

# *They've lost control: reflections on skill*

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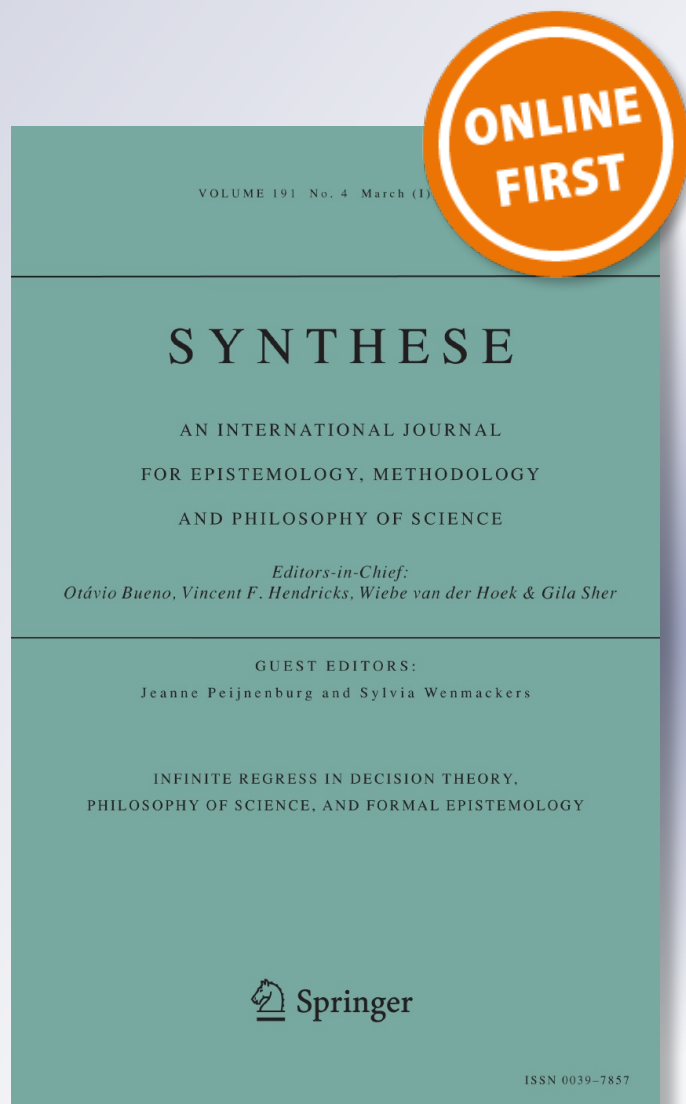
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## They've lost control: reflections on skill

Ellen Fridland

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**Abstract** In this paper, I submit that it is the controlled part of skilled action, that is, that part of an action that accounts for the exact, nuanced ways in which a skilled performer modifies, adjusts and guides her performance for which an adequate, philosophical theory of skill must account. I will argue that neither Jason Stanley nor Hubert Dreyfus have an adequate account of control. Further, and perhaps surprisingly, I will argue that both Stanley and Dreyfus relinquish an account of control for precisely the same reason: each reduce control to a passive, mechanistic, automatic process, which then prevents them from producing a substantive account of how controlled processes can be characterized by seemingly intelligent features and integrated with personal-level states. I will end by introducing three different kinds of control, which are constitutive of skilled action: strategic control, selective, top-down, automatic attention, and motor control. It will become clear that Dreyfus cannot account for any of these three kinds of control while Stanley has difficulty tackling the two latter kinds.

**Keywords** Skill · Know how · Control · Automaticity · Intellectualism · Anti-intellectualism

*learning to play the piano is learning to reason with your muscles*  
-Jeremy Denk

### 1 What's so skilled about skilled action?

When we tune in to the Olympics once every 4 years to watch the best gymnasts in the world compete for gold, there is no doubt that every single one of the women competing is a skilled gymnast. But what exactly comprises their skill? That is, out of

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all of the things that the gymnasts know and do in order to compete at the highest levels, e.g., their training histories, their capacity for concentration, dedication, willingness to travel, etc., what constitutes the skilled part of their skilled action?

Of course, there are countless aspects of skill that are shared in various ways with various kinds of other actions. For instance, skilled action is a species of intentional action (Stanley and Williamson 2001; Noë 2005; Fridland 2010).<sup>1</sup> That is, it is an action that the agent performs for reasons or on purpose or with some intention.

