and discriminate* subtle situational constraints or task-specific requirements (Hutto & Robertson, 2020; Miyahara & Robertson, 2021). These ecological features indicate that habitual dispositions can be *sensitive to context* as they are informed by *implicit reasons* (Kruglanski & Szumowska, 2020), *goals* (Martens, 2021), *preferences* (Beilock, 2008; Beilock & Holt, 2007) and *values* (Brownstein, 2014a, 2014b). Thus, I agree with other authors (Birch, Breivik & Fusche Moe 2019) that the First Characterisation tend to confound the correct appreciation of habitual control: on the one hand, characterising the pre-reflective stance of skilful performers as non-conscious ignores that competent habitual routines can be and often are initiated purposely, executed attentively, and integrated in broader decisional activities (Breivik, 2013; Brownstein, 2014a, 2014b; Gottlieb, 2015; Martens, 2021); on the other hand, reducing the scope of the pre-reflective to non-conscious movement fails to acknowledge that also patterns of strategic thinking and rational problem-solving, no less than overt muscular efforts, can be automatized, becoming cognitively effortless habitual activities (Van der Herik & Rietveld, 2021).

But Dreyfus is right about the Second Characterization: reflective control interferes with habitual control (Holt & Beilock, 2006; Jackson & Beilock, 2008) because (through the explicit representation of one’s own actions, or rules and instructional maxims, or objective facts) it evokes a self-focussed, analytic, and calculative stance. In perfectly familiar activities, habitual control does not involve representation because it is *immediately responsive, intuitive, non-analysable* and *non-vetoable* (Neemeh, 2022); also, it is selectively inattentive towards the details of execution (i.e., the attention sustaining skilful control is outcome-focused, as opposed to self or component-focused); finally, sense of agency, sense of volition, and sense of effort

happen to be specifically attenuated during episodes of flow performance, which are characterised by habitual control (Swann, 2016; Swann et al., 2016). However, as clarified in Cappuccio (2017), none of this implies that habitual control is “non-conscious” (no qualitative experience, no attentive awareness), “non-agential” (entirely devoid of sense of control, effort, commitment) or “mindless” (no cognitive elaboration, no decision).

For a correct appreciation of Radical Habitualism, it is imperative to sanitise the concept of “pre-reflective” (see Sect. 3.2.2). We must in fact urgently acknowledge that, during the last ten years at least, the disproportionate emphasis put by the critical literature on the First Characterization has regrettably derailed the philosophical debate on the role of habitual control, reducing it to an artificial, unproductive, and rather caricatural rivalry between “mindful” and “mindless” cognitions (Segundo-Ortin & Heras-Escribano, 2021), as if Dreyfus’ interest was really to ascertain whether performers act “consciously” or rather “as zombies”. The good news is that the First and the Second Characterization of the pre-reflective are entirely dissociable.

That is why, in this paper, I will methodologically ignore any portrayal of habitual control as *non-conscious*, *non-agential*, or *mindless* to focus on an aspect of Dreyfus’ phenomenology of skilful coping that I find much more important and interesting. What truly characterises the distinction between pre-reflective and reflective control is not the absence or presence of conscious awareness, attentive deliberation, or reasons to act, but *the agent’s reliance on contentful or rather contentless forms of intelligence, attention, and knowledge* (Hutto & Sánchez García, 2015; Hutto & Satne, 2015). My choice to selectively focus on the contentful-vs-contentless dichotomy (semiotic), definitively abandoning the conscious-vs-zombie dichotomy (metaphysical), is not arbitrary: first, as argued in Sect. 3.2.3, it best epitomises the Merleau-pontian account of motor intentionality that inspires Dreyfus (1996, 2000, 2002a, 2002b); second, as discussed in Sect. 5.3.1.2, it is well positioned to elucidate the complex connection between attentive self-monitoring and representational processes that Dreyfus examines phenomenologically with only scant references to the experimental literature (Dreyfus, 2005, 2007a, 2013); third, as illustrated in Sect. 5.3.2, it is the only dichotomy truly capable to challenge the representationalist dogma of cognitivism, indicating that an anti-representationalist alternative is both possible and necessary (Dreyfus & Dreyfus, 1999).<sup>6</sup>

### 2.4.3 The third pillar of Radical Habitualism: pre-reflective and reflective intelligence correlate to contentless know-how and contentful know-that, respectively

Assuming *ceteris paribus* conditions, pre-reflective control proves the expertise level of a performance, while reflective control is symptomatic of a lack of expertise. By

<sup>6</sup> Another important terminological remark is necessary: occasionally, Dreyfus asserts that skilful coping involves content of a non-conceptual, non-propositional kind (e.g., Dreyfus 2002a) and, in other occasions, that “there is no place in the phenomenon of fully absorbed coping for intentional content mediating between mind and world” (Dreyfus 2013, p. 28). The contradiction is only apparent: motor intentionality is semantically contentless in the sense that it involves neither logical values (Dreyfus 2007a) nor content/attitude distinction (Kelly 2002); if it has a “content”, it is only in the phenomenological sense of hyletic contingencies, i.e. inherently qualitative, unorganized experiential material (Dreyfus & Dreyfus 2014). I believe this explains the lexical discrepancy highlighted by Thompson (2018).

capturing the specificity of DisC, the Third Pillar neatly distinguishes Radical Habitualism from the conciliatory versions of habitualism. A performance is unskilled in proportion of how it is controlled reflectively, i.e. to the extent that it is produced in absence of relevant habits or through the mediation of contentful representations (verbal commands, plans, models, rules, etc.) that explicitly instruct the agent, telling them if, when, and how certain component movements are to be executed (Dreyfus & Dreyfus, 1999). Such a reflectively controlled action is not skilful even when the outcome of said performance is unanimously considered satisfactory or successful and even in the case that the representations informing the agent's reflective control never interfered with their habitual dispositions, because in both cases the mode of execution was unfamiliar, i.e. not based on direct practice, which remains the exclusive source of expertise. Thus, the Third Pillar does not exclude that successful performances could at times rely on representational processes, but it clarifies that the varieties of performances correctly indicated as "skilful" or "expert" are never controlled by contentful representations (Dreyfus, 2002b).

Importantly, this thesis collides with "Mesh" (Christensen et al., 2016; Christensen & Sutton 2019; Christensen et al., 2019a, 2019b; Christensen & Bicknell, 2022) and similar integrative approaches to skill (e.g. Gallagher & Varga, 2020; Gallagher et al., 2022), which consider beneficial to performance a perfectly harmonized blend of pre-reflective and reflective cognition; also, Dreyfus' anti-representationalism seems *prima facie* at odds with the neo-pragmatist approaches to enactive cognition that construe semiosis as a representational process grounded in interpretative habits (Baggio, 2021; Legg, 2021). Since the early days of enactivism (Varela, Thompson, Rosch 1991), Dreyfus strongly criticized all the emerging embodied approaches to cognition, alleging their unadmitted commitment to Cartesian premises (Dreyfus, 1993, 2008).

Today, this ancient antagonism appears less interesting than the fact that Radical Habitualism shares a generic, yet very important, habitualist assumption (BHA) with enactivism and other varieties of the "4E approach" to cognition (Newen, De Bruin, Gallagher, 2018). In particular, in substantial accord with the First and the Second Pillar, all enactivists see "mental life as a habit ecology" and consider habitual control as "an agent's behaviour generating mechanism in coordination with its environment" (Barandiaran, 2017). Emerging from the sedimentation of the agent-environment coupling, habitual dispositions are the true source of the motoric and perceptual know-how, i.e. the very fabric of which embodied intelligence itself is made out. This perspective is truly relational and interactionist in the sense explored by Coeckelbergh (2015).

The strands of 4E cognition that seek a compromise with representationalism struggle to accept the Third Pillar. Radical Enactivism (which emphasizes the contentless nature of "basic" forms of cognition, see Hutto & Myin, 2013, 2017) might, on the other hand, provide a more conducive ground to defend an intransigent anti-representationalism like the one proposed by Radical Habitualism. If it will prove itself radical enough to incorporate the Third Pillar, Radical Enactivism could offer a new home to Dreyfus' idea that pre-reflective know-how is informed by a primordial kind of intentionality, a form of cognition that is both ontogenetically and phylogenetically more fundamental than, functionally irreducible to, and logically incompatible

with representational cognition (i.e., the kind of intelligence based on contentful judgment and explicit knowledge of facts, rules, principles, and instructions, see Hutto & Satne, 2015).

As the Third Pillar is probably the most polarizing aspect of Radical Habitualism, we will need to clarify its reach in Sect. 4.1 and exhaustively refute the objections that threaten it in Sect. 5.2, 5.3, and 5.4.

### 3 Three arguments supporting Dreyfus' Controversial Thesis

In this section, I will present three arguments that support Radical Habitualism by corroborating the DisC. The first two are directly taken from Dreyfus, while the third argument is, as far as I know, original. The first argument (Sect. 3.1) derives from the analysis of the general mechanics of expertise development according to the influential "Adult Skill Acquisition" model proposed by Dreyfus and Dreyfus (1980, 1988), asserting that a learner's skill level progresses as their contentful know-that is replaced by dispositional know-how. The second argument (Sect. 3.2) builds on the phenomenology of skilful action and the reciprocal incompatibility of the different normative conditions under which the success of reflective and unreflective action is defined. The third argument (Sect. 3.3) stems from the acknowledgment that reflective and unreflective action rely on irreducibly different forms of knowledge, and that only the kind of expert know-how embedded in embodied habitual dispositions has the qualities required to support skilful performance.

#### 3.1 First argument: the structure of skill development

The first argument builds on the empirical analysis of the universal form of skill acquisition, a gradual process that follows a predictable pattern. Bryan and Harter (1899) noted that the development of expertise progresses at once with "the acquisition of a hierarchy of habits." Since James (1890), at least, scientific psychologists have used the technical term "automatization" to indicate the *learning process* through which the components of performance progressively become *habitual* (Logan, 1988). According to Logan's prominent definition (Logan, 1985), the sub-personal processes underpinning the control of automatized (i.e., habitual) actions distinctively are: (1) comparatively effortless<sup>7</sup>; (2) autonomous; (3) partly unavailable to attentive awareness (i.e., eluding explicitly directed, analytic self-monitoring); and (4) consolidated through practice. Psychologists still debate whether any of these four conditions is either necessary, sufficient, or both for a full automatization. Importantly, within the lexicon normally used by contemporary performance psychologists, the term "automatized" (2) does not imply fixed repetitiveness or blind mechanicity (Carr, 2015),

<sup>7</sup> As specified earlier, the complete absence of sense of effort is not a necessary pre-requisite of automatized action (i.e., controlled habitually). A total lack of experienced effort is rare, even in the extraordinary conditions of pre-reflective control referred as "flow" or "clutch" performance. However, progressive action automatization (coinciding with control habitualization) does correlate with a diminished or transformed sense of effort, which is experienced as more tolerable, or even enjoyable, when compared to unhabitual action.

which is why it is rather remarkable that some philosophers have started using it with this connotation (e.g., Montero, 2016; Wu, 2013)<sup>8</sup>: “automatized” simply indicates that the performer’s control ability irreversibly moves toward a fully pre-reflective modality while progressively moving away from the reflective modality.

But how can our actions become habitual if the trainee’s practice is based on the consumption of contentful indications like rules or maxims? When they begin to learn a skill, the typical learner *temporarily relies on* the explicit instructions and representational models provided by an expert trainer/teacher *but the learning process does not consist in acquiring or retaining such instructions and models in a contentful form*. The role of content is particularly evident during the early stages of skill learning, which heavily rely on such instructions and models. The more experienced performers may rely on explicit know-that to reach the higher levels of expertise too and the exact extent of their reliance on know-that depends significantly on the discipline’s specificity, the instructor’s teaching method, the learners’ preferences, etc.

The point to be made here is not that learners initially *need* contentful representation of rules and facts to become experts (in fact, in many cases, they don’t); the point is rather that, any time contentful know-that and reflection are leveraged to learn a skill, *the role played by content is merely instrumental* to reaching the next level of know-how, without being *constitutive* of it. This role, like *that of a scaffold*, is *temporary, functionally replaceable, and not essential*. The learners reach a more mature developmental stage the very moment they prove ready to discard such a scaffold, when its assistive function finally becomes redundant. Thus, their knowledge (which is contentful only at an early stage, if it is contentful at all) is transformed (i.e., it becomes contentless) by the very same process of skill development that transforms them into experts.

This point is perfectly captured by the influential model introduced by Dreyfus and Dreyfus (1980, 1988), recapitulated by Dreyfus (1997, 2002a), and recently expanded and refined by Rouse and Dreyfus (2021). According to this model, skill development advances linearly through six<sup>9</sup> distinct stages that reflect the performer’s increasing expertise level: *novice* (a learner who rigidly applies narrow sets of rules to navigate context-neutral and goal-specific situations), *advanced beginner* (a learner who still relies on general instructional maxims and applies them flexibly to a variety of familiar practical situations characterised by similar aspects), *competent* (a performer who still needs to deliberately choose the practical perspective to be adopted for reaching the goal associated with a familiar situation), *proficient* (a performer who can intuitively adopt the most appropriate practical perspective on the situation but still needs to explicitly decide how to respond to direct solicitations), *expert* (a performer who can count on a large repertoire of familiar perspectives to fluidly switch from one goal-specific situation to another, intuitively responding to the direct solicitations

<sup>8</sup> Montero (2016, p. 42): “I think this conception of automaticity suffices for my purposes and more or less captures Dreyfus’s notion of automaticity, the concept is understood in myriad ways in the philosophy and psychology literature. For example, Sutton et al. (2011) argue that automatic actions themselves are thoughtful. See also Wu (2013) and Fridland (2015).”

<sup>9</sup> Originally five, as the Mastery level does not appear in all the versions of the theory.



to act), and, finally, *master* (an expert capable to actively experiment with the available perspectives, exploring new action possibilities and creatively reconfiguring the solicitations to act in innovative ways).

As summarized by the following table, the key mental functions involved in performance control (recollection of relevant actions, recognition of relevant situations, decision about the best courses of action, awareness of the action possibilities offered by the situation) are gradually automatized as the performer advances through the higher levels of expertise.

Skill level/Mental function	Novice	Advanced beginner	Competence	Proficient	Expert
Recollection	Non-Situational	Situational			
Recognition	Decomposed		Holistic		
Decision	Analytical			Intuitive	
Awareness	Monitoring				Absorbed

The table shows how the mental functions involved in performance control become progressively pre-reflective as the skill levels improves (Dreyfus & Dreyfus, 1988)

The protocols, rules, and norms relevant to the task at hand represent the first component of the performance to be automatized, followed by the capability to decide the tactical perspective on the practical context in which the agent is situated, then by the capability to appropriately select the strategic goals to be achieved in the given circumstances, and finally by the capability to track, select, and directly respond to specific action opportunities among the multitude that the situation affords.

The following remarks (Sect. 3.1.1, Sect. 3.1.2, Sect. 3.1.3) are necessary to dispel three common misunderstandings associated with the decreasing dependency on reflective thought and contentful knowledge that marks the automatization of control in experts.

### 3.1.1 In the performance domain, habits are trained for a specific purpose

The key aspects of a performance typically *can*, and most often *must*, become automatized via targeted training practices before they can be controlled skilfully. While not all habits are useful to an expert or beneficial for performance, expert performances always require a broad, cohesive set of well-chosen, well-diversified, well-trained habits to attune their actions to the situation. That is why, in the performance context, the development of habits via practice and exercise is purposeful and deliberate. As the performer achieves skilful control through habit formation, the depth and breadth of

action automatization prove that the performer is prepared to control the relevant performances skilfully; conversely, a superficial, narrow level of automatization proves that the performer's control is not mature enough for skilful execution.

Unlike compulsive habits developed accidentally, the actions controlled by well-trained habitual dispositions developed for a specific purpose are normally initiated and interrupted voluntarily. Thus, the automatization of well-trained behaviours does not cause the agent to suddenly lose their ability to mindfully monitor the details of their performance's geometry or deliberately decide the exact trajectory of their actions based on strategic considerations, if this is what the agent wants or what is required by the praxical norms of a specific task. Remarkably, the execution of automatized actions (unlike the execution of compulsive actions) is never experienced as an imposition. On the contrary, automatization implies a new form of freedom as it offers the possibility to execute certain actions without involving the kind of centralized, reflective processes that consume cognitive resources to manipulate contentful representations. So, an experienced performer may or may not be able, but certainly is not required, to represent to themselves the low-level sensorimotor details of their actions in order to execute them correctly (Dreyfus, 2000; Kelly, 2000).