After all, Olympic gymnasts do not simply find themselves flung into a full-twisting layout on the beam, but perform the trick with every intention of performing it. They do not find their bodies compelled into dancing the moves of their floor routines; they intend to dance them even before they walk out onto the mat and salute the judges. For evidence of this, notice how the women prepare for their routines on the sidelines of the floor apparatus—throwing their arms up, and twisting their bodies in what seems to be a half-visual, half-physical simulation of their tumbling passes.<sup>2</sup>

Also, the gymnasts, like their coaches, are in possession of countless pieces of verbalizable, propositional knowledge. Doubtless, they can talk you through each element of their bar routine with varying degrees of detail and sophistication. Doubtless too, like their coaches, the gymnasts have a great deal of demonstrative knowledge pertaining to gymnastic performances and skills.<sup>3</sup> Watching a video of their own performance played back to them, they would likely be able to point to various skills in order to show you the way in which they do them, perhaps a way that is different from the way other gymnasts perform the same or similar skills. They may not be able to report this knowledge without pointing, but presumably they'd be able to reidentify the ways they refer to when they see another instance of the skill being performed.

But what is it that the gymnasts have in addition to their ability to act intentionally and to possess a whole slew of propositional knowledge about their skills? The answer, it seems to me, is pretty obvious: it is the ability to put their knowledge into action! It is their ability to implement their goals in the nuanced, particular controlled ways in which they are able to implement them in the various circumstances in which they perform.<sup>4</sup>

For example, when we watch Gabby Douglas's beam routine, it seems clear that her skill is expressed in the fact that, e.g., she takes off with the right amount of force, she jumps backwards at the right angle, she arches her back to the right degree, she places her hands in the right location on the beam (directly under her shoulders and popping

<sup>1</sup> Though seemingly beyond question, Dreyfus (2002) disagrees that skill is a species of intentional action.

<sup>2</sup> See Kirsh (2013) for more on how incomplete or simplified actions like marking in dance serve to promote skill.

<sup>3</sup> Stanley (2011b) has argued that knowledge how can be verbalized as a demonstrative. The boxer can utter, for instance, "This is the way I fight against a southpaw" (p. 161).

<sup>4</sup> I should note that I am not begging any questions by construing the problem in this way. I am not committed to a propositional reading of "knowledge" and Dreyfus would agree that, e.g., an elite tennis player "knows how" to play tennis. Also, I am not claiming that the detail or nuance in the performance must be mirrored in or represented by the intention. Further, the Intellectualist explicitly endorses the difference between the knowledge required to explain or articulate how one performs one's skills and the knowledge required to perform those skills (Stanley and Williamson 2001; Stanley 2011a,b; Stanley and Krakauer 2013).

away from the beam at the right moment in order to propel herself backwards and upwards for her next trick). She points her toes, she splits her legs, she puts her foot down in the right place, her toes gripping the side of the beam with the right amount of tension (given the texture of the leather covering the 4" surface, and the amount of chalk that has accumulated on that surface and also rubbed off from the bottom of her slightly sweaty foot.) She lands with the right emphasis, her arms reaching backwards to the right position. The pass is solid; her movements precise; the micrometer, microsecond adjustments and modifications that she makes with each part of her body are perfect. She executes her tumbling pass as she intended to. She is in complete control.

But notice that even if there was a small wiggle or if her foot were to slip a touch on landing, it would be in Gabby Douglas's capacity to recover, to adjust and modify her performance in response to the unexpected wiggle or slip where her skill would be manifest. That is, it is by an agent's ability to respond to both expected and unpredictable environmental circumstances and to revise her strategy accordingly, that we measure skill. As such, control is evident not only in the smooth, elegant execution of an uninterrupted action but in the appropriate responses and recovery to variable factors, as well.<sup>5</sup>

As such, I submit that it is the controlled part of skilled action; that is, that part of an action that accounts for the exact, nuanced ways in which a skilled performer modifies, adjusts, revises, and guides her performance, which we must give an account of, if we are to have an adequate, philosophical account of skill. My claim is that control is at the heart of skilled action because the particular way in which a skill is instantiated is what defines how skillful that action is. That is, the level of skill that one possesses is in direct proportion to the amount of control that one exerts over the performance of one's own actions. Control is what constitutes the difference between a gold medal performance and a bronze medal one, and between an elite athlete and a novice.<sup>6</sup> It is control that is learned through practice and control that allows us to gasp at the beauty, elegance, and perfection of a skilled performance. Control is what can make watching sport, if we are lucky, a religious experience.<sup>7</sup>

In the final section of this paper, I will present in some detail three different kinds of control, which I will claim are characteristic of skilled action. For now, however, I

<sup>5</sup> It may seem that because gymnasts are not responding to other players or highly variable environmental circumstances then the control that I am highlighting here isn't generalizable. However, I think this would be a shortsighted understanding of both gymnastics and various other sports. That is, though gymnast's environments do not involve various opponents and teammates this does not entail that the gymnast's environment is fixed or simple. The variations in the surface texture from one part of the beam to another, or the wiggle that the gymnast needs to overcome in different instantiations of her skill may seem small but they are nevertheless crucial variables for the gymnast. The gymnast is not just controlling her actions, she is responding to variables that she cannot control as well. Likewise, though in "open" sports like tennis, hockey or boxing, there is quite a bit of variability on behalf of the environment, one's opponents and teammates, it would be an oversight not to notice the hours and hours of practice that athletes put into trying to hone and refine their technique in the absence of those variables. For these reasons, the control involved in gymnastics is not unique or specific to this sport.

<sup>6</sup> Of course, there are a multitude of factors that can impact any performance at any one time. As such, this should be read as a *ceteris paribus* claim.

<sup>7</sup> See Wallace (2006) "Federer as Religious Experience" for an unbeatable account of the awe that we sometimes experience when observing skills performed at the heights of expertise.

will make some very general remarks about what I understand control to be. First, I take control to be a theoretical concept. Second, I take control to be acquired through practice where I take practice to require, at least temporarily, attending to and attempting to improve an ability as an end in itself. As such, practice is more than simply the improvement of an ability through regular instantiation—it requires intending to improve and refine that ability.

Third, I take it that control is responsible in large part for the nuanced, particular, fine-grained modifications and adjustments that an agent manifests in skilled action. Control is not identical to these observable adjustments and modifications, but it is that which accounts for an agent's ability to guide and modify her actions appropriately. Further, I take controlled processes to have several important features: they are flexible, manipulable, subject to learning and improvement, responsive to intentional contents at the personal-level, and holistically integrated with both cognitive and motor states. Lastly, and importantly, control need not be identical to any one neural process. Various kinds of underlying neural mechanisms can give rise to the control exerted in skilled action.

To be clear, at this stage, I am not taking a principled stance about the nature of control—it could be propositional or conceptual or representational or procedural, maybe all of these and maybe none. I am simply drawing our attention to the fact that *this* is what we need to explain if we want to explain skill.

This paper will proceed as follows: in the following two sections, I will argue that neither Jason Stanley, a paradigm proponent of Intellectualism, nor Hubert Dreyfus, a prominent champion of Anti-Intellectualism, have an adequate account of control. Further, and perhaps surprisingly, I will argue that both Stanley and Dreyfus relinquish an account of control for precisely the same reason: each reduce control to a passive, mechanistic, automatic process, which then prevents them from producing a substantive account of how controlled processes can be characterized by seemingly intelligent features and integrated with personal-level states. I will end by introducing three different kinds of control, which are constitutive of skilled action: strategic control, selective, top-down, automatic attention, and motor control. It will become clear that Dreyfus cannot account for any of these three kinds of control while Stanley has difficulty tackling the two latter kinds.

## 2 Dreyfus and control

### 2.1 Dreyfus's anti-intellectualism

According to Dreyfus, the main problem with most contemporary approaches to expertise and skill is that theorists misconstrue human intuitive expertise as a kind of calculation or rule following. For the past three decades, Dreyfus has been arguing that in cases of true expertise, actors are (1) neither consulting nor applying rules nor (2) engaging in active control over their actions. Instead, experts are drawn to the right positions or responses intuitively, through a kind of holistic perceptual discrimination of the situation, developed through countless hours of training and practice.