It is to be noted that slowly practicing an action according to a rigidly repetitive exercise protocol (even a mechanical, scripted routine) is one of the possible methods to achieve automatization (although it rarely is the most effective one, cfr. Gray, 2021), but this does not imply that automatization always requires mechanical repetition or that automatized actions necessarily have the detrimental characteristics of a repetitive mechanism (Cappuccio & Ilundáin-Agurruza, 2020). Rote repetition of standardized movements, accompanied by attentive self-monitoring and explicit instructions, may or may not be beneficial during training and pre-performance routines but it is inevitably detrimental and highly disruptive during peak performance, when all the attentional resources must coherently converge toward the action's intended outcomes (Wulf, 2013, 2015).<sup>10</sup> Ultimately, the goal proper of forming well-trained habits is making control more decentralized and thus autonomous, not indefinitely repeatable or inflexible (Dewey 1983; Hutto & Robertson, 2020).

### 3.1.2 Habits acquired for a purpose are neither unintelligent nor involuntary: they are "autonomous"

Dreyfus might have at times indulged in the praise of "mindless" (in the sense of "not cognitively demanding") performance to rhetorically emphasize the anti-cognitivist posture of his doctrine, but he certainly did not intend to suggest that habitual agents are insentient zombies (Breivik, 2013) or puppets mechanically manoeuvred by their own habitual dispositions (Fridland, 2014).

What Dreyfus intended to suggest is compatible with Fitts and Posner's (1967) model of attention and the dual-process models of intelligence: the progressive

<sup>10</sup> It is also to be noted that, as remarked by Gray (2021), the repetitive training of abstract movements is not the most effective and meaningful manner to obtain automatization: on the contrary, the repetition of modularized and standardized movements abstracted from the ecological context that solicits them reduces the adaptive flexibility of the habits acquired, hence delaying the skill development process. More specific considerations apply to different kinds of skilful activity.

minimization of the cognitive resources committed to low-level control corresponds to the gradual increase of uncommitted resources available for other, higher-level aspects of the performance (Evans & Stanovich 2013, Neemeh 2022). However, as critically remarked by Christensen (2019), Dreyfus also emphasizes that the progressive automatization of the action components tends to progressively reduce, not increase, the performer's overall reliance on decisional procedures that utilise explicit inferences based on rules and instructions (that Dreyfus calls "calculative reasoning").

This needs clarification: that experts rely less on calculative reasoning does not mean that they make less intelligent or fewer decisions, or that they cannot rely anymore on self-focussed thought and contentful knowledge, especially if the situation solicits them to rely on those. Rather, it means that calculative reasoning is progressively replaced, as skill develops, by the expert's capability to exert their "deliberative rationality", which greatly grows in scope and efficacy as the experts develop their "perspectival deliberation" ability, i.e. a pre-reflective readiness to intuitively adopt the practical perspective most appropriate to the task at hand (Dreyfus, 1997). This readiness leverages either the performer's familiarity with the practical perspectives previously adopted to successfully address similar tasks or the performer's capability to improvise new perspectives based on the familiar ones (Rousse & Dreyfus, 2021).

Importantly, that an action is automatized does not mean that the agent is unable to foresee its broader implications, act purposefully and rationally, or pay attention to what they are doing; on the contrary, it means that the control of the details of the execution becomes *autonomous* from the explicit, centralized decisional processes that are based on inferential, analytic and calculative reasoning (Fitts & Posner 1967; Logan, 1988). An automatized performance (compared to a non-automatized one) does not only *allow* a greater and greater independency from reflective control and contentful instructions, but also *requires* such an independency (as demonstrated by the direct correlation between Stroop interference and skill-level, see Logan, 1988) because automatized performance relies on control routines incorporated into a background of contentless know-how. Habitual control neither needs nor can directly tap into the pool of cognitive resources specifically dedicated to representational processes, such as explicit, analytic, attention, working memory, formal inference, and logical analysis (Beilock & Carr, 2005).

That an automatized action is controlled autonomously means neither that it is repeated mechanically nor that it is executed in a rigid, scripted, stereotyped, or inflexible manner (Hutto & Robertson, 2020; Miyahara & Robertson, 2021; Robertson & Hutto forthcoming). Both clinical evidence and everyday experience attest that experts confidently rely on habitual control. This motivates our justified scepticism toward the claims that autonomously controlled actions are not "initiated by intentions" and "run to completion without regulation by goal" (Moors & De Houwer, 2006, cited by Christensen et al., 2016), as if autonomous control was a defective, substandard process: in fact, the compulsive production of stereotyped actions is a pathological condition that has little to do with the way experts normally carry out their habitual actions (Rietveld, 2012; Cappuccio & Wheeler, 2012), hence the two concepts should be kept carefully distinct; moreover, the risk of initiating inflexible, poorly controlled actions due to a scarce consideration of their goal and an

inadequate understanding of the context is even greater for the novices than for the experts who have already automatized their execution.

### 3.1.3 Control becomes more intelligent and reliable when it becomes autonomous

Habitual control is strictly indispensable to produce competitive performances. Making an action autonomous, via automatization, is an advantageous way, and often the only way, to deliver that action in a rapid, fluid, richly adaptive, context-sensitive, intuitive, spontaneous and thus creative and original manner (Dewey 1983; Carr, 2015; Rucińska & Aggerholm, 2019). The main advantage of automatization is that spontaneously initiated, instinct-like, and self-motivating forms of intuitive control become available to the performer like their second nature. This reduces the burden for the cognitive system, promotes a superior degree of internal coherency and, most important guarantees contextual adequacy, which is why control risks being severely slowed down, if not entirely disintegrated, when the agent decides to micro-manage the actions that have already been automatized.

Competent and proficient performers don't need to make micro-decisions about the action structure and, when their expertise is fully mature, they don't even need to explicitly reflect about the situational context or make effortful strategic decisions. Skilled control processes typically occur below the level of representation, at the margin of the expert's explicit judgment. They are incorporated within direct (non-vetoable) perceptual processes that the agent can, but does not need, to actively monitor (Neemeh, 2022).

#### 3.1.4 Provisional conclusion: the direction of skill development

The Dreyfus & Dreyfus model corroborates DisC because it recognizes that many components of performance execution can be automatized and that the process of skill acquisition proceeds consistently and irreversibly toward the broader and deeper autonomy of actions, decisions, and thoughts. The destination of the learning process is the same whether the development of pre-reflective competences is preceded by a reflective stage or not (Hutto & Sánchez García, 2015; Masters & Maxwell, 2004). Even though pre-reflective cognition is ontologically more fundamental than reflective cognition (because non-representational intentionality is more primordial than representational intentionality), pre-reflective control can become more sophisticated and effective than reflective control insofar as it embodies the kind of intelligence that is uniquely acquired via practice (Hutto & Myin, 2017; Kiverstein & Rietveld, 2015). Thus, habitual control is not a simpler and less refined form of intelligence: rather, it is the specific form of performative, practical intelligence that derives from, and is attested by, the progressive eclipse of reflective control and contentful knowledge. Some objections to the First Argument will be discussed in Sect. 4.1.1.

### 3.2 Second argument: the phenomenological foundations of pre-reflective control

The second argument builds on Dreyfus' phenomenological analysis of the experiential condition of skilful performers, which is "embodied, embedded, situated and

absorbed” (Fridland & Pavese, 2020). Intellectualists and cognitivists contend that skilful behaviours must be controlled by contentful intentions, not habitual dispositions, as they assume that only the former (by conveying truthful indications about the most effective ways to perform) can enable the flexible adaptive behaviour that experts need to perform successfully (Butterfill et al., 2014; Bermúdez, 2021; Brozzo, 2017; Ferretti & Zipoli Caiani, 2021; Mylopoulos & Pacherie, 2019 and Wu, 2013 among others).

Two assumptions are typically evoked in support of this representationalist doctrine: first, flexible and adaptive control needs sensitivity to contextual conditions; second, such a context sensitivity requires explicit representation of the action goals and reasons to act. Dreyfus’ analyses (2000) validate the first assumption. However, not only does his phenomenology indicate that the second assumption is unwarranted, but it entirely flips it over, showing that representation necessarily constrains and limits our context sensitivity (Dreyfus, 1997, 2002a). To unpack this view and its key terms (background, pre-comprehension, situated familiarity) we need to introduce three observations, respectively organized as two premises of an argument and the conclusion logically deriving from them.

### 3.2.1 First observation: both habit and representation presuppose a background of performative familiarity

Experts confidently anticipate the implications of their actions (Christensen & Bicknell, 2019). This is possible because they are intuitively familiar with an open-ended horizon of practical preconditions that define the significance, appropriateness, and purpose of their actions (Dreyfus, 2014). Experts draw from this horizon their hermeneutical capacity to discriminate between very similar contexts and confidently navigate the familiar ones. Dreyfus, appealing to the Heideggerian notion of “Being-in-the-world” (Heidegger 1927; Taylor, 1993; Wheeler, 2005, 2008), calls this horizon “background” to indicate the incalculable number of formal and material preconditions behind every particular variety of skilful coping (Dreyfus, 2008, 2012; Fusche Moe, 2004).

The background concretely shapes and fills of operational significance the pre-reflective know-how that informs the expert’s decisions during their performance. Representational content can guide performance only when it is situated against a backdrop of concrete know-how that precedes and vitalizes know-that, being necessary to make contentful representation practically meaningful and contextually relevant (Hutto, 2012). That is why, despite the claim by Stanley and Krakauer (2013) that “motor skill depends on knowledge of facts”, both experts and neurotypical people who have not suffered brain traumas usually do not need objective knowledge of facts and rules to choose the most efficacious course of action in familiar circumstances (Masters, 1992; Masters & Maxwell, 2004; Porter, Wu & Partridge 2010; Komar et al., 2014). Even when their performance benefits from some know-that, experts can apply it in a way that is distinctively relevant and appropriate to context because they directly perceive the most appropriate opportunities of actions afforded by the circumstances, not because they were provided with rules and objective facts (Kiverstein & Rietveld, 2018; Rietveld & Kiverstein, 2014).

Dreyfus' persuasion about the fundamentally non-representational architecture of human intelligence originates from his theoretical research on general artificial intelligence (AI) and the history of its fiascos (Dennett, 1984; Dreyfus, 1992, 2008; Dreyfus & Dreyfus, 1988). The systematic failure of every known attempt to build general AIs using descriptions of actions and stored heuristics justifies the conjecture that the experiential background required to navigate a meaningful context of action cannot be grounded in detached, contentful representation. If an artificial cognitive system solely based on finite representations of the world were realizable (hypothesizing that it is conceivable) it would only offer a rigid, stereotyped, incomplete guide to action because it would lack any authentic familiarity with the relevant practical contexts (Dreyfus, 1992). Portraying the human cognitive system like a disembodied mechanism removed away from the pre-verbal and non-conceptual background of real-life experience is, from this perspective, utterly misleading.<sup>11</sup>

### 3.2.2 Second observation: performative familiarity affords a form of comprehension that is more fundamental than representation

A deep and broad background of familiar experiences and performative know-how provides the pre-comprehension of the context that experts need to adjust their actions to the circumstances. With “pre-comprehension”, philosophical hermeneutics indicates the kind of implicit comprehension that both precedes and is presupposed by analytic understanding (Gallagher, 2004); such a tacit background of experience and knowledge is purely practical and performative in nature; it sustains and, at once, is sustained by, the pre-reflective engagement of experts in their skilled activities (Dreyfus, 2012). The pre-comprehension relevant to skilled performance originates from a primordial dimension of pre-verbal, interactive experience that is solely disclosed through embodied involvement and affective solicitations (Andler, 2000). It is accessible only in the form of a rich perceptual responsiveness to complex, fluid, multifaceted circumstances (Dreyfus, 2002a, 2008). As such, it exceeds the low granularity of propositional knowledge and conceptual analysis. The theory of autopoietic enactivism expresses a comparable concept when it argues that the fundamental *sense-making capabilities* of a certain lifeform predate representational cognition and arise from the history of embodied dealings established by that lifeform in their unique world-environment (Varela, Thompson, Rosch 1991; Di Paolo, Buhrmann & Barandiaran, 2017).

This notion builds on the principle that real-life experience necessarily transcends its own representation: an indefinite number of different representations can be created to fixate this or that set of aspects of experience, but no finite set of representations could exhaust the transcendent complexity of the life-world that animates them. Thus, representations are structurally insufficient to make the agent practically acquainted with the inherent intricacy and perspectival depth of contextual circumstances: while local, particular perspectives on the background may become representable at this

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<sup>11</sup> This claim becomes ever more important in the age of generative AI and Large Language Models, as the incapability of chatbots to produce accurate, consistent accounts of practical engagement with real-life conditions suggests that the simulation of human intelligence is inherently limited and faulty when based only on disembodied, linguistic descriptions.

or that moment, the background as an interconnected whole inevitably exceeds the knowledge of particular facts. This means that contentful judgments and inferences about facts can only offer a bounded, derived, and uncertain guide to skilful action (Van den Herik & Rietveld, 2021). Independently of how large, numerous, and granular they are, representations simply do not provide an agent with the kind of *familiar* (transparent, trusted, immediately available), *inherent* (tied to the subject's unique experiential history), and *pragmatic* (actional, embodied, purposeful) comprehension that they need to make sense of the real purpose, motivation, and implications of their own actions.

Conversely, the expert is exactly the sort of agent who can count on the *holistic* (systemic, non-analysable in discrete parts) and *situated* (sensitive to an unquantifiable number of massively interconnected experiential particulars) *pre-comprehension* (non-conceptual competent familiarity) of their own actions' *practical background* (the inexhaustible horizon of pre-conditions that implicitly defines the causes and reasons of their actions, see Dreyfus, 2012; Cappuccio & Wheeler, 2012). Control is skilful only if it is sufficiently fine-grained and flexible to incorporate this contextual pre-comprehension (Wheeler, 2008; Cappuccio & Wheeler, 2010a, 2010b, 2012). Only contentless, embodied habitual dispositions, not contentful knowledge, are able to sustain a practically relevant pre-comprehension: while representation of facts is self-contained, value-neutral, merely receptive, and contextually detached, well-trained habitual dispositions allow perception to be active, intelligent, value-laden, predictive, and practically tuned to numerous contexts so to enable the fast, precise adaptivity required to perform skilfully (Beilock & Gray, 2012; Craighero et al., 1999; Gray, 2014; Rizzolatti & Craighero, 2010; Witt et al., 2007).

### 3.2.3 Third observation: reflective and pre-reflective forms of comprehension obey two irreducibly different normative regimes

This observation concerns the normative dimension of skilful control (Rietveld, 2008), that Dreyfus derives from Merleau-Ponty's *Phenomenology of Perception* (1954/2012). According to this phenomenology, each instance of effective action control may rely only on one of two mutually exclusive types of intentionality (Dreyfus, 2000; Fusche Moe, 2016; Jackson, 2018): *cognitive intentionality* (representational) vs *motor intentionality* (dispositional).<sup>12</sup> Only the former can have a semantic content and truth values thus, from a normative perspective, what distinctively characterises cognitive intentionality is that it serves an adequative (i.e., correspondence/similarity-seeking) semantic function; motor intentionality, in turn, does not distinguish contents from attitudes (Kelly, 2000), hence it serves a compensatory and homeostatic (i.e., dynamical balance/equilibrium-seeking), regulatory function.

<sup>12</sup> This duality of forms of intentionality hints at what, according to dual-process theorists, is a fundamental duality of types of cognitive processes, i.e. a dichotomy between irreducibly different forms of evaluation and decision: the former, i.e. "Type 1" processes, are "intuitive", "autonomous" (not explicitly monitored and unsupervised), "fast", "involve no working memory", and "cannot be rationally vetoed"; the latter, i.e. "Type 2" processes, are "reflective", "decoupled from the immediate situation", "slow", "require working memory" and can be rationally scrutinized (Evans & Stanovich 2013). Stuart Dreyfus (2015), however, rejects this analogy, asserting that pre-reflective control is not reducible to Type 1 cognition but constitutes a third Type (Type 0).



They sustain two completely different epistemic processes: know-that, which is normatively satisfied by *truth, correctness, or accuracy conditions*, and know-how, which is normatively satisfied by *far-from-balance or “improvement” conditions* aiming to bring the agent closer and closer to a desired, but implicit, goal-state (Dreyfus, 1999, 2007a). In accord with these characterisations, the success/appropriateness of an action controlled reflectively is attested by the structural isomorphism to an explicit plan, rule, or conceptual model, while the success/appropriateness of a pre-reflectively controlled action coincides with the progressive reduction of the distress to which the system is subject and the minimization of the sense of deviation from an optimal Gestalt configuration that is never entirely explicatable yet always perspicuous in terms of uncertainty or entropy (Dreyfus, 2002a; Fusche Moe, 2016).