In what follows, I will briefly explore each of the above claims in order to clarify what they get right and also what they get wrong. I will argue that Dreyfus

leaves us in an unsatisfactory position insofar as an account of skill is concerned because he does not provide us with an adequate account of control. More precisely, I'll maintain that Dreyfus leaves us without a substantive understanding of what accounts for the expert's ability to act fluidly, with precision, elegance, and decisiveness, modifying and adjusting her actions in a way that is sensitive to the content of personal-level intentional states and integrated with automatic, fine-grained, motor routines.

## 2.2 Skills and rules

Dreyfus regularly claims that expert skill is a case of non-deliberative, non-reflective, arational, atheoretical action.<sup>8</sup> It is the novice, the advanced beginner, and the competent person, i.e., those persons at the lower stages of skill development, who need to think. In contrast, the expert just does.

Dreyfus argues that beginners need to consult rules, calculate and decide upon what the appropriate course of action should be. With proficiency and expertise the need for deliberate contemplation melts away. He writes that "the proficient driver is certainly more likely to negotiate the curve safely than the competent driver who spends additional time *considering* the speed, angle of bank, and felt gravitational force, in order to decide whether the car's speed is excessive" (2002, p. 371, emphasis in original). Further, [Dreyfus and Dreyfus \(1986\)](#) write "the expert is simply not following *any* rules!" because "no amount of rules and facts can capture the knowledge an expert has when he has stored his experience of the actual outcomes as tens of thousands of situations" (p. 108, emphasis added).

Moreover, unlike unskilled drivers, the expert does not think about her goals or how to achieve them; the expert just acts! For the expert, "no detached choice or deliberation occurs. It just happens" (1986, p. 28). "The expert driver, generally without any awareness, not only feels when slowing down on an off-ramp is required, he or she knows how to perform the appropriate action without calculating and comparing alternatives. *What must be done, simply is done*" (2002, p. 372, emphasis in original).

We should notice that Dreyfus's argument is premised almost entirely on the phenomenological experience of skilled performers. That is, his argument goes something like this: as we gain experience and become skilled in a particular field, we feel ourselves transition from acting in ways that are consciously guided by thoughts and instructions towards acting in ways that are automatic, where there is no need to consult, calculate, or deliberate about the rules guiding our actions. Therefore, it follows, that we are not consulting, calculating, deliberating, or following rules when we perform skills. Though I'm deeply skeptical about what phenomenology can teach us about the nature of our mental states, conscious or nonconscious, I won't pursue this methodological concern here.<sup>9</sup> Let's admit, as most of us probably would, that as we develop expertise, much of what we once had to consciously and painstakingly keep in

<sup>8</sup> As [Dreyfus and Dreyfus \(1986\)](#), write "competent performance is rational; proficient is transitional; experts act arationally." (p. 36, emphasis in original).

<sup>9</sup> See [Rey \(2002\)](#) for more on the methodological problems of this argument.

mind becomes automatic and effortless. Most of our explicit self-instructions become transparent.

The problem remains that in admitting that we can draw such conclusions from the phenomenology of skill, we are left with the following questions: In what does the expert's skill consist? What is the expert doing when she exercises her skill? How does the expert know what to do and when? What does the expert learn when she learns a skill? What allows the expert to discriminate, modify and adjust her skills appropriately? How is the skill of one expert different from that of another? The biggest problem with Dreyfus's account of skill is not that it is wrong but that it is uninformative.

If phenomenology entails that experts are not following rules,<sup>10</sup> should this not require us to seek out an alternative theory of how experts are able to manifest their expertise? Isn't Dreyfus now obligated to give us an account of how it is that these non-thinking, non-calculating, non-rule-following experts possess the ability to do all the fancy things that they do? After all, I can agree with Dreyfus that, "the ability to make more subtle and refined discrimination is what distinguishes the expert from the proficient performer" (2002, p. 372) and still ask, "on what basis are such refinements and subtle kinds of discrimination made?"

An adequate account of skill should tell us what the expert learns and how this enables her to make more refined and subtle discriminations. I'm not claiming that only rules or propositions can give us an account of this, but I am insisting that if it is not rules, then it has to be something else.

### 2.3 Skilled happenings

However, because Dreyfus construes expert skill as a non-agential activity, he is prevented from engaging with the above questions in a serious way. That is, because Dreyfus considers the expert control of skilled action to be a passive affair, he is forced into thinking about control in terms of subpersonal, low-level, neural mechanisms. And thinking of control in this way necessarily misconstrues its nature, characterizing skill at the causal level instead of at the intentional level.<sup>11</sup> As a result, Dreyfus is unable to account for personal-level discriminatory capacities, automatized motor routines that are learned through deliberate practice, and the integration of these processes with the goals, strategies and plans of the skilled actor.

According to Dreyfus, skillful coping is a passive affair. It is not something that the agent does, but something that happens to the agent. Dreyfus writes:

But if one is expert at the game, things are going well, and one is absorbed in the game, what one experiences is more like one's arm going up and its being

<sup>10</sup> Please note that I am not conceding that phenomenology entails that experts are not following rules (unless, of course, rules are defined as conscious, propositional states—but such a move is a poorly-motivated, semantic, sleight of hand). In fact, the only thing that phenomenology entails is that *it does not seem to us* that we are following rules when we perform skills expertly.

<sup>11</sup> Of course, Dreyfus would not admit that his account has this implication and would insist that he is characterizing skill on the non-representational but still intentional level. As such, this claim serves as a point of contention, which constitutes an objection to Dreyfus's understanding of his own theory.



drawn to the appropriate position, the racket forming the optimal angle with the court—an angle one need not even be aware of—all of this so as to complete the gestalt made up of the court, one's running opponent, and the oncoming ball. One feels that one's comportment was caused by the perceived conditions in such a way as to reduce the sense of deviation from some satisfactory gestalt.

The environment draws the right response from the expert but the expert does not actively direct, control, or guide this response. The expert is moved in the appropriate manner by her environment but she is not intentionally moving.

Not insensitive to the counter-intuitiveness of this claim, Dreyfus distinguishes between two types of passivity. First, there's ordinary, garden-variety passivity and then there's the passivity of skill where expert action is passive in a special way: the expert is in control of his action by being able to intervene when necessary. Dreyfus writes, "I am in control of my movements in the sense that I can stop doing what I'm doing if I will to do so" (2002, p. 380).<sup>12</sup>

On this view, the expert is like a police officer at a peaceful protest. The officer *can* intervene to keep the peace but, if all is going well, she need not. She is controlling the crowd by retaining the ability to stop it from going out of control. It is this kind of control, that Dreyfus asserts we exert over our skills.<sup>13</sup> The skilled actor, when all is going well, isn't an agent but a ready observer or monitor.

Since skilled action is not characterized in terms of the agent's actions, Dreyfus is compelled to give a causal, subpersonal explanation of the development and execution of expertise. For Dreyfus, skill learning and expert performance is spelled out in terms of Hebbian learning. On this view, after a good deal of instruction and a great deal of practice, the expert's brain and body just get connected up in the right ways so as make skillful action possible. In "Intelligence without representation," Dreyfus (2002) outlines this account where "the strength of the connections between the neurons changes on the basis of experience. This kind of adjustment of connections is all there is to learning in a simulated neural network" (p. 381). And according to Dreyfus, this is all there is to skill.

We should notice, however, that such an explanation gives us only a cursory understanding of the learning and refinement that leads to expert action. The Hebbian account of learning, even if it is correct as a description of the mechanisms that underlie skill learning at the neural level, does not tell us anything about what it is that these connections allow the skilled agent to discriminate at the personal-level. It does not tell us which features of the action environment the agent is attending to and why. It cannot tell us, for example, whether the gymnast is attending to the back-handspring, or to

<sup>12</sup> See also, Dreyfus (2002) where he writes that there are "at least two kinds of passive experience, one of which could in spite of its passivity be attributed to me as an agent...*I am letting myself be moved* by the gestalt tensions I experience on the court" (p. 380, emphasis in original).

<sup>13</sup> Frankfurt (1978) has made a similar but much more reasonable claim: That we don't always need to interfere in order to exert control. But, for Frankfurt, guiding is straightforwardly about intervening, modifying, and adjusting one's actions when necessary. His point is only that that such active modification is *not always necessary* (as in the example of the car going down hill—to be in control the driver doesn't have to constantly steer. Surely, however, there are many points at which the driver does, in fact, turn the wheel!).

its takeoff, or to her core, or her legs, or to the beam, or to all of the above. It does not tell us how focusing on different features of her performance changes the execution of her skills. And it does not tell us how it is that she acquired the right connections so as to deploy the right motor routines in the right situation. It does not tell us how the countless repetitions during practice, where the agent explicitly focused on her hand placement on the beam and the position of her toes when landing, contribute to what she is able to do now, expertly, gracefully, and automatically.