Habitual control generates rich responses under the urge to reduce the sense of deviation from an optimal global configuration (e.g., a certain homeostatic balance or dynamical coupling with the environment, see Dreyfus, 2002a). Only the contentless, embodied readiness to act that distinctively informs motor intentionality, not the contentful knowledge of facts conveyed by representation, can provide the kind of pre-comprehension required by experts to navigate the context of action adaptively and flexibly (Ungureanu & Rotaru, 2014). This is true regardless of how accurate and structured the know-that provided by representations is. Contentful representations and habitual dispositions exist to fulfill entirely different kinds of expectations, and only the latter are directly relevant to control skilful performance: by definition, a representation is correct if and only if it truthfully corresponds to the reality it is meant to represent; in turn, a disposition is efficacious if and only if it produces the expected form of engagement with the environment. The skilful value of a performance is measured by the qualities and merits of its execution, not the veridicity of the assertions associated with it, therefore only embodied habitual dispositions are categorically relevant to skilful expertise.

### 3.3 Third argument: the epistemic qualities of expert know-how

The third way to defend DisC consists in showing that skilful control manifests certain epistemic qualities that exclusively pertain to contentless know-how. Skilful expertise presupposes a performative knowledge that is inherently embodied (Beilock, 2015). This implies, *inter alia*, that experts do not only simply *use* but literally *incorporate* the know-how necessary to exert online control through perceptual, motoric, and anticipatory-predictive dispositions (Dreyfus, 1996, 2002a, 2007a, 2007b; Robertson & Kirchoff 2020). This know-how is grounded exclusively in habits because only embodied habitual dispositions can offer a specialised competency that is immediately, constantly, and consistently accessible, more like a constitutive trait of the performer's own being than an external resource instrumentally used by the performer.

Experts, in other words, do not *simply know how* to reliably produce skilful performances; they also have this knowledge in a *private, context-sensitive, and trusted* manner. Skilful control necessarily incorporates these three *epistemic qualities*, i.e. properties that differentiate the kind of knowledge mastered by expert performers from other kinds of knowledge. These qualities provide action control with the precision,

rapidity, flexibility, and robustness uniquely associated with skilful expertise: not only are they deeply ingrained in the pre-reflective control enabled by habitual dispositions; they are also at odds with the reflective control informed by representational content. This is clearly shown by the fact that only the performances informed by embodied know-how, not the actions controlled by representations of facts and rules, display the spontaneous, self-reliant, harmonious, parsimonious, and effortless execution that distinctively characterizes the control of an expert.

In what follows (Sect. 3.3.1, 3.3.2, 3.3.3), I will describe more precisely these qualities, discussing why they can be found only in the know-how embedded in habitual dispositions. I will partly utilize investigations on tool use initiated by theorists of extended/distributed cognition (Clark & Chalmers, 1998; Menary, 2010; Sterelny, 2010; Wheeler, 2012). Their analyses suggest that the practical knowledge required to perform skilfully must be privately owned (Sect. 3.3.1), context-sensitive or non-neutrally situated (Sect. 3.3.2), and trusted (Sect. 3.3.3).

### 3.3.1 Privately owned (characterized by a privileged access deriving from the unique constitutive relationship between the expert and their skill)

Skilled performers possess their skills in an intimately familiar manner, i.e. a manner that implies phenomenal transparency and fast and reliable access. Experts *have* their skilful expertise in a deep sense, in modalities and forms that inherently define their performative engagement: *not only do experts own this knowledge*; they also have an *exclusive privilege* over it in reason of the unrepeatable and irreversible personal history that ties together an agent and their performance. According to Bäckström and Gustafsson (2017), this idea can be traced back to Gilbert Ryle (1949/2009): performative know-how is what experts *typically do*, not some information they *store*; as such, it diachronically constitutes the expert's identity as an expert through the history of their dealings with familiar contexts of action. Before explicit representation of goals is useful or even possible, their well-trained dispositions already make them receptive of intrinsically motivating solicitations and pre-reflectively aware of the contextual relevance of the consequences of their actions (Cappuccio et al., 2019b; Miyahara & Robertson, 2021).

Contentful knowledge, in comparison, resembles a neutral commodity or a currency that performers can spend only in particular situations: scarcely available due to the cognitive constraints of the human intellect (e.g., working memory limitations, see Maxwell et al., 2003; Beilock & 2005), yet indefinitely accumulable and in principle universally transferable (via linguistic and figurative forms of notation), contentful knowledge about action is usable by any agent but does not belong to (let alone constitute) any of them. Contentful knowledge is never truly owned because access to it is necessarily mediated: know-that is always merely borrowed by the agent, who can use it only upon concession of an external source. Every situation in which an expert relies on a defined set of contentful rules or instructions is somehow similar to that of a chess player who needs to consult her move-by-move handbook between a move and another; football players who can play in formation only when their coach provides them with the relevant strategic instructions; a boxer who needs a transmitter concealed in his ear to receive precise instructions about where, when, and how he has to hit the

opponent's body; an Alzheimer patient who writes detailed instructions in a notebook to remind himself all his daily activities (Clark & Chalmers, 1998). The knowledge provided by these epistemic add-ons can be instrumentally exploited by their agents but it is never deeply ingrained in them: as convincingly argued by Facchin (forthcoming), phenomenal transparency is more of a complication than a requirement to cognitive extension, which is why many extended cognitive activities are not skilful. These supplements may work just fine and produce outcomes that are functionally equivalent to the outcomes they are meant to reproduce or replace (hence, the validity of parity principle is not at stake here, Wheeler, 2012), but (as I will systematically argue in Sect. 5.3.3) the bare ability to produce outcomes characteristically associated with a skilful performance does not guarantee that those outcomes are produced skilfully.

### 3.3.2 Context-sensitive or non-neutrally situated (specifically tailored to particular sets of unrepeatable circumstances)

Only the habitual/dispositional form of action control can be truly skilful, not the reflective form, because only contentless know-how (associated with the former) can be context-sensitive and contingently situated, not contentful know-that (associated with the latter). The key difference between the former and the latter is that contentful representations, unlike contentless dispositions, presuppose the very distinction between vehicles and contents of cognition, and such a distinction implies the functional neutrality of the instantiating medium and the multiple realizability of the content (Wheeler, 2010a).

This means that contentful knowledge about objective facts and verbal instructions can be *re-implemented* in a variety of conventional formats (oral, written, visual, etc.), *physically externalised* (e.g., stored in a tool, like a notebook, or assigned to another physical support of information, like an architecture) or *entirely outsourced* (when judgments are derogated to another cognitive system, whether natural or artificial): in all these cases, the vehicles of cognition remain neutral to its content, thus the way the agent learns some know-that does not modify their performance. The contentful know-that that guides reflective control (rules, schemas, and instructional maxims) can be identically replicated over time or relocated in different spatially situated vehicles while remaining functionally unchanged (Cappuccio & Wheeler, 2010a, 2010b; Wheeler, 2010b).

On the contrary, know-how does not allow for the content-vehicle distinction because the details of the means (how the performance is executed) and the details of the ends (the intended outcome of the performance) concretely map into one another and establish reciprocal constraints as they are two constitutive sides of one and the same performative experience: from the pre-reflective perspective of our tacit dispositions, recognizing the motivating goal of an action in a given context amounts to knowing how to execute that action in that context and, conversely, recognizing how a particular action is executed means immediately understanding why that action is executed in that particular way (Fusche Moe, 2016).

Now, skilful expertise always arises from a unique history of interactions characterised by the particular spatio-temporal situation of the learner. Skilful control gradually forms and develops through consecutive stages in accord to the specific

rhythm and style of each learning process (Francesconi & Gallagher, 2019). Due to its acute sensitivity to the holistic configuration of sensorimotor contingencies (Ilundáin-Agurruza, 2016) and ecological constraints (Gray, 2021), skilful control is always informed by the unrepeatable contextual circumstances in which the agent-environment coupling forms and by the specific situation of the agent (Bocanegra & Hommel, 2014). Such rich and adaptive sensorimotor responsiveness to granular, massively interconnected circumstances cannot be learned like a formula from a book or transferred unmodified from a cognitive system to another: it is effectively learnt only when it is practiced in ecologically relevant, and highly cohesive, value-laden conditions that instantiate a set of unique affordances, i.e. opportunities for action highly specific of a context (Gray, 2021; Segundo-Ortin & Heras-Escribano, 2021). That is why skilful control necessarily has the nature of contentless habitual dispositions, not of contentful representations: skilful know-how must be finely calibrated to match the tacit context in which embodied habitual dispositions form and to which they are coupled.

### 3.3.3 Trusted (reliably available, confidently usable, familiarly applicable)

To control their actions skilfully, experts need a reliable access to the relevant embodied expertise: this means not only that they must perfectly trust the information they rely on (e.g., procedural memory, Eichenbaum & Cohen, 2004), but also that the recollection and application of this information must occur through an absolutely simple and immediate process. No additional interpretative or inferential effort should be attached to this process, as this would hamper action control, making it slow, hesitant, and unnecessarily complicated. This kind of simple and immediate access is offered by the embodied know-how embedded in habitual dispositions: when the agent's competency is habitual, the relevant pre-comprehension of the context of action is immediately, implicitly available to them through the solicitations that they perceive in the environment, as these solicitations exert on the agent an inherently motivating force in the form of affordances (Heras-Escribano, 2021). For a skilled expert, relying on their embodied habitual dispositions, detecting affordances in the environment and comprehending the practical implications of one's actions in the given context of activity are simultaneous aspects of one and the same perceptive experience (Bruineberg et al., 2019).

On the contrary, this immediate access is not available to cognizers who must process contentful rules and instructions to control their actions: they are hampered and delayed because they must constantly make interpretative and inferential attempts to decode the information contained in their stored representations. The information conveyed by representations is less trustworthy because its utilization is *mediated, tentative and demanding*.

**Mediated** While habitual dispositions allow us to directly pick up the most relevant contentless information from the perceptual environment (i.e., salient covariational regularities), the process of accessing information through representation is mediated by our capability to retrieve and correctly decode (or infer) its content. That is why knowing pre-reflectively how to do X via Y and being told that Y is the best way

to do X are two very different kinds of epistemic access (Flegal & Anderson, 2008); in the first case, the required knowledge is transparently accessible as part of our phenomenal experience, in the latter it must be parted away from online experiential evidence and linked to non-evident mechanisms and processes located beyond the horizon of perceptually perspicuous events (Kiverstein & Rietveld, 2018).

**Tentative** Every time an agent relies on contentful know-that to guide their actions they must reconstruct all the relevant semantic and causal relations through hypotheses, guesses and, if the source is questionable, a leap of faith. The testimony of a witness is a less trustable source than direct evidence: analogously, the performers who rely on rational inferences or representations of objective facts inevitably perform less competently than experts because their inferences need to be rationally validated and facts need to be verified (Wheeler, 2010b; Miyahara, Ransom & Gallagher 2020). This uncertainty prevents the agent from promptly responding to circumstances and confidently investing their motivational and attentional resources in a consistent project of action. A tentative access to information is incompatible with skilful control because it is uncertain both *probabilistically* (in terms of prediction of the chances of success) and *psychologically* (in terms of emotional self-regulation). The resulting confidence erosion can dramatically curb the control of actions requiring fine-grained spatio-temporal regulation (Cappuccio et al., 2019b).

**Demanding** Demanding information processing (e.g., instructions encoded in a declarative format, see Maxwell et al., 2003; Jackson et al., 2006) is incompatible with skilful control because it is taxing in both *volitional* and *cognitive* terms. Action control cannot be skilful if it requires struggling efforts that compromises the agent's readiness and responsiveness to contextual contingencies. Effortful action control tends to be imprecise, cumbersome, and sluggish and hence potentially detrimental to performance outcomes, which presuppose the parsimonious use of the agent's physical and cognitive resources (Cappuccio & Ilundáin-Agurruza, 2020). Note that not all effort is detrimental to skilful activity (Brownstein, 2014a, 2014b; Jackson, 1996; Swann, 2016): for example, the moderate, continuous effort perceived during flow activities feels like a stimulating and invigorating challenge and is accompanied by an attenuated or peculiarly modified sense of agency (*they let their action happen* as a spontaneous response rather than *making it happen* as the effect of an effortful deliberation, see Swann et al., 2016).

On the contrary, the intellectual effort required to process recurrent contentful thoughts (which can be involuntary, intrusive, and obsessively reiterated) can severely disrupt performance, even when the cognitive load is manageable and commensurate to the agent's cognitive capabilities (i.e., the task's cognitive load is not onerous enough to cause distraction or overload). Contentful thoughts can cause performance disruption in at least two different ways (Cappuccio 2015; Cappuccio et al., 2019a, 2019b): first, contentful thoughts can solicit a compulsive self-monitoring stance, which interrupts the expert's continuous, highly optimized, flux of pre-reflective sensorimotor activity, fragmenting it into discrete components (performance disruption by execution/internal-focus, see Beilock et al., 2002a, 2002b, 2004, 2008; Beilock &

Carr, 2001, 2004; Beilock, 2011; Gray, 2004; Wulf, 2015; Wulf & Su, 2007); second, contentful thoughts risk causing an unwanted psychological regression in the expert performer, triggering in them an uncontrollable search for rules and instructional maxims, thus bringing the expert performer back to a novice-like condition (performance disruption by dispositional reinvestment, see Masters, 1992; Masters & Maxwell, 2004, 2008; Jackson et al., 2006).

### 3.4 Summary of the three arguments and provisional conclusions

These arguments defend the idea that performance is either skilful or controlled reflectively. It cannot be both. Consequently, the kind of action control that we legitimately call “skilful” must be grounded in contentless habitual dispositions and cannot be grounded in contentful representation. Habit is the only source of the pre-reflective pre-comprehension that experts need to adjust promptly and flexibly to complex, diverse contexts of practical activity. Reflective and pre-reflective control are distinct and incompatible as they have entirely different geneses, obey different normative principles, and demand different epistemic resources. Thus, pace Conciliatory Habitualism, habitual control is *not only* a distinctive marker and an enabling condition of skilful expertise (i.e., one of the reasons sufficient to infer that an agent masters the relevant skills and one of the prerequisites necessary to recognize an action as the skilful performance of an expert); *it is also* the exclusive epistemic root and the only cognitive constituent of expertise. In contrast, contentful judgments deriving from representational cognitive processes, like decisions based on propositional knowledge and rules, do not play any necessary, sufficient, constitutive, or causal role in expertise because they do not meet the genetic, the normative, and the epistemic requirements of skilful control.

## 4 Intermezzo: an important clarification

### 4.1 Three prima facie exceptions

There are at least three prima facie exceptions to Radical Habitualism, which seem to challenge Dreyfus’ intransigent anti-representationalism. First, Dreyfus himself (2002b; Dreyfus & Dreyfus, 1999) recognizes that propositional knowledge plays a beneficial, often indispensable, role in the process of skill acquisition (learning) and maintenance (exercise). Second, he admits that moderately experienced performers (“competent” level and above) may appeal to representational resources when they face unfamiliar or problematic tasks that, while falling under their general domain of expertise, cannot be successfully dealt with relying exclusively on habitual dispositions (Dreyfus, 2007b, 2008; Wheeler, 2005, 2008). I will consider a third exception too: regardless of how difficult and unfamiliar the task at hand is, performers may find it convenient to rely on explicit instructions and other contentful representations, as the knowledge they provide can offer a competitive advantage and help producing superior outcomes (Sutton 2007; Cappuccio & Wheeler, 2012). While these three

cases represent instances of unhabitual, reflective control, none of them contradicts the DisC.

Radical Habitualism does not exclude that some representational processes may opportunistically serve the performer's best interests, operating (in a merely contingent and non-constitutive manner) as a temporary scaffold or external prosthesis of performance (Dreyfus, 2002b, 2008). Like in Dreyfus' famous metaphor, contentful representations are like *training wheels*, which undoubtedly constitute beneficial aids to any child who is still learning to ride their bicycle (this paper's opening quotation, taken from Dreyfus, 2005).

What Radical Habitualism contests is that the advantages provided by representational content could ever be a legitimate criterion to determine when agents perform as experts and which performances count as skilful: training wheels eventually must be set aside to permit the full maturation of our skill as cyclists. They don't magically turn into invisible, intangible mechanisms when their cognitive function becomes redundant: the training wheels entirely disappear from the horizon of an expert cyclist's performance.