Further, this kind of causal-level explanation lacks the resources to account for how these strengthened connections are integrated with the goals, plans, strategies and knowledge of the agent at the personal-level.<sup>14</sup> That is, this kind of account cannot tell us why deciding, *in situ*, to do an easier second tumbling sequence and a bigger, bolder dismount changes the gymnast's performance in predictable and systemic ways. In fact, such an account cannot tell us these things because it functions at the wrong level of description—a neural account of learning cannot provide us with an explanation of the content involved in skill at the agent level because this kind of content must be integrated with conceptual, propositional, domain-general processes that are not characterized at the causal level. What we require for an account of skill is more than content that is only available to subpersonal systems and insensitive to the intentional states of the skilled actor. What we need is an account of skill that functions in the space of reasons rather than merely in space of causes. However, if all we can say about skill is that it is the result of stronger neural connections then we are left without the possibility of explaining how the strength of the connections at the neural level are sensitive and responsive to the particular goals and strategies that guide the agent in learning and expert performance.

The fact is that maybe Hebbian learning can tell us something about the basic processes of motor acuity involved in skill but there is certainly more to skill than motor acuity. We can see why Dreyfus would be satisfied with the Hebbian account of learning since, for him, expertise doesn't implicate anything especially interesting at the personal or agent level. But this is exactly where the account becomes unsatisfactory. It is by miscategorizing the controlled part of skilled action as nothing more than the strengthening of neural connections that Dreyfus precludes the possibility of providing an adequate account of skill.

We should notice that in attempting to redefine intelligent action as non-representational in character, Dreyfus saps the intelligence from intelligent action altogether. This is not to say that all nonrepresentational attempts to account for skill will necessarily have this result. But it is to say that Dreyfus, instead of developing a theory of the intelligent but nonpropositional mechanisms responsible for skill, gets sucked into the all too familiar dichotomies of cognitive/non-cognitive, conscious/nonconscious, propositional/procedural, representational/nonrepresentational and ends up placing skill on the mechanical, unintelligent side of these dichotomies.<sup>15</sup> And, in doing so, he fails to provide answers to the most pressing questions about skill.

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<sup>14</sup> See Christensen et al. (draft) for more on the role of goals, plans and strategies in skill.

<sup>15</sup> See Sutton et al. (2011) for a similar objection to Dreyfus's account.

### 3 Stanley and control

#### 3.1 Stanley's intellectualism

Jason Stanley's Intellectualist account of skill stands in direct contrast to Dreyfus's anti-representationalist, Anti-intellectualist tendencies. However, Intellectualism fails to give us an adequate account of skill for the same reason that Dreyfus's account fails. Like Dreyfus, the Stanley's Intellectualism misconstrues the control involved in skilled action as a mechanistic, subpersonal, non-agential process.

According to Stanley and Williamson (2001), Stanley (2011a,b), knowing how to perform a skill is simply a matter of knowing the appropriate propositions governing its instantiation. On this account, knowing how or the knowledge responsible for skillful action is no different than the knowledge involved in knowing that, knowing where, who, what, why or when. Accordingly, when we say, for example, that Hannah knows how to ride a bike, what we really mean is that Hannah knows the answer to the question, "what is the way for you to ride a bike?" That is, in a particular context  $c$ , we can say that Hannah knows how to ride a bicycle "if and only if there is some contextually relevant way  $w$  such that Hannah stands in the knowledge relation to the Russellian proposition that  $w$  is a way for Hannah to ride a bicycle and Hannah represents  $w$  under a practical mode of presentation." In short,  $S$  knows that  $w$  is the way to  $\phi$ , where the way to  $\phi$  is represented as a Russellian proposition, and  $S$  considers that  $w$  is the way to  $\phi$  under a practical mode of presentation.