Crucially, the valence of DCT is *also normative* and not only descriptive: it does not simply tell us what a successful *performance looks like* and which cognitive processes underpin their production (e.g., if, when, and how our training wheels improve our biking performances); it also gives us rigorous principles to appropriately rethink the notion of expertise and accordingly *decide which performances deserve to be considered skilful* (e.g., no cyclist relying on prosthetic wheels to keep their balance could ever be considered an expert). DCT does not ignore the consolidated scientific understanding of how well-trained agents do or do not access know-that to perform successfully: rather, it builds on scientific evidence to correctly situate the function of know-that within the processes of skill development and application.

#### 4.1.1 First exceptional case: representations in skill development

Regarding skill training and re-training, agents obviously do not operate as experts when they rely on explicit rules and instructions for developing a new skill or when they deliberately practice some component movements to maintain or correct a related existing skill or to upgrade that skill to the next level. Therefore, the fact they focus on instructions and rules to develop new embodied habitual dispositions (as in learning), to fine-tune the existing ones (as in deliberate practice), or to regain full access to the damaged ones (as in rehabilitation, see Stanley & Krakauer, 2013) does not undermine Radical Habitualism. It is true, as emphasized by Ericsson (2008) and Montero (2016), that a serious practitioner (regardless of their expertise level), *never stops practicing* – in the sense that skill development is a life-long endeavour and in the sense that even competition in the agonistic context constitutes an opportunity to learn. But this does not change the well-demonstrated fact that exerting one skill with the explicit intent to improve the skill itself (deliberate practice) or rather to produce the best possible performance (peak performance) involve two entirely different modalities of control: the former aims to produce well-trained habits, the latter to effectively use those habits.

Montero (2016, p. 130) defends a different perspective on deliberate practice, as she claims that “experts, in at least many domains, deliberately try to get better during



performance” and that “deliberate improvement is typically an element of not only practice but also of a performance or tournament”. It seems to me that these claims are problematic in at least two ways. Firstly, they are *empirically problematic* because they are systematically contradicted by evidence: the competition-vs-practice distinction is universally valid across all domains of expertise, including the most intellectual ones, like mathematical problem solving and linguistic expression (Beilock, 2008; Beilock et al., 2002a, 2002b; Wulf, 2013, 2015, etc.) This cannot be accidental. Training practices benefit from attentive self-observation since the trainee needs to deliberately, temporarily, selectively use their focussed reflection to single out and correct this or that element of their execution; peak performance, in turn, demands an entirely different emotional, cognitive, and motivational profile, as the agent must leave in the background all the aspects of the execution that are already automatized in order to maximize their focus on the immediate outcomes of their action. Secondly, these claims are *conceptually problematic*. Not only because they presuppose that reflective processes are needed to deliberately improve expert performance (as if training wheels were needed by a professional cyclist), not only because the presence of these processes is hardly verifiable (like the material presence of invisible wheels), but also because, if confirmed, the presence of reflective processes would not constitute legitimate evidence of a superior skill (reliance on training wheels is not a sign of mature expertise).

#### 4.1.2 Second exceptional case: representations in unfamiliar and troubled circumstances

Regarding troubled and challenging performances in unfamiliar scenarios, Dreyfus (2012) acknowledges that, in order to overcome unexpected obstacles, experts may rely on minimally or quasi-representational processes. Wheeler (2005, 2008) calls “action-oriented” these representations and, in contrast with fully-fledged representations, characterise them as *agent-centric*, *pragmatic*, and *context-sensitive* instances of “special purpose adaptive coupling”. Dreyfus (1990, 2008, 2012), using Heidegger’s (1927/1996) terminology, calls “unready-to-hand” the troubled modality of performance that requires an agent to produce on-the-fly and to immediately consume, without storing them, “minimal” or quasi representations of the actions necessary to surmount the difficulties. This modality is situated between the “ready-to-hand”, or familiar modality (pre-reflectively controlled) and the “present-at-hand”, or fully-fledged representational modality (reflectively controlled), because it combines the direct modality of access specifically granted by habitual experience via adaptive coupling with the detachedness of content-mediated understanding (see Wheeler, 2005, 2008 and Cappuccio & Wheeler, 2010a, 2010b, 2012).

By means of action-oriented representations, competent and proficient agents may provisionally adopt contentful rules, maxims, or models as prosthetic aids or scaffolds to compensate for the inadequateness or limitedness of their habitual dispositions, thus integrating the exploratory and tentative stance of novices and the improvisational capabilities acquired with experience. Importantly, DisC is not violated by the fact that, during troubled circumstances, agents may recall some contentful heuristics learnt during their training, for example repeating to themselves “instructional

nudges” as self-regulatory expedients (Sutton, 2007; Porter, Wu & Partridge 2010), or even inventing new rules-of-thumb (Cappuccio & Wheeler, 2012): in the first place, whether or not these contentful aids are useful to deal with the circumstances, their performance cannot be considered expert *if* the unfamiliar situation was not dealt with using the know-how embedded in habitual dispositions, because that implies the situation was dealt with (effectively or not) using some external, expediential knowledge that is instrumentally accessed by, but not constitutive of, the expert performance. Therefore, whether or not action-oriented representations are effectively used to overcome unexpected challenges, the phenomenology of the unready-to-hand does not justify the belief that mixing habits with content could make more skilful the control exerted by an experienced performer.

First, the issue has been raised that minimal representations might not be properly contentful, at least not in the sense of fully-fledged reflective control, as they do not display all the essential features of rule-based intelligence and inferential decision-making (Gallagher, 2008; Hutto, 2013). In particular, the instructional nudges evoked by performers through self-talk work more as “material symbols” (Gallagher & Francesconi 2018) serving emotional and perceptual self-stimulation and attentional self-regulation than fully-fledged contentful representations with a definite truth-value: in this case, the role they play in performance is merely exhortative or transformative, not isomorphic/projective, because they leverage the pathic, suggestive function of verbal expression (characterized by improvement, or far-from-balance conditions), not its denotative, analytic function (characterized by accuracy, or similarity-seeking conditions).

Second, in a Dreyfusian perspective, actions performed in an unready-to-hand mode are truly skilful only if the agent ultimately reverts to habitual control and limitedly to the extent that they rely on habitual dispositions (Dreyfus, 2008; Wheeler, 2008). Thus, the guiding principle is still compatible with DisC: in the event, and to the extent, that performers rely on representation when facing unpredictable circumstances, they do not deal with those circumstances like real experts, even if they are experienced and well-trained practitioners.

#### 4.1.3 Third exceptional case: representations as aids to boost performance outcomes

Know-that may be involved in successful, outstanding performances, but this does not mean that those performances are executed skilfully or that the agent controls them like an expert. It would be hubristic, for a practitioner, to believe that every action they perform successfully is the result of their expertise and their expertise only. True experts know that even the most inspired and serendipitous performance cannot be flawless like a textbook description. Dreyfus’ approach (2014) is at once more true-to-life and intellectually humble: it recognizes that many performances, including the most efficacious and outstanding ones, are transient patchworks of skilled and unskilled behaviours and even the most seasoned practitioner should be willing to admit that their performance is punctuated by more or less frequent moments in which they do not act skilfully, as they intermittently disconnect and reconnect with the familiar background of their habitual dispositions.

## 4.2 Assessing expertise: radical habitualism in hybrid scenarios

In all these cases, when confidence mixes with tentativeness and familiar execution demands intense mental and physical effort, judging whether and to what extent a performance is truly skilled is a multifaceted, complex task. Not only because know-how, unlike know-that, is a gradable quality (a classical Rylean puzzle thoroughly discussed by Pavese, 2017 and Stanley & Williamson, 2017), but also because assessing one's skill level involves multiple dimensions and different (possibly reciprocally competing) variables. In comparison, judging whether the behavioural components of an action are controlled skilfully is simpler.

That is why we should assume, like Wu (2013) does, that each and every component of a performance is either habitual ("automatic") or unhabitual ("reflective"). Among the key components (i.e., the cognitive/functional building blocks) of a performance we should include the fine-grained movements that compose an action (shaped by "motor acuity" according to Stanley & Krakauer, 2013), the simple goal-oriented actions composed by such movements, complex motor chains composed by simple actions, and then the processes governing the agent's situational awareness, their tactical decision, their strategic planning, their self-regulation, their online coordination with other agents, etc. This list (which is not meant to be exhaustive) includes also the "higher-order mental processes that structure and coordinate multiple lower-order automatic processes toward the completion of a goal" (Bermúdez, 2017), because –pace Bermúdez– most higher-order mental processes (i.e., the processes that organize, initiate, or inhibit the lower-order ones) can be automatized too as there is no known upper limit to the kinds of mental faculties that can become habitual (Araújo et al., 2006; Bruineberg et al., 2019; Kiverstein & Rietveld, 2018, 2021; Legg, 2021).

It is well possible that some skills don't allow some of these components to be automatized (I will discuss this in Sect. 5.2). However, if all or most of the processes underpinning performance control can become habitual, then how do we determine whether the performance as a whole is controlled in a mode habitual enough to be called "skilled"? Let us consider two different approaches to this question: both approaches admit that a performance may result from any combination of habitual and representational components, but they ultimately disagree about *which kinds of performances are controlled skilfully*.

The first, call it the "Skill-No-Skill" approach to hybrid scenarios, is integral to Radical Habitualism. This approach assumes that a performance is perfectly/completely skilled *iff* its components are optimally arranged under the control of habitual dispositions and proportionally less skilled in reason of the number and type of components that are controlled by contentful know-that: in Dreyfus & Dreyfus model, the lower levels of skill (proficiency, competence, etc.) are more imperfect and immature exactly because, unlike levels 5 and 6 (expertise/mastery) they may still involve residual elements of contentful representation (like instructions).

In a way compatible with this framework, the three epistemic qualities of habitual control offer an additional heuristic tool to classify imperfect/incomplete forms of skill: the higher or lower magnitude of these qualities reflects the expertise level of the performance and depends on how many discrete components of the performance are

controlled habitually. From a “Skill-No-Skill perspective”, the fact that most actions involve mixes of habitual and unhabitual components does not imply that both the habitual and the unhabitual contribute to make that action skilled or (unskilled): only the habitual (automatized) components contribute to qualify a certain instance of action execution as expert; on the contrary, the representational and contentful components (reflective) not only do not make an action more skilled but often make it less skilled, either because they directly interfere with the pre-reflective component of control or because they water down the overall skilled quality of the performance by reducing the pre-reflective/reflective ratio.

As for the second approach to hybrid scenarios, call it “Knowledge-No-Knowledge”, it arguably represents the baseline position endorsed by both Intellectualism and Conciliatory Habitualism. Instead of construing performance as a mix of skilled and unskilled components, this approach construes skilful performance as a successful blend of representational (content) and habitual processes (no-content) and skill acquisition as a process based on the “continuing symbiosis or bootstrapping between knowledge and non-knowledge” (Stanley & Krakauer, 2013). This view is epitomized by the original “Mesh” approach spearheaded by Christensen, Sutton, McIlwain (2016), which systematically articulates the principle that “controlled and automatic processes are closely integrated in skilled action, and that cognitive control directly influences motor execution in many cases” (ivi, p. 43).

Cognitive and automatic processes both make a major contribution to skilled action. The basic idea on which this theory is based is that cognitive control is not eliminated in advanced skill, but is rather shifted primarily to higher-level action control. This idea is not new—it can be found in varied forms in prior work. Thus, although Schmidt and Wrisberg (2008) characterize skill learning as a progression to increasingly automatic action production, they also say that increased automaticity in motor production and sensory analysis ‘frees the best performers to engage in higher-order cognitive activities, such as split-second shifts in strategy during a basketball game or spontaneous adjustments in the form or style of a movement in dance or in figure skating’ (ivi, p. 38).

Mesh has the remarkable merit of pointing out that human performance depends on the deep integration of different types of informational processes underlying perceptual, memory, and control systems. This architecture was further complexified by Gallagher and Varga (2020), who have incorporated bottom-up regulation, affective, and external material factors within the framework originally proposed by Christensen and colleagues.

Radical Habitualism does not deny that several varieties of performances, including some skilled ones, may occasionally display a mix of reflective (“cognitive”) and pre-reflective (“automatic”) control or that action automatization may free-up the cognitive resources needed by reflective control processes, as observed by Schmidt and Wrisberg (2008). But Radical Habitualism does dispute two key premises of Mesh: first, the idea that a performer relies more and more on reflective control as their skill level increases (the fact that a greater amount of resources become available for reflection does not allow us to infer that reflection becomes necessary for or beneficial to performance, as discussed in Sect. 5.4.3); and, secondly, the idea that a greater reliance on reflective

control constitutes legitimate evidence that reflective control is constitutive of, skilful performance (because the performances producing better outcomes are not necessarily those executed more skilfully and also because the most experienced performers do not always perform more skilfully than the others, as argued in Sect. 5.3).

In other words, Radical Habitualism primarily questions Mesh because it is not persuaded about the normative criteria chosen by the Knowledge-No-Knowledge approach to evaluate whether a performance is skilled or not. From any Mesh-like perspective it does not matter whether a performance is controlled habitually or not: a performance is skilful, according to the Knowledge-No-Knowledge approach, insofar as the combination of habitual and representational components/aspects, whatever they are, ultimately produces successful outcomes. This definition of expertise is more permissive but requires the introduction of *extrinsic criteria* to define success, that is: criteria that don't track how the action is controlled because they consider only the action's outcomes, which are supposed to provide an exhaustive measure of the performance's competitive efficacy. As I will argue in the next section, this approach is problematic from Radical Habitualism's perspective, which rejects the idea that bare performance outcomes could be a valid and sufficient indicator of the performance true value.

## 5 Notable objections

### 5.1 Summary of the three objections

Appealing to extrinsic criteria that verify exclusively the production of desirable and competitive outcomes, the defenders of the Knowledge-No-Knowledge Approach are in a position to raise the following question against the Skill-No-Skill Approach: instead of trying to disentangle the skilful components of a performance from the unskilful ones, is it not more convenient to assume that a performance is overall skilful if it successfully produces the outcomes that the performer is wishing for? Both Intellectualists and Conciliatory Habitualists may be inclined to believe that Radical Habitualism is somehow compelled to answer positively. One reason to expect such a concession is that it would help Radical Habitualism avoid the theoretical complications highlighted by three objections. The "Scope" Objection (Sect. 5.2): Many expert activities are exquisitely intellectual. Their control does not depend on habit because they have no embodied basis and/or do not fully automatize (e.g., ). The "Efficacy" Objection (Sect. 5.3): Reliance on reflective control, sustained by self-monitoring and deliberate decisions, allows agents to control their actions more efficaciously, producing superior performance outcomes (e.g., Montero, 2016). Finally, the "Modality" Objection (Sect. 5.4): The execution of skilful performances is distinctively associated with representational practices and the manipulation of contentful knowledge (e.g., Fridland, 2019, 2021).

In truth, Radical Habitualism can confidently give a negative answer to the previous question, having robust reasons to oppose any appeal to extrinsic evaluative criteria: first, the spatial contiguity and temporal concomitancy of contentful instructions/judgments and effective control does not prove that the former is integral or necessary to the latter; second, any representational component can undermine the

efficacy of the performance as a whole (empirical claim); third, consistently with our definition (Sect. 2), a performance is not skilful simply because it produces outstanding results but also because the way each component individually and all of them as a whole are executed displays the epistemic qualities that characterize the performance as the doing of an expert (normative claim).

Based on these considerations, Radical Habitualism can deploy exhaustive counterarguments against the Three Objections. I will present these counterarguments in the following sections (Sect. 5.2, 5.3, 5.4), arguing that each objection presupposes a misguided phenomenology of skilful performance. They erroneously presuppose, respectively, that intellectual activities don't have a habitual basis, that performance outcomes are a sufficient indicator of expertise, and that some contentful practices may be constitutive of skilful execution.

## 5.2 The “scope” objection: when intellectual skills are controlled reflectively

The first objection questions the reach of Radical Habitualism more than its intent. This objection fails to acknowledge that, by definition, all skilful performances, whether eminently sensorimotor or not, are characterized not only by their tendency to produce desirable outcomes but also by their distinctive form of execution. In turn, the quality of execution is closely tied to the details of action control. By underestimating that expert action control necessarily emerges from a background of direct experiential familiarity, this objection fails to recognize that all skilful abilities, not only sporting skills, have an embodied and dispositional component as they develop thanks to the incremental sophistication of the agent-environment adaptive coupling. This coupling establishes the expert's inclination to produce richer, more accurate and faster responses to specific perceptual solicitations (i.e., environmental affordances, see Gibson, 1979; Rietveld & Kiverstein, 2014; Miyahara, Ransom & Gallagher 2020) and, correlatively, the expert's ability to predictively anticipate the sensory input following either self-generated (behaviour) or environment-generated (circumstances) events (Robertson & Kirchhoff 2020). As the consolidation of adaptive coupling primarily expresses itself through action automatization, all *expert activities must automatize to some degree* and a practical activity that did not automatize at all (if one ever existed) would be unable to fulfill the key requirements of skilful expertise. All authentically skilful activities are abilities of an embodied, embedded, and dispositional nature, as they emerge from the agent's coupling with the environment (Noë, 2005): this applies, to an extent, also to the activities that *do not entirely automatize*, for example calculus, hermeneutical exegesis, or improvisational abilities infused with cultural, symbolic, and aesthetic meanings, like doodling.

The presence of a robust agent-world coupling primarily grounded in perception–action feedback loop mechanisms is thus a universal criterion to evaluate whether performance execution is skilful, and it applies to all domains of expert activity. Embodied know-how always is habitual *insofar as* and *to the extent that* action control automatizes (Dreyfus, 1996, 2007b) and this principle holds even for those kinds of performances that cannot become entirely habitual: in fact, even an imperfect or incomplete know-how ultimately relies on the meta-stable attunement that the embodied agent establishes with the familiar contexts of their performance (Araújo &

Davids, 2011; Bruineberg et al., 2021), revealing the precarious functional autonomy and self-regulatory capabilities of the agent's body (Barandiaran, 2017; Di Paolo & Iizuka, 2008). Whether it is perfectly or imperfectly attuned to the worldly circumstances, the expert's bodily know-how transpires from their characteristic readiness to spontaneously anticipate and flexibly adjust to fluid contingencies. Pace intellectualists about know-how (Stanley, 2011; Stanley & Krakauer, 2013; Stanley & Williamson, 2017) and intellectualists about skill (Fridland, 2017; Montero, 2016; Toner, Montero & Moran 2015; Wu, 2013), habits are the fundamental constituents of this flexibility, not perils to its exertion.

Even the kinds of performances commonly deemed reflective and exquisitely intellectual (like chess playing, poems composition, and mathematical puzzle-solving), if truly skilful, must have a dispositional root, as they rest on core adaptive capabilities that clearly were acquired and refined via agent-environment coupling. This root is the reason why experts can read real-life contingencies as "rich landscapes of affordances" (Rietveld & Kiverstein, 2014), including linguistic and symbolic affordances (Bruineberg et al., 2019; Kiverstein & Rietveld, 2021), being able to confidently navigate such landscapes to deliver the most appropriate and timely embodied and affective responses. The adaptive coupling is manifested by how identifying the action opportunities relevant to a certain skill engages the expert perceptually and affectively, soliciting their online behaviour through multiple fields of attraction and repulsion that motivate or inhibit this or that pattern of action independently of any detached judgment (Dreyfus, 2008, 2012).

### 5.3 The "efficacy" objection: when contentful knowledge enhances performance outcomes

The second objection defends a belief that, while largely unsubstantiated, is nowadays singularly popular among academic philosophers.

The *Know-that Improves Performance* belief [KIP]: contentful knowledge and judgments (like those conveyed by verbal instructions, exhortations, self-talk, or well-designed action plans) can help agents make the most out of their skills, producing better performance outcomes.

My refutation of KIP is articulated in three steps, aiming to show –contra intellectualism about skill– that no competitive advantage provided by know-that could ever make a performance skilful or expert.

Step 1 (Sect. 5.3.1): the beneficial role played by contentful knowledge in the production of superior performance outcomes is overestimated. The empirical evidence supporting KIP is disputed and limited to particular domains: in some circumstances, the competitive efficacy of habitually controlled actions increases when automatized routines are accompanied by reflective judgments, e.g. strategic indications, execution-guiding instructions, and self-regulation principles, but in other circumstances these judgments decrease the efficacy of habitual actions and put performance at risk.

Step 2 (Sect. 5.3.2): even if performance scientists discovered a general correlation between contentful knowledge and superior performance outcomes, this would



not imply that contentful knowledge is the cause of those outcomes. In particular, even if it was proven that performances accompanied by contentful knowledge tend to produce comparatively superior outcomes, it would still be unclear how representational content could ever play a causally efficacious or semantically relevant role in the control process.

Step 3 (Sect. 5.3.3): even if contentful knowledge was the cause of superior outcomes, that would say nothing about skilful expertise. Even if KIP was validated empirically, it could not disprove Radical Habitualism because it would still be orthogonal to DisC. That is because, in order to assess whether a performance is skilful or not, we need not only criteria to evaluate the *action outcomes* (i.e., the aspects of the performance that make an athlete “score” during a competition) but also, and more importantly, criteria to evaluate whether the *action execution displayed* the distinctive epistemic qualities of skilful control.

### 5.3.1 Refutation of KIP—Step 1: contentful knowledge is less helpful and more detrimental than usually assumed

Is contentful knowledge beneficial or detrimental to competitive performance? Empirical data do not allow a simple answer. On the one hand, the forms of practical engagement categorized by Dreyfus as “present-at-hand”, which include content-manipulating practices of a representational and symbolic nature, are demanding in terms of consumption of attentional and cognitive resources (working memory, attention, processing power, inferential abilities, etc.). Clark & Toribio (1998) call these processes “representation hungry” because they require a greater cognitive effort. Today, embodied cognitive scientists hotly debate which activities are truly representation-hungry (if any), and what methodology should be used to identify them, as it is now becoming clear that many activities traditionally considered cognitively demanding (“imagination, memory, planning, and language processing”, *ibidem*) can in fact be explained without appealing to content-involving representational processes (Dreyfus, 2002a; Hutto & Myin, 2017; Wheeler, 2010b). Despite this controversy, the great majority of philosophers and psychologists agree that, whichever exactly they are, content-manipulating activities tend to be slower and less fluid when they compete for the available cognitive resources with other content-manipulating processes (Hutto & Sánchez García, 2015; Kiverstein & Rietveld, 2018; Maxwell et al., 2003).

On the other hand, knowledge of facts and maxims may facilitate performance outcomes when optimal control substantially depends on a relatively small number of kinematic and biomechanical constraints and, at the same time, explicit instructions allows the performer to regulate the parameters of their performance in accord with such constraints; for example explicit instructions telling a swimmer how to form non-habitual patterns of movements to increase the efficiency of their strokes (Cappuccio & Ilundáin-Agurruza, 2020); or indicating a batter how to maintain non-spontaneous bodily postures to minimize the response time and precision of their actions (Sutton 2007; Fridland, 2021). It is also often remarked that some transfer of knowledge in a declarative format, prevalently through speech, is involved during training, especially if the trainees need linguistic instructions during the process of skill acquisition (Porter,

Wu, Partridge 2010; Fridland, 2013; Komar et al., 2014; Francesconi & Gallagher, 2019).

While acknowledging all these platitudes, Radical Habitualism also stresses the merely derivative and ancillary function of explicit instructions in the activities of novices and experts alike. Two facts, concerning learning (Sect. 5.3.1.1) and peak performance (Sect. 5.3.1.2), respectively, encourage us to deflate the importance usually attributed to contentful judgments to skilful expertise.

**Learning** Coaching and preparation methods that emphasize explicit instructions and rules are not the most beneficial form of skill transfer. Research on dispositional reinvestment indicates that teaching models based on declarative communication engender long-term problems to which analogical (e.g., metaphoric and pantomimic) communication are less exposed (Cappuccio et al., 2019a; Hutto & Sánchez García, 2015; Masters, 1992; Masters & Maxwell, 2008; Maxwell et al., 2000, 2003): skill-learning methods building prevalently on explicit models and instructions offer an experientially impoverished type of training practices because reliance on contentful knowledge can delay the acquisition of the appropriate sensitivity to affordances (Abrahamson & Abdu, 2020; Gray, 2014, 2021); also, such training methods represent a common cause of underperformance in pressured-filled situations, because they predispose experts to compulsively recall principles and instructions, thus compelling them to revert to a novice condition that undermines their confidence in their habitual dispositions and, consequently, their fluid control (Masters, 1992; Masters & Maxwell, 2004; Maxwell et al., 2000).

**Peak performance** Contentful judgment is often detrimental to peak activity and performance optimization. Advices and instructions given by coaches prevalently promote an internal focus in the practitioner (Porter, Wu & Partridge 2010), soliciting them to voluntarily or involuntarily redirect their attention toward components and processes of their performance that have already been automatized (Baumeister, 1984; Cappuccio et al., 2019a, 2019b). This shift from the proximal goals of the performance to the procedural aspects of the execution disrupts the optimal allocation of attentional resources, as demonstrated by several experimental studies on attentional focus (Gray & Cañal-Bruland, 2015; Wulf, 2013, 2015; Wulf et al., 2001). Also, anxiogenic situations tend to trigger a counterproductive tendency to self-representation and introspective thoughts that are prevalently verbal (hence, contentful) in nature (Beilock & Gray, 2012; Castaneda & Gray, 2007): this tendency disrupts performance not only because it overloads the agent's mind with excessive informational content but also and primarily because the analysis of action promoted by reflective thoughts about the agent's own performance hinders the habitual control of the automatised routines that instantiate that very performance, discouraging the agent from confidently relying on habitual dispositions and thus making their action less fluid and adaptive (Beilock & Carr, 2005).

Now, not all contentful judgments and instructions incite self-awareness, and self-awareness may or may not have the assertive (thetic) force of a contentful judgment (Dow, 2017). Therefore, in principle, reflective body awareness and representational content are dissociable like two orthogonal kinds of processes, as correctly remarked

by Montero (2010, 2014), Toner, Montero & Moran (2016), and Bermúdez (2017), among others. However, in practice, these processes tend to occur together and recall each another, promoting reflective over pre-reflective control (Cappuccio et al., 2019b): contentful instructions that single-out specific body parts and component movements predispose the agent to prioritize self-awareness over environmental solicitations (Beilock, 2011; Beilock et al., 2004; Ilundáin-Agurruza, 2016); conversely, spontaneous introspective self-focus incentivizes the recollection and use of contentful heuristics over habitual dispositions (Gray, 2004; Komar et al., 2014). This is confirmed empirically by an “impressive” (Christensen, 2019) array of bodies of evidence: first, distractive interventions aiming at reducing self-directed attention are effective in reducing performance disruption, because they prevent the practitioner from compulsively recalling rules and other verbal thoughts due to anxiety (Beilock et al., 2008; Cappuccio et al., 2019a; Carr, 2015); second, only novices, not experts, are facilitated by explicit instructions about the posture and execution, while experts tend to perform better in conditions that facilitate their pre-reflective engagement (Beilock et al., 2002a, 2002b; Beilock et al., 2002a, 2002b); third, poor reflective judgments (e.g., when an expert is asked to explicitly assess the situation in which they have to perform) do not predict the impairment of habitual competences (experts who judge poorly can still perform familiar actions effectively), while the automatization of sensorimotor routines predict more accurate judgment in the relevant domains (the formation of habitual competences facilitates better judgments, see Beilock & Holt, 2007).

In summary, while it is well-established that contentful knowledge can interfere with expert control in several tasks and add a cognitive burden to control, it is still unclear whether a correlation exists between contentful knowledge and superior performance outcomes, and, if such a correlation exists, it is certainly not universal, but situational and limited to particular solutions adopted in specific domains of activity, mostly instrumentally to enhance performance outcomes.

### 5.3.2 Refutation of KIP—Step 2: contentful knowledge is impotent and irrelevant

Step 1 has questioned the possibility of a universal correlation between contentful knowledge and superior performance outcomes. Step 2 will now specify that even if such correlation existed, uncritically assuming that contentful knowledge is what produces these benefits would be a problematic simplification, for at least three reasons: first, without appropriate task manipulations and counterfactual evidence, it is impossible to ascertain what causal role content plays in the improvement of performance outcomes (if any), see Cappuccio et al. (2019a); second, there might be a trade-off between advantages and disadvantages engendered by contentful knowledge in specific activities that structurally rely on propositional content (e.g., the outcome of the same swimming performance may be improved by some explicit heuristics employed by the swimmer to optimize the position of their arms and, at once, damaged by the reflective self-observation triggered by the very same instructions, see Cappuccio, 2017 and Cappuccio & Ilundáin-Agurruza, 2020); and third, because the advantages and disadvantages brought by contentful knowledge can only be assessed comparing them with the advantages and disadvantages brought by training practices that use little or no contentful knowledge at all. Two facts suggests that, if know-that

has any beneficial role at all in a skilful performance, that role always presupposes, and actually is parasitic on, the concomitant role played by know-how in the same performance (Cappuccio & Wheeler, 2010a, 2010b, 2012).

**Verbal communication is grounded in non-verbal practices** The contentful dimension of speech is sustained by the rich background of bodily and affective interactions in which it is embedded (Kiverstein & Rietveld, 2021): illustrative actions, tool use demonstrations, iconic and indicative gestures, postures, gaze, facial expressions, and proxemics. The acquisition of know-how requires non-verbal information because skill transfer demands communication to be filled with a concrete, situated, operational meaning which derives from examples and exercises, not from the linguistic domain: even when a trainer can accurately describe the objectives that the trainees must achieve, those descriptions can operate causally (i.e., in a functionally efficacious manner) only when they are finally embedded in a background of bodily actions that not only *illustrate* but also concretely *instantiate* those objectives (Abrahamson & Abdu, 2020; Abrahamson et al., 2020). The comprehension of the content of rules and instructions always already presupposes the pre-comprehension of the contentless background of affordances (Bruineberg et al., 2019) to which such rules and instructions refer (Holt & Beilock, 2006) and it is impossible without it (Dreyfus, 1999, 2007b; McManus, 2008).

**The severity of skill disruption grows with the amount of representational content leveraged by rules and instructions** Although recalling the rules learned during training generally interferes with skilful control, some explicit instructions are less detrimental to performance than others. For example, external focus and speed instructions can often be objectively beneficial to performance, and anyway less detrimental than internal focus and execution focus instructions, precisely because, while being conveyed in a reflective (verbal) modality, they promote the pre-reflective regulation of action (i.e., they bring the agent's attention closer to its goal, away from its component processes, see Wulf et al., 2001, 2002; Wulf & Su, 2007; Komar et al., 2014). Thus, they ultimately facilitate absorption in the holistic flux of lived activity, instead of interrupting it with an effort to analyse action for singling out this or that mechanism (Ilundáin-Agurruza, 2016). The reason external focus (Wulf, 2015) and speed instructions (Beilock et al., 2004) are comparatively beneficial is that, while leveraging a minimally reflective process, they prevent action control from becoming fully reflective, thus reducing the overall dependency on explicit knowledge about single action components (Cappuccio et al., 2019a).

That is why we must differentiate two possible functions for contentful representations in performance, considering whether rules and instructions are meant to leverage and support pre-existing habits or rather offer a systematic procedure to act and decide that is completely abstracted from and substitutive of the agent-environment adaptive coupling: in the first case, contentful know-that essentially works as a *trigger* (enabler), *catalyzer* (facilitator), or *enhancer* (multiplier) for the agent's embodied habitual dispositions; in the second, it has instead the function to replace those very dispositions, substituting them with a protocol that is externally-sourced because provided to, rather than developed by, the performer.

Either way, the contentful knowledge conveyed by representations cannot surrogate the know-how embedded in the underlying background of pre-reflective dispositions or operate without such a background, by reason of the *causal impotency* and *semantic irrelevance* of representations, that I will discuss in Sect. 5.3.2.3 and Sect. 5.3.2.4, respectively.

**Causal impotency problem** Representational content cannot exert any causal power over action, as such power can be exerted only by psychophysical processes, not purely formal (i.e., logical, semantic, or syntactic) ones. Explaining how the content of mental representations could engender physical action represents a challenge to philosophy of mind (Adams & Aizawa, 2017). Postulating intermediate cognitive layers between content and action indefinitely delays and pointlessly complicates the treatment of this problem without offering a solution to it. Several philosophers assert the causal impotency of representations because semantic relations ultimately derive from causal efficacy, not viceversa (Chemero, 2009; Hutto, 2013; Kiverstein & Rietveld, 2015). What concretely determines behaviour is the sensorimotor and affective responsiveness embedded in the underlying dispositional mechanisms (muscular, nervous, hormonal systems, etc.). As skilful control is a natural variety of causal power, contentful instructions and rules cannot be its legitimate source. Talks of contentful instructions soliciting and shaping skilful control are essentially metaphorical, as the causal efficacy they portray is merely epiphenomenal or ultimately reducible to dispositions (Hutto & Myin, 2017). In short, know-that merely stands in for the real efficacy of embodied know-how and the advantage allegedly brought by it is either vicarious in nature or entirely apparent. Either way, know-that cannot make an agent perform like an expert because content can only *inform about* the natural world (describing it), not *inform it* (by constituting or changing it).