To start, I'd like to point out that in comparison to Dreyfus's account, at least the Intellectualist provides us with the beginnings of a substantive theory of skill. At least we can see what the answers to some of the interesting questions about skill might look like. Returning to our considerations about control, however, we should now ask about how the Intellectualist might account for the control that is responsible for the the exact, nuanced, micromillimeter, microsecond adjustments and modifications that are painstakingly learned and developed through countless hours of practice and training with a particular skill. That is, we should ask how propositions can account for the control that differentiates a great performance from the greatest performance.

I submit that the Intellectualist account of control fails precisely where low-level, non-cognitive, mechanistic, automatic processes are invoked to do the heavy lifting. In what follows, I will review Stanley and Krakauer's (2013, from hereon, S&K) most recent attempts to clarify, in Intellectualist terms, what accounts for the fine-grained motor details involved in skillful action. I will argue that by misconstruing all control as motor acuity, a low-level, subpersonal process, S&K, like Dreyfus, sacrifice giving a satisfactory account of skill.

#### 3.2 Motor skill and motor acuity

S&K begin by stating that the "intellectualist holds that at least part of skill is propositional knowledge." This is important since it means that the Intellectualist need not commit himself to the view that every aspect of a skill is reducible to knowledge of a proposition. Quite reasonably, the Intellectualist can hold that some parts of skilled action can be accounted for by informational processes that are not in any way knowl-

edge involving. Before moving on, we should be careful to notice, however, that just admitting that skill involves propositional knowledge is not sufficient to make one an Intellectualist. After all, Gilbert Ryle, the father of Anti-intellectualism, frequently admitted that skills involve propositional knowledge (1949).<sup>16</sup> What Ryle denied, of course, and what the Intellectualist must be committed to, is the fact that *the intelligence of skill* is reducible to a proposition. That is, though the intellectualist need not claim that all parts of skill are intelligent, he must claim that for those parts of skill that are indeed intelligent, they are intelligent in virtue of the propositions that the skilled agent knows.

This is the intellectualist view that S&K endorse. They claim that propositional knowledge is required for skilled action and that the intelligence of skilled action is captured by the propositions that a skilled agent knows. However, S&K deny that all there is to skill is propositional knowledge. They claim that skill also involves what they call, following Shmuelof et al. (2012), “motor acuity.” Motor acuity, they claim, is best construed as a process that is not intelligent or knowledge involving. It is simply the analogue of perceptual acuity:<sup>17</sup> a process that can undergo improvements as a result of experience but which is neither the result of attentive practice nor is it under voluntary control.<sup>18</sup> The problem with much philosophy and cognitive science, S&K claim, is that “motor skills have been incorrectly identified with the part of skill that is not knowledge” (p. 15). That is, they claim that what has often been called procedural knowledge is not knowledge at all; it is simply the subpersonal, low-level mechanisms of motor acuity tuning up.

According to S&K, “manifesting any kind of knowledge, and any kind of skill, requires possession of both [perceptual and motor acuity and propositional knowledge]” (p. 16). On this account, instantiations of skill can be thought of as hybrid states, which combine guidance by propositional knowledge with basic, mechanistic, subpersonal motor and perceptual abilities. Importantly, however, motor and perceptual abilities are not themselves skills of any kind. We should also notice that not all improvement in skill will simply follow from the acquisition of propositional knowledge. As S&K write, “though of course some improvements in skill are due to gaining new belief states or knowledge states, we disagree that this is a correct model for *all* improvements. Some improvements in skill are *just* due to improvements in motor acuity” (p. 17, emphasis in original). Improvements that result from motor acuity need not be accounted for in epistemic terms since they are not improvements of one’s know how.

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<sup>16</sup> For example, Ryle (1949) writes, “Certainly we often do not only reflect before we act but reflect in order to act properly. The chess player may require some time in order to plan his moves before he makes them” (p. 29).

<sup>17</sup> S&K write that “motor skills have an acuity component that is directly analogous to perceptual acuity” (p. 16).

<sup>18</sup> As S&K write, “Shmuelof et al. have recently coined the term “motor acuity” to describe the practice related reductions in movement variability and increases in movement smoothness.... Such adaptations are not the acquisition of something that is characteristically manifest in intentional action, i.e., they are not the acquisition of skills” (p. 15).

Now, if we return to our considerations of the control expressed in skilled actions