Certainly, contentful knowledge can boost performance outcomes by offering cognitive scaffolds or epistemic prostheses that ultimately are either parasitic on or reducible to embodied habitual dispositions (Bäckström Gustafsson 2017). However, like training wheels attached to your child's bicycle, these representational scaffolds cannot be considered a legitimate cause of skilful performance until their function is effectively incorporated by the performer as a set of habits... at which point they are not contentful representations anymore.

**Semantic irrelevance problem** An agent can attribute an operational meaning to representational content only if they already possess a performative familiarity with the concrete details of the contexts of action described by such representations (Dreyfus, 2000). Contentful knowledge may happen to be relevant to the execution of this or that action, but it cannot specify all the circumstances in which it is or it is not relevant (Dreyfus, 1999). In this sense, it is fundamentally different from the contentless know-how that we embody when we unconsciously produce fast ocular responses or habitual gestures, a knowledge that is entirely self-sufficient because immediately tailored to the context. In turn, contentful rules and instructions can help us navigate a context of action only insofar as their practical relevance is specified by underlying habitual dispositions (Cappuccio & Kiverstein & Rietveld, 2018; Wheeler, 2010a,

2010b, 2012). When an agent becomes able to perform skilfully without being explicitly informed about the contextual conditions (e.g., descriptions of when and how to act) it is because their know-that has already been replaced by implicit know-how (sensitivity to background conditions). So, even when effectively applied to improve or correct one's *know-that does never become one with that ability*: content is not embedded into the performer's skillset as such.

Some authors have argued that practical knowledge encoded in "executable action concepts" is simultaneously or diachronically accessible by multiple cognitive systems to produce either propositional representation or action, based on the needs of the moment, hence its function is to mediate between contentless and contentful levels of cognitive processing (Ferretti & Zipoli Caiani, 2021). Ironically, this hypothesis undermines representationalism, instead of corroborating it, because it requires that some implausibly rich and detailed concepts are incessantly formed, stored, and manipulated to discretely represent the incalculable varieties of situated contingencies in which the agent is immersed. Our experience of skilful control reveals, in contrast, the simple and direct nature of our response to these contingencies, a response that does not display any sign of the cognitive effort that would be necessary to process them as contentful representations. Even if the format of the relevant concepts were actional (as suggested by the proponents), this would not make their content less discrete and finite, hence it would not make them more adequate to the infinite complexity of real contexts. The content of rules and instructions is never concretely meaningful per se but can operate efficaciously as a proxy of practical dispositions only if the agent is already experientially acquainted with the pre-reflective background of performative know-how.

These considerations recall and expand Ryle's (1949/2009) Crucial Objection against Intellectualism about Know-How [CROKH] (see Pavese, 2021). Stanley (2011) summarizes CROKH in the following way: if know-how were entirely reducible to propositional know-that, as intellectualism maintains, then Premise 1 and Premise 2 should be simultaneously true:

Premise 1: "The Intellectualist view entails that 'for any operation to be intelligently executed', there must be a prior consideration of a proposition".

Premise 2: "The consideration of propositions is itself an operation the execution of which can be more or less intelligent, less or more stupid".

But this would imply that "acting intelligently requires the performance of an infinite number of prior actions, which is a vicious regress" (Stanley, 2011, p. 214).<sup>13</sup> A proposition could be a valid guide to expert performance only if it exhaustively specified how the relevant action is to be correctly executed, but applying the proposition to the context is a skilful action itself, an action that can be executed correctly

<sup>13</sup> "The Intellectualist is committed to the view that each intelligent action is preceded by a prior action of considering a proposition. Since considering a proposition is something that can be done intelligently or stupidly, it is an intelligent action. So, acting intelligently requires a prior action of considering a proposition, and considering a proposition intelligently requires a prior action of considering a proposition intelligently. Presumably, if any of these prior actions is performed stupidly, then the original action will not be performed intelligently. But then acting intelligently requires the performance of an infinite number of prior actions, which is a vicious regress" (Stanley 2011, p. 215).

only if another proposition exhaustively specifies how this is to be done. To skilfully implement the instructions provided by the first proposition, some supplementary propositional knowledge is necessary, which in turn requires the correct implementation of the instructions provided by other propositions, and so on ad libitum. No finite amount of know-that per se could exhaustively specify the correct modality of its own application. CROKH implies that intellectualism about know-how is false because the skilful application of any bit of know-how requires the prior manipulation of an infinite amount of know-that.

Intellectualists about know-how have proposed a number of theoretical solutions to break the regress highlighted by CROKH (Stanley & Williamson 2017; Pavese, 2021) but they have yet to address the puzzle in its most general and fundamental form. We find this general formulation in Dreyfus, where the infinite regress, instead of being caused by the underspecified nature of linguistic denotation, arises from the inherent finitude and hermeneutical situatedness of representational knowledge itself. In fact, while formulated in a different domain, Ryle's diagnosis closely resembles Dreyfus' phenomenological and existential analyses of the *Frame Problem*, which point to an equally debilitating form of infinite regress (Dreyfus & Dreyfus, 1988; Dreyfus, 2008, 2012, see also Dennett, 1984).

For Dreyfus the problem is that the finite informational content carried by a finite set of representations would never be sufficient to correctly and exhaustively denote a horizon of concrete real-world circumstances, because any attempt to represent such a horizon that is not infinitely complex like the horizon itself is inevitably incomplete and thus meaningless (Andler, 2000; McManus, 2008; Fusche Moe, 2004; Wheeler, 2008; Cappuccio & Wheeler, 2010a, 2010b, 2012). The information conveyed by representations (of which propositions are just a subset) could help an agent meaningfully navigate a practical context only if such representations (A) were connected to a non-representational background of pre-reflective familiarity that enabled their hermeneutical pre-comprehension or (B) exhaustively portrayed all the defining aspects of all the relevant practical contexts in which that information is applicable. A is exactly the option that intellectualism excludes. The problem with the remaining option (B) is that distinguishing the aspects characterizing the relevant contexts from the aspects characterizing the irrelevant ones requires meta-contextual information (i.e. more contentful representations), which again cannot specify all the preconditions of its contextual application. Thus, the correct interpretation of any representation requires the prior interpretation of infinitely nested levels of meta-representations.

This is particularly evident when representations are meant to convey rules and instructional maxims as guides to skilful performance.<sup>14</sup> Unlike artificial toy-worlds (simulations based on representations characterised by a finite number of parameters),

<sup>14</sup> "Naturally, we can exchange the skills of language with the skills of soccer and reach the same end result as Dreyfus has done. The argument will then go like this: If we are to establish a full-blown theory of the skills of a soccer player, we not only must have rules for how the player shall kick and run, but we also need a specification of the rules that makes the player able to recognize the contexts of where the rules are applied. And with the constant changes of the game, we are talking about many rules. The cognitivist must therefore be able to specify an enormous number of rules that make sure that the soccer player is capable of recognizing the different situations and so on. But if the theory then requires even more rules to be able to explain how the former rules are applied, as the pure cognitivist must do according to Dreyfus, then we are in an infinite regress of rules required for applying rules." (Fusche Moe 2005, p. 169).



real-life scenarios are characterised by an incalculable number of finely grained practical contingencies, so massively interconnected that even a minor variation in their global configuration may generate systemic effects capable to impact the whole performance (Dreyfus, 2008; Wheeler, 2008). Rules and instructions cannot be a valid guide to skilful control because the informational content they carry is inherently underdetermined to specify how the agent must negotiate all the possible contextual contingencies: it would never be sufficiently comprehensive and granular to inform the kind of on-line agile and flexible decisions required by the circumstances. Subsequently, the practical indications generated by explicit commands and rules cannot be fluid and adaptive like those spontaneously arising from embodied, habitual dispositions. Without the adaptiveness distinctively granted by habitual dealings with the action context, an agent cannot effectively implement general rules to particular actions, which remain rigid, mechanical, and “out-of-context” (Ramírez-Vizcaya & Froese, 2020).

Both Dreyfus and Ryle point to the epistemic constraints of representational cognition. Causal impotency and semantic irrelevance are consequences of the fact that a representation, regardless of how rich, cannot provide real-world grounding to the information it carries, because it remains causally decoupled from the dynamical context that makes them relevant. If contentful representations are unable to specify in which contexts they are relevant/useful it is because, without a background of pre-comprehension, they are just static, discrete, self-contained units of information that do not co-vary with the context to which they are supposed to be relevant or the cognitive systems that makes sense of this information, which in turn are dynamic, continuous, and expansive like other natural processes (Hutto, 2012). That is why the epistemic quality of representations is incompatible with the skilful processes they are supposed to guide. Habitual dispositions, on the contrary, materially originate from and are spatio-temporally grounded in the infinitely complex details of the very adaptive coupling that makes expert behavioural responses causally efficient and, at once, inherently relevant to the varying contexts of activity.

### 5.3.3 Refutation of KIP—Step 3: better outcomes do not imply greater expertise

So far, we have questioned the capability of contentful knowledge to enhance performance outcomes. In truth, even if contentful knowledge played a relevant causal role in making an agent more efficacious in a competitive context, that competitive advantage would still tell nothing about whether their performance was executed skilfully or not.

Assessing a performance based on its outcome serves to produce a comparative judgment about its efficacy. An assessment exclusively based on outcomes reflects a cognitive bias similar to *selective abstraction* (Maric et al., 2011): a particular aspect or feature of a performance (e.g., the number of goals scored during a match, the height of a jump) is singled out to become “the outcome” of the performance, i.e. the result of an action conceptually separated from the quality and form of its execution. In many domains of expertise (e.g., who is the most skilled painter? The most skilled coder?), this process of abstraction is largely arbitrary in the sense that it depends on conventions and decisions established by communities of humans within their

shared cultural practices (Cappuccio & Ilundáin-Agurruza, 2020; Ilundáin-Agurruza, 2016). An abstractive process of this kind may be to an extent unavoidable, but its arbitrariness often risks confounding the recognition of authentic expertise: even when empirically accurate, a value judgment on skill *exclusively* based on outcomes de facto reduces a performance to an instrumental action, contradicting the very definition of performance and thus preventing the broader appreciation of the particular contextual contingencies in response of which performances are produced.

Although sport business puts brute results under the spotlight and idolizes competition winners, it is clear to experienced coaches and club managers that the most skilled player in their team is not necessarily the one who has scored more points in the season, as there are myriads of other qualities to be considered in a comparative evaluation of their overall performance. Often, in the professional and artistic domains, the value of outcomes is not clearly defined by objective measurements systems, thus assigning an objective “score” to a performer proves even more difficult, as the correct evaluation of their performance involves situated normative principles that are qualitative and value-laden in character (Rietveld, 2008). Unless these principles are deeply incorporated in our immediate ways of feeling and perceiving, performance comparative assessment is an inherently complex, possibly endless, endeavour. Even in contexts characterised by objectively measurable and perfectly quantifiable outcomes (i.e., standardized, controlled environments such as the sporting field or the experimental laboratory), performance assessment is never exhausted by the measurement of this or that variable alone, as it also depends on the interpretation of their particular contextual significance.

The inadequacy of outcome-centric assessment methods is illustrated by the possibility to artificially enhance or reduce performance outcomes without affecting the agent’s skill level. Let us consider three categories of *expedients used to enhance performance outcomes*. Under the first category we find expedients like muscle development routines or meditation and relaxation practices for self-regulation and emotional control. These expedients, if proven safe for the athletes, are accepted by the sport community because they enhance the same kinds of abilities that normally underpin skill. By enhancing the abilities that univocally and specifically constitute the foundation of a certain skill, these expedients are considered legitimate aids to support that skill’s development.

The second category includes expedients such as chemical boosts or cybernetic augmentation. They are forbidden in agonistic activities not only because they can be harmful and violate the athlete’s psychophysical integrity but also because they violate the principles of sportive competition, as they artificially enhance performance outcomes without promoting legitimate skill improvement.

Our evaluation becomes more difficult with the third category of expedients, which includes *auxiliary skillsets* that are acquired with the intent to enhance the outcomes of the skillset immediately relevant to competition. An auxiliary skillset  $\psi$  is an expedient to support their *performance skillset proper*  $\varphi$ : for example, a professional golfer may decide to learn meditation techniques to improve his golf putting performance. The fact that  $\psi$  can be instrumentally exploited to optimise/enhance the outcome of their  $\varphi$ -performance indicates their expertise in  $\psi$ , not  $\varphi$ . In turn, expertise in  $\varphi$  per se does not entail skill  $\psi$ , unless  $\psi$  clearly is a structural component of  $\varphi$ : this would clearly be

the case only if  $\psi$ -expertise were (1) systematically required in all  $\varphi$ -performances and (2) specifically tailored to enhance  $\varphi$ -performances. These two circumstances rarely occur and anyway almost never together: golfers can perfectly put without meditation techniques, which, in turn, are not specifically designed to improve golf putting. This means that the efficacy of these auxiliary skillsets is not constitutive of the performer's expertise: in fact, the magnitude of the competitive advantage that they provide is pretty much orthogonal to the experiential history of the agent. Thus, a  $\varphi$ -performance is not more skilful because its outcome was enhanced by an expedient  $\psi$  if the nature of  $\psi$  is merely instrumental to increase the outcomes of  $\varphi$  or if  $\psi$  was acquired independently of  $\varphi$ , as either circumstance contradicts the definition of skilful performance.

Only the expedients in the first category contribute to increase one's expertise, because –unlike the other two– they are legitimate constituents of the process of skill development. The expedients listed in the third category, which use auxiliary knowledge to improve one's performance, are more similar to the expedients of the second category in the sense that they enhance performance outcomes without increasing the know-how embedded in one's inherent control capability. This confirms my point that success is not a valid indicator of one's skilful expertise.

The same reasoning applies, in reverse, to the disruptive factors that typically cause a performance to fail. Some cases of underperformance are engendered by conditions (e.g., physical debilitation or contingent distractors) that undermine the agent's efficacy in a competition without reducing their habitual control. A poor performance outcome engendered by one of these objective extrinsic factors does not give reasons to doubt that the agent performed like an expert. Remarkably, this reasoning does not apply to other debilitating factors, like performance anxiety, which affect experts, and experts only, by interfering with their habitual control. In these cases, underperformance is caused exactly by the agent's incapability to perform “like an expert”.

Choke, a psychological effect particularly feared by expert athletes and performers, is effectively explained as the subconscious tendency to reinvest attention into the explicit monitoring of action execution (Baumeister, 1984; Beilock, 2008, 2011; Hill et al., 2010). Skilful expertise deteriorates when habitual control is disrupted by self-focus. That is why leading sport psychologists construe choking as a *debilitating paralysis* of the automatized behaviours caused by compulsive self-monitoring, either spontaneously produced or promoted by explicit instructions (Beilock & Carr, 2005; Castaneda & Gray 2007; Mesagno & Hill, 2013). The sufferers of choking are diagnosed with a *temporarily loss of their normal ability to perform as experts* exactly because they involuntarily revert to a novice condition as soon as they start to compulsively monitor their own actions (Cappuccio et al., 2019a, 2019b; Jackson et al., 2006; Masters & Maxwell, 2008).

Of course, experts tend to be more successful than novices: skilful expertise (S) goes hand in hand with outstanding outcomes (O) and we expect to find them together. Radical Habitualism does not deny that an inductive correlation between S and O exists but reminds us that it goes only in one direction (the implication  $S \rightarrow O$  does not justify the converse implication  $O \rightarrow S$ ); moreover, correlation does not mean causation; causation is only one aspect of constitution; and constitutive accounts (i.e., essentialist accounts that characterise  $x$  in terms of  $x$ 's ontological components) are not more informative than explanatory ones (i.e., processual accounts that describe  $x$

in terms of how  $x$  functions and what it concretely does). Even the fact that a non-lucky agent can compete with experts, reliably producing performances comparable to those generally expected from skilled performers, is insufficient to prove that they truly have the expertise: a junior boxer with limited experience on the ring and poor technique is likely to win several matches if he is naturally gifted with an extraordinarily robust built and lightning-fast fists. The evidence that experts frequently produce outstanding outcomes is per se insufficient to infer that any agent producing outstanding outcomes truly is an expert. To ensure that  $O$  is a reliable and accurate indicator of  $S$  we need an account that satisfactorily explains their causal relation.

Performance measurements collected in highly controlled environments can, in principle, justify an inference to the best explanation from  $O$  to  $S$ , which is why such measurements are conducted in laboratories and athletic competitions alike: by filtering out all accidental factors (including random circumstances and the agent's natural "gifts"), they artificially construct a link between outcomes and putative skill level. Such a selective construction, however, offers only a narrow picture of skilful expertise because the information it provides is less ecologically valid than the information provided by a more comprehensive assessment (e.g., it ignores that exploiting accidental circumstances and abilities is a prerogative of experts, see Davids et al., 2012).

"Skill is relative rather than absolute" warned us Logan (1985), referring to the fact that a performance can be considered more or less skilful only in relation to a particular context, or world-environment, to which their skill is originally attuned. "We may talk about skilled performers versus unskilled performers, but we immediately recognize that this is only a convenient fiction. There is no sharp demarcation between the skilled and the unskilled" at least not if we assume that a skill is a simple, objective feature of an agent or if we evaluate a skilful performance simply looking at its outcomes abstracted from the modality of its execution.

However, this does not mean that expertise level is an illusion or that it is an indiscernible property. We can and we normally do recognize an expert boxer because, in addition to scoring many victories, he demonstrates an elegantly balanced stance, an impenetrable defence, perfectly timed moves, and a confident use of fancy footwork (*inter alia*). *While being situated and relational, these features tell us exactly why* he is very often the one who prevails on the ring, thus – by providing an accurate description of how the performance was executed, these features offer also an explanation of his outstanding outcomes.

Obviously, the boxer who can count on such a bodily know-how tends to be also the one who wins his matches more frequently. After all, their know-how was expressly developed through practice for winning matches. But the point is that even an unimpressive or common outcome on the ring may be perfectly skilful, if the boxer performs a complex sensorimotor task with flawless perceptual, motoric, and emotional readiness, dealing effectively with an adversary that most boxers would consider dangerous. The skilful quality of an action shines through its form of execution, revealing how confidently the boxer's actions are regulated and how harmoniously they are organized. Conversely, a performance cannot be considered skilful, despite its impressive outcome, if its execution is poor or does not entirely originate from the agent (i.e., when it depends on supplementary aids).

This three-step refutation of KIP definitively dismisses the Efficacy Objection: the competitive advantage brought by contentful knowledge is situational, modest, uncertain, or merely apparent, and anyway orthogonal to skill level because insufficient to explain successful performances.

#### 5.4 The “modality” objection: when execution is informed by representation

The line of argument used to block the Efficacy Objection cannot work against the third objection, which asserts that mastering certain content-involving practices distinctively characterizes the expert’s performance’s mode of execution, independently of its outcomes.

The Modality Objection correctly acknowledges that skill transpires from the form of execution, but wrongly assumes that contentful knowledge contributes to make the execution of a performance more skilled. This objection misinterprets some empirical facts broadly confirmed by experimentation and the practitioners’ reports: experts, compared to novices, are capable to give more accurate judgments and richer verbal accounts of their performance (Sect. 5.4.1); experts, more frequently than novices, are able to deal creatively and improvisationally with difficult or unprecedented problems (Sect. 5.4.2); experts, more competently than novices, strategize and make complex decisions during performance (Sect. 5.4.3).

The objection assumes that, because verbal reporting, creative improvisation, and strategic decision-making predict higher skill levels, they must essentially define the distinctive way experts perform (Fridland, 2021). So, Objection #3 argues that these cases undermine Radical Habitualism because they (a) indicate the agent performed like an expert and (b) their performance involved reflective, contentful judgements and deliberative processes that cannot be automatized. I shall question these two points, arguing that verbal reporting, strategic decision-making, and creative improvisation either (a) are insufficient to prove that the agent performed like an expert or (b) can be automatized, or both.

##### 5.4.1 Regarding rich accounts of ongoing or past performances

One of the main arguments against intellectualism about know-how is that the ability to execute certain actions and the ability to report on them seem totally unrelated: experts often struggle to describe “how they did it”, while many excellent coaches are not able to perform the actions they effectively describe to their trainees. Nonetheless, intellectualists find it remarkable that some expert performers tend to indulge in copious efforts of recollection and verbalisation of their prior actions. Moreover, these performers’ potential to generate rich verbal accounts after performance seems to increase with the agent’s expertise level. This is plausible. However, a greater potential of this kind does not predict more skilful performances. The loquacity of experts is largely explained by the well-known fact that people tend to have a broad (but not always deep or reliable) factual knowledge in their areas of personal or professional interest, as they hold stronger and more articulated (but not always accurate or insightful) opinions about it (Logan, 1985).

Obviously, retrospectively analysing one's own performances during the debriefing phase can help a professional performer identify mistakes and areas of improvement, thus increasing the effectiveness of their successive training. However, there is no evidence that performances accompanied by accurate verbal accounts are executed more skilfully. On the contrary, experiments show that, when they perform skilfully, experts, compared to novices, tend to generate fewer explicit judgments about their ongoing performance (Beilock et al., 2002b). Also, offline verbalization about a new motor experience tends to damage subsequent performances in novices (Chauvel et al., 2013). Last but not least, experts, compared to novices, recollect specific episodes or aspects of their performance with lower accuracy and granularity. This well-documented phenomenon is called "expertise-induced amnesia" (Beilock & Carr, 2004, 2005): skilled performers can produce rich accounts concerning the extra-personal dynamics underpinning execution (e.g., the scientific knowledge of the metabolic processes relevant to energy-use maximization) or the personal dynamics that oversight execution (e.g., the strategic knowledge relevant to effective action planning and rational decision making), but their verbal recollection of the details of specific instances of performance execution (episodic memory) tends to be, compared to novices, vague and impressionistic (Beilock & Carr, 2004; Beilock et al., 2002a, 2002b).

This tendency is explained by studies on attentional focus (Wulf, 2015) and embodied perception (Gray & Cañal-Bruland, 2015): the attention of experts, during peak performance, spontaneously tends to target their immediate intended effects, not the components of their movement: their habitual engagement disinclines (but does not mechanically prevent) them from closely monitoring their ongoing actions, thus reducing the amount of contentful information they can extract and encode from their ongoing execution (Cappuccio et al., 2019a, 2019b; Gray, 2004).

That is because reflective self-monitoring tends to disrupt expert performance, as testified by the fact that catastrophic performance deterioration correlates to both compulsive self-monitoring and pressure-filled environments. Gray (2004) indicates that, in situations of psychological distress, the attention of experts tends to target the procedural components of their movements, deteriorating the execution of their habitual actions while improving the accuracy of their judgments about those very actions. The cognitive effort required to report on one's own actions, making concurrent judgments, is part of the process that deteriorates their execution (Flegal & Anderson, 2008). This is enough to reject the claim that verbal processes are a defining, positive feature of the skilful control of experts.

#### 5.4.2 Regarding the ability to act creatively and improvisationally

The fact that experts are more confident and effective than novices in exerting their creativity during peak performance could undermine DisC only if creatively improvised action was obviously unhabitual in nature. However, the idea that creativity and imagination necessarily involve contentful knowledge is disputed (Hutto & Myin, 2017), while there are many reasons to understand the imaginative and visualisation processes

behind improvised performance as non-representational in nature (Rucińska & Aggerholm, 2019) and fundamentally based on embodied habitual dispositions (Beilock & Gonso, 2008).

Besides, our previous considerations on unready-to-hand forms of interaction indicate that the DisC would still be valid even if the creative and improvised control of an expert proved completely unhabitual: the transient formation and situational application of action-oriented representations as temporary scaffolds to deal with unfamiliar circumstances can be facilitated by richer and opportunely diversified constellations of habitual dispositions. This explains why expertise level positively contributes to the process that brings an expert to envision and apply minimally representational forms of control in troubled scenarios (Baggio, 2021; Cappuccio & Wheeler, 2012; Wheeler, 2005). Therefore, whether or not action-oriented representations constitute truly contentful cognitive devices, their performative efficacy is ultimately to be credited to pre-reflective processes (Hutto, 2013). This means that even unready-to-hand action is truly skilful only to the extent that it is controlled pre-reflectively, i.e. when habitual dispositions played an active role in improvising a coping strategy, and it is unskilled (or progressively less skilled) commensurately to how such strategy was not supported by any habitual dispositions.

That is because, when imaginative abilities are sustained by decoupled, contentful processes, they must rely on auxiliary and expediential sources of knowledge that are essentially different from the expertise deriving from historical agent-environment coupling, thus such abilities cannot have the characteristic epistemic qualities (and constraints) of skilful control (Rucińska & Gallagher, 2021).

#### 5.4.3 Regarding decision-making and strategic reflection

Dreyfus' account of skill levels emphasizes that experts tend to have a superior awareness of the bigger picture, which helps them plan their actions with a strategic perspective, possibly a long-term one. Papineau (2015) remarks that experts prefer planning their purposeful activity in accord with holistic styles and distal goals. Strategic reasoning is often constructed as the high-level decisional process that organizes motor intentions subordinating them to distal and more general intentions (Fridland, 2021). The objection emphasizes not only that representations can be used to strategize, but also that they are used more frequently, effectively, and confidently by experts than novices (Christensen et al., 2016): this is used as evidence that contentful knowledge can play a constitutive role in the control of expert performance (Gallagher, 2018; Gallagher & Varga, 2020).

This inference is, however, flawed: as in the case of imagination used improvisationally, we must again remark that, while rational  $x$  aiming to build a hierarchy of means and ends is often sustained by reflective awareness and explicit representation (Mylopoulos & Pacherie, 2019), this is neither necessary nor constitutive in many kinds of skilful activities; moreover, strategic reasoning, like any other component of a performance, can be truly reflective without being simultaneously skilful. Once again, we need to distinguish the instances of strategic reasoning that are grounded in pre-reflective control from the reflective ones, while assessing which of them deserve to be called "skilful".



**When strategic reasoning skills are dispositional and incorporated in the same habits that control the performance** This happens, paradigmatically, when the practical knowledge relevant to strategic decision-making is contextually embedded: know-how solutions are created “on the fly” from patterns of thought and volition spontaneously solicited as part of one’s automatic dispositions (Araújo et al., 2006). This is illustrated by fast chess playing in which complex anticipations of the adversary’s behaviour are generated in a purely habitual manner and the depth of the player’s strategic vision is strictly contingent upon their embodied responsiveness to familiar patterns of spatial organization and correlated activity (Dreyfus, 2002b). Some strategically significant preferences and inclinations have, as a matter of fact, an embodied and affective root determined by sensorimotor familiarity (Beilock & Holt, 2007). In these paradigmatic cases, decision is implicit and its burden is taken on by embodied habitual dispositions, not representation, thus control is pre-reflective (Brownstein ).

Pre-reflective decision-making and automatized problem-solving are normally available at the highest levels of expertise, starting from “Competence” level. Dreyfus and Dreyfus (1980, 1988) portray this kind of strategic intuition as an intelligent propensity that, in many ways, is more similar to a gut reaction or an acquired instinct than to detached and unemotional calculus. While largely pre-reflective, this “deliberative rationality” is often supported by planning practices that can be lengthy and demanding. One way to construe complex rational planning as an embodied, dispositional process is using the notion of embedded or *nested affordances* (Rucińska, 2021), i.e. articulated chains of action possibilities that are perceived in the environment as indicating secondary action possibilities, and secondary action possibilities that indicate tertiary ones, and so on – with the number of embedded levels of action possibilities being limited uniquely by the agent’s perceptual specifications, nor their cognitive resources. Elaborating on similar premises, Cappuccio, Sánchez García & Ilundáin-Agurreza (forthcoming) have developed a general pre-reflective non-representational account of strategic decision and skilful planning inspired by the ancient concept of “Metis”, described by the Greek as a cunning, crafty, resourceful, and often deceptive form of embodied intelligence and epitomized, for example, by Ulysses in the Homeric poems and, in more recent times, by Captain Kirk in Star Trek. Metis is a dispositional quality deeply related to the classical virtue of *practical wisdom*, that Dreyfus conceives as the equivalent of skilful coping in the moral domain (Gehrman, 2016).

**When strategic reasoning skills are representational and rely on contentful knowledge** Know-that  $\psi$  is used by the agent expedientially, to enhance their performance  $\varphi$ . As such,  $\psi$  is decoupled from the context of performance  $\varphi$  itself, which is why it often is processed asynchronously from online performance control. In this case, the expediential knowledge is based on contentful rules, models or instructions, and its contribution to the control of performance  $\varphi$  is reflective. However, as discussed earlier, the knowledge informing the control of  $\varphi$  cannot be considered part of  $\varphi$  if it does not belong to the agent in an intimately familiar manner (Sect. 5.3.3) and does not display the three epistemic qualities of skilful control (Sect. 3.3). A sport performance cannot be controlled in a familiar manner if the agent relies on know-that about principles and facts established by academic disciplines such as performance science,

kinesiology, logistics, cognitive neurosciences, metabolic medicine and biochemistry, or any other discipline that studies the skills of experts without presupposing direct practice or exercise. By extension, if the strategic reasoning skill  $\psi$  is based on contentful knowledge acquired independently of skillset  $\varphi$  then, at best,  $\psi$  proves the performer's ability to effectively extract some instructional maxims or notions that are relevant to performance  $\varphi$ . However, this only proves the performer's erudition and their ability to apply such erudition to a practical domain  $\varphi$  like an advanced beginner, not the performer's competency in the  $\varphi$  skillset.

To summarize, also control based on strategic decision is unable to undermine Radical Habitualism because (consistently with DisC) such control is either: (i) habitual and deeply rooted in the same skillset used to perform; (ii) reflective because based on contentful knowledge and, thus, unskilled because irrelevant to determine the agent's expertise level. Consequently, it is not true that performers, even the most strategic ones, rely more and more on reflective control as their skill level increase. Moreover, a greater reliance on reflective control does not constitute legitimate evidence that reflection plays a greater control function in skilful performance.

### 5.5 Provisional conclusions: in favour of the Skill-No-Skill approach

Our analysis of the three objections has proven that even intellectual activities have a habitual basis, that performance outcomes are not reliable evidence of expertise, and that reflective practices cannot be constitutive elements of skilful execution. These analyses definitively undermine the Knowledge-No-Knowledge approach to hybrid scenarios because they prove that the performer's ability to effectively combine some auxiliary know-that  $\psi$  with the habitual dispositions underpinning performance  $\varphi$  is not a valid indicator of the performer's expertise in  $\varphi$ . The fact that the ability to use  $\psi$  increases with the performer's skill level in  $\varphi$  does not prove that representations have a greater role in their skilled performance: on the contrary, it suggests that the habitual dispositions previously acquired by the performer scaffold his abilities to act pre-reflectively and reflectively alike.

So, the Knowledge-No-Knowledge approach is wrong because the agent's ability to combine elements of reflective and unreflective control is ultimately irrelevant to assess the agent's expertise in  $\varphi$ . Conversely, a robust pre-reflective control capability emerging from well-trained habitual dispositions in  $\varphi$  is a key precondition to adequately and adaptively apply the reflective resources provided by  $\psi$ . Thus, whether know-that is involved instrumentally in a performance or not, only the agent's habitual dispositions reliably indicate the agent's authentic potential to execute a performance skilfully and moreover they represent a crucial factor for the agent's odds to perform successfully (producing desirable outcomes); conversely, if such know-that is not supported by an adequate background of habitual dispositions, it improves performance only situationally, conditionally, and partially, and certainly cannot make their performance more skilful.

This gives us some strong reasons to prefer the Skill-No-Skill approach over the Knowledge-No-Knowledge approach, rejecting the supposition that a skilful performance is essentially the one that produces the outcomes wished for by the

performer. By systematically neutralizing the three objections against the Skill-No-Skill approach, this section has eventually corroborated the DisC: if the performer's actions are ultimately governed by contentful knowledge, then they are not controlled skilfully. It has also helped us articulate the idea that, when a performer appeals to contentful knowledge to enhance or modulate behaviours that are already under the control of robust habitual dispositions, that performer can act like an expert only to the extent that a pre-reflective attunement with the performance environment sustains their engagement with the task's context.

This result finally confirms that the contribution offered to skilful control by rules and instructional maxims is either epiphenomenal or entirely reducible to the habitual dispositions in which the comprehension of rules and instructional maxims is embedded, because the ability to control a performance *skilfully* (regardless of its outcomes) derives solely from the history of their online embodied engagement. In short, what we have learned is: first, the fact that actions involve mixes of habitual and unhabitual components does not mean that the habitual and the unhabitual contribute to make that action skilled (or unskilled): only the habitual components contribute to qualify an instance of action execution as expert; on the contrary, the non-representational or contentful components (reflective) not only do not always make an action more skilled but are also likely to make it less skilled.

## 6 An illustration: the BBQ scenario

Let us conclude with a thematic analysis meant to exemplify the concepts reviewed so far. Perfectly grilling steaks on a barbeque is a skilled activity that demands the competent use of several tools and techniques. Contentful indications learned from written or verbal accounts are insufficient to master the tricks of the trade, which must be painstakingly practiced in real-life scenarios until one is entirely confident about their implementation in a range of quite different situations.

This does not mean that the performance of a BBQ master can never include any contentful knowledge at all. Experts continuously recall old information or search for new one, for example when they consult a recipe book to confirm the cooking time of a certain kind of meat. The point is that, while this contentful knowledge may or may not help them complete their task, it certainly does not help them do it *as experts*. The knowledge of recipes and procedures becomes an effective guide to action only once it is incorporated as a set of habitual dispositions, which prepare the cook to recognize and appropriately respond to the relevant environmental solicitations, making grilling their second nature. Every bit of contentful knowledge initially learned from books or verbal instructions must become contentless if it has to be applied skilfully. The cook must incorporate this know-that as a set of pre-reflective dispositions.

For, example both unexperienced and experienced grillers may find it useful to rely on a digital BBQ thermometer to check that a steak has reached the right internal temperature. Determining when the steak is ready is a complex decision that must take into account the thickness of the steak, the meat type, its cut, the fire temperature, the grilling technique, the BBQ specifications, and several other variables. Without the BBQ thermometer's aid and without cutting the meat to check its internal colour,

no novice and only few amateurs can track these variables, which is why non-experts are typically advised to use a thermometer to avoid disappointing outcomes. However, nobody would say that their cooking performance became more skilful because they started relying on such an external aid. The novice's dependency on this tool is exactly what reveals that their control of the grilling process is still uncertain: such dependency betrays their inexperience despite their steaks being perfectly done. What betrays their unpreparedness is not the artificial nature of the technological tool they rely on, but the fact that their decision is entirely delegated to an extrinsic judgment of a contentful nature. We would have equal reasons to consider them inexperienced if the same contentful information originated from a different source (e.g., the advice of another cook in the kitchen, a manual of BBQ techniques, a microchip implanted in their pre-frontal cortex, etc.): in all these cases, control is entrusted to some discrete, self-contained operation entirely independent of the agent's performative history and decoupled from the context in which performance is executed.

Some BBQ experts pride themselves to avoid thermometers because –they say– a true master checks the doneness of the meat simply using their tactile and visual abilities. Other professional chefs systematically use thermometers to minimize the risk of disappointing their diners, especially when they must supervise numerous grills at once: they deem thermometers objectively useful and see no shame in using them. These are just subjective preferences. What crucially distinguishes experts from novices is that, when they are not allowed to use a thermometer, experts have significantly better chances to guess the right cooking time. Also, out of two perfectly done steaks, respectively cooked by two different cooks with and without the help of a thermometer, the steak cooked without the thermometer certainly is –all the other things being equal– the one cooked by the most experienced cook between the two. Also, the cook's expertise is indicated by the cooking style (elegance, parsimony, rapidity, confidence, etc.) no less than its final outcome, although the former might be less apparent than the latter: true skill shows first of all in the fine control exerted by the master, when the distinctive epistemic qualities of expert know-how make a crucial difference.

There is more. Experts and novices don't apply the thermometer with the same effectiveness: using the thermometer appropriately is challenging for a beginner, even after they duly memorized all the applicable instructions, as these instructions (regardless of how detailed they are) are never sufficient to make appropriate decisions in all possible contexts. What is the best way to position the thermometer? What is the best course of action when the thermometer reaches the critical temperature? Abruptly removing the steak from the fire, flipping it to the other side, moving it to a less central area of the grill, or diminishing the heat? These are only some of the many plausible options and each of them, to be implemented correctly, requires dozens of other context-sensitive micro-decisions.

Reading the thermometer's value and applying some generic instruction associated with it is not even the beginning of what is required to appropriately deal with a steak that quickly approaches its ideal doneness: when the meat has reached the recommended internal temperature, it takes an expert to complete all the right operations in the right order with the right care. Novices risk to overcook or undercook their steak even if they blindly follow all the instructions and tips associated with the thermometer,

as they lack the constellations of habits necessary to skilfully apply those instructions and tips while effectively navigating the infinite contingencies of the grilling process. The correct application of the thermometer “by the book” requires only the narrowest skillset, which makes the agent proficient *exclusively in* the “thermometer use” skill (if anything at all), *not in* the “cooking with a thermometer” skill. An inexperienced cook turned into an expert thermometer user would still have only the bare competence strictly sufficient to cook mediocre steaks and avoid the most common mistakes. To be truly skilful, the application of the thermometer must become an integral part of, and immediately cohere with, a galaxy of context-specific micro-practices that is as broad and deep as the art of grilling itself, which is why either the know-that invoked to instruct the use of a thermometer represents the entire skillset of a BBQ master or it is practically useless and possibly even deleterious.

Now, the greatest advantage of thermometers is that they are designed to be a universal source of user-friendly contentful knowledge. They can be used both by experts and novices and, in a sense, they establish a standard that is valid in any circumstances. They certainly tend to reduce the chances to ruin a steak, which represents the best possible outcome for the novice and a desirable minimum for the expert. But the fact thermometers provide a serviceable, advantageous, skill-level-neutral bit of information is exactly what makes the cook’s skill level less relevant: in no way that information, per se, contributes to increase the agent’s know-how; conversely, that information is practically useful and relevant *only insofar as some know-how is already pre-reflectively available* to the cook in the form of a set of embodied habits. Paradoxically, the thermometer becomes a legitimate element of the cook’s skilful activity only once its function becomes redundant: not an informative instrument providing a necessary bit of content but just another element in the system of environmental solicitations to which the dispositional know-how of the agent is coupled; not a critical, discrete decision-point but a perceptual cue within a continuous horizon of possible affordances.

Considering this constraint, should we consider the use of the thermometer an integral component of the grilling skillset or not? Again, the answer has nothing to do with the extrabodily and instrumental nature of tools (which, under the right circumstances, can be considered legitimate extensions of the expert cook’s body schema, i.e. active functional components of an extended cognitive system), but on the modality of control brought about by the thermometer, which can be either unhabitual or habitual. On the one hand, we must note that, unlike the cook’s well-trained perceptual and motoric dispositions, the thermometer is neither necessary, nor sufficient, nor constitutive of the skilful control of grilling:

- First, unlike the novice, the expert can obtain the same result with or without thermometer, as their control of the grilling process is grounded only in their grilling habits;
- Second, unhabitual control might compete with or even confound habitual control, in the short term, and produce deskilling, in the long term, progressively weakening the cook’s ability to perceptually check the doneness.
- Third, a jury tasked to evaluate the cook’s skill level would not be surprised to learn that they rely on a digital thermometer but would not be impressed either. On

the contrary, they would positively evaluate the fact that the cook did not need the thermometer or the fact that the thermometer's use was harmonized with a multitude of relevant habits confidently and effortlessly exerted by the cook.

On the other hand, we must acknowledge that a cook who treats the information provided by the thermometer as a narrow prescriptive indication, rigidly executing the pre-defined script associated with it, can only be a novice as they cannot do much more than blindly follow a set of received rules and instructions; conversely, a cook who, having fully automatized the use of the thermometer, experiences it as a transparent element of their grilling practices and pre-reflectively responds to it as just another environmental solicitation (not different from the colour or the consistency of the meat) must be an expert because they have fully incorporated the tool among the affordances to which their embodied expertise is responsive.

Therefore, the performance with the thermometer can be considered skilful *iff* the cook has already made it habitual, systematically relying on their relevant embodied dispositions to effectively control the grilling process via the thermometer. The thermometer does not play an effective causal role and does not have a concrete practical relevance per se, but only to the extent it is incorporated in the background of habitual practices that pre-reflectively control the cooking process. The representational content attached to the thermometer (the mere logical and informational value of the number displayed by the tool) has no causal efficacy or semantic relevance per se because it is decoupled from its user and the context of its own use, thus either it does not contribute to the grilling performance or its contribution is not of a skilful (positive) nature.

To sum up, the thermometer does not help a novice grill steaks like an expert but can help them prevent many common yet avoidable amateurish disasters: thus, the more the thermometer proves useful the more its user has already acquired some relevant grilling know-how. Using the thermometer effectively does not provide the cook with a supplement of skilful control but, on the contrary, presupposes that very skilful control. Whether the use of the thermometer is skilful or not is not attested by how advantageous that usage is; rather, it is attested by how the grilling performance displayed the characteristic qualities of expert execution. In a way or another, performance is never made skilful by the contentful information provided by the thermometer. As per Radical Habitualism, performance is either skilful or controlled by contentful knowledge, because know-that is never an authentic source of skilful control.

## 7 Conclusion: the broader implications of Radical Habitualism

Experienced performers obviously *can*, typically *do* and, moreover, often *must* use reflective control informed by contentful knowledge during peak performance. Without denying this, the previous analyses have shown that an agent performs like an expert, and their performance is truly skilful, only if their actions are confidently controlled by well-trained habitual dispositions. We must then conclude not only that the intellectualist maxim “all knowing how is knowing that” (Stanley & Williamson, 2017) is false but also that the opposite maxim is true: “no knowing how is knowing

that.” This conclusion can now be appreciated in all its compelling force as our analyses have systematically shown that the account of skilful expertise offered by Radical Habitualism is *universal, positive, innovative, phenomenologically sound, consistent with naturalistic explanation, and based on empirical evidence*.

First, our investigation releases Dreyfus from the allegation of arbitrarily narrowing-down the standard definition of skilful performance to exclude the cases that contradict his phenomenology. Some authors (e.g., Montero, 2016, p. 53; Christensen et al., 2016, p. 59) allege that the habitualist perspective (like those defended by Dreyfus, in philosophy, and Beilock and Carr, in sport psychology) conveniently relies on canonical descriptions of agents performing routine actions (e.g., car driving in “automatic pilot” mode) or producing serendipitous performances in rare “flow” conditions, thus limiting his analyses to a specific set of well-chosen cases in which explicit knowledge does not play a major role. Against these allegations, my full-spectrum analyses confirm the universality of Radical Habitualism insofar as all known forms and levels of skilful expertise have a fundamentally embodied and dispositional basis. In fact, Dreyfus’ approach promotes an expanded and more comprehensive picture of skilful expertise, not a reduced one, because it invites us to appropriately appreciate the qualities of the execution of a performance in addition to its competitive outcomes and its propositional description.

Second, Dreyfus has been unjustly accused of offering a merely negative account of skill, i.e. limited to describing what expertise *is not*: un-reflective, non-representational, etc. (Stanley & Williamson, 2017). In truth, Radical Habitualism offers a positive account that is both viable and sound: the original attunement of intentional agents with their world-environment constitutes the authentic source of skilful control and the true mark of expertise, which is why the skilful valence of a performance is to be found in the network of dynamic, interactive relations that reciprocally link an agent and their environment (Freeman, 2000). Appreciating the ecological qualities of this network of relations means valuing how a performance is executed confidently, swiftly, adaptively, creatively, parsimoniously and whether the agent demonstrated the characteristic readiness to cope with the situation that distinguishes experts (Davids et al., 2012). Skill is a form of familiarity or propensity arising from concrete dealings. Also, expertise is an organisational, dispositional quality that expresses the agent’s personal history and reflects their robust metastable attunement with the environment (Heras-Escribano, 2021; Miyahara, Ransom & Gallagher 2020; Bruineberg et al., 2021).

Third, while being old at least like Merleau-Ponty’s and Heidegger’s phenomenologies, the general account offered by Radical Habitualism is truly innovative and likely to produce a concrete transformative impact on the practices of skilled experts and the normative criteria used to evaluate their performances: Radical Habitualism invites us to rethink the notion of expertise beyond stereotypes that are still too common in both the agonistic and the academic worlds, where the value of competitive efficacy and the importance of formal titles tend to be overemphasized, in a way that promotes the superficial identification of the skilful expert with the competition winner or the degree holder, respectively. Skilful expertise is too often construed as the conformity of a subject to some essentialist standard:



- (A) as some sort of epistemic authority or curricular status (professional credentials or similar entitlement to have an opinion);
- (B) as an indication of the length of the practice that the agent has done (for example 10,000 h of practice or ten years of experience);
- (C) as the amount of knowledge or information that the agent carries in their mind like a stored commodity or usable resource (facts, data, rules, etc.);
- (D) as a power or ability that the agent can exploit instrumentally to achieve whatever goals.

Radical Habitualism consists in a form of *relationalism about skill* (Coeckelbergh, 2012, 2015) because it helps us realize that expertise does not reduce to any of these essentialist definitions (i.e., A–D), although each of them may be heuristically useful, in specific settings, to monitor specific aspects of specific performances: for example, when we need to explain the reliability of a professional or predict their probabilities of success. But neither one's epistemic entitlement (A), nor the length of their training (B), nor the depth and breadth of their scholarship (C), nor the capability to serve instrumentally one's goals (D) are sufficient to capture the experiential quality (the phenomenological relation) and the cognitive form (the informational relation) that distinctively characterise the expert's skilful engagement.

Radical Habitualism consists also in a form of *particularism about skill* because it emphasizes that know-how is a *situation-specific* and *applied* kind of knowledge that arises dynamically from a meta-stable (thus always precarious) agent-environment coupling process. Even the most experienced agent does not perform like an expert all the time: their modality of attunement continuously fluctuates, co-varying with a myriad of relational aspects that the four stereotypes (A–D) cannot capture. For example: how resolutely the agent approaches a challenge and whether they are truly ready to perform, sustained by a robust familiarity with similar tasks, confident self-regulation routines, and a harmonious attunement with the context. That is why Radical Habitualism advocates appropriate ecological consideration for the galaxies of interconnected practices in which embodied competences became relevant and useful.

Importantly, Radical Habitualism offers a robust and flexible framework to appreciate the relational and situational qualities of skilful control that the rationalist approaches systematically neglect: skill level increases when the agent-environment coupling becomes rich, robust and mature enough to allow the agent to navigate both routine and unexpected challenges in a *spontaneous, confident, self-reliant, harmonious, parsimonious, and effortless* manner. These qualities can consolidate only moving through an experiential itinerary that makes familiar and predictable the kinds of practical challenges that novices and unprepared experts can only encounter as discomfortingly unfamiliar and uncontrollable. If one reliably performs like an expert, that is normally because they eventually stopped using rules and instructions as *expedients to produce the outcomes of an expert*. To become an expert, the content of their know-that must finally dissolve to give life to habitual dispositions: crucially, this does not only mean that skilful performance cannot be based on know-that; it also means that the prolonged persistence of know-that is an inherent limit, a burden, and possibly a threat to one's capability to perform like an expert.

Also, Radical Habitualism is superior to the other accounts because it has a truly *explanatory* valence and not a merely *constitutive* one (refer to Sect. 5.3.3). With regard to the essential constitution of skill, Dreyfus' account is useful to recognize both the necessary and the sufficient conditions of expert performance: *necessary* is the progressive automatization of the action components, while *sufficient* is the presence of certain patterns of epistemic qualities that distinctively characterize skilful action control. This means that Radical Habitualism gives us universal and unambiguous principles, concerning the general constitution of skilled actions, to determine whether an action is performed skilfully or not. The first criterion is whether action is controlled habitually (necessary condition). Notably, complex actions are composed of different sub-actions and components, which is why, before giving a simple judgement about the action as a whole, one has to consider whether each component is controlled habitually (automatized) or not. The universal principle to be adopted here is: a greater incidence of habitually controlled action components indicates a higher level of skilful expertise. The second criterion (sufficient condition) is whether the action's form of execution displays the typical epistemic properties of expert performances (private, context-sensitive, trusted) and the associated virtues of expert execution (self-reliant, harmonious, parsimonious, etc.), to be considered jointly as a coherent configuration of markers of skilful expertise. The principle to be adopted here is that of family resemblances: the more closely the form of execution approximates the ideal normative profile of an expert action, through any one of its distinctive patterns of qualities and virtues, the higher is the expertise level of the performer.

Most important, Dreyfus' account also offers a theoretical platform to articulate concrete, accurate, and consistent *explanations* of the systems and processes that underpin the genesis and manifestation of skilful control in real life scenarios. Unlike the arm-chair approach favoured by analytic epistemologists and metaphysicians, who rely prevalently, if not exclusively, on "linguistic analyses and cultivated intuitions" (Noë, 2005, p. 288), the ambitious synthesis offered by Radical Habitualism is backed by the experimental data collected by three generations of sport & performance psychologists, the experiential accounts of professional practitioners, the methodological indications of naturalistic research, and the dynamicist and probabilistic models of machine learning.

**Author contributions** Single author submission.

**Funding** Open Access funding enabled and organized by CAUL and its Member Institutions.

**Data availability** Not applicable.

**Code availability** Not applicable.

## Declarations

**Conflict of interest** I have no conflict of interests.

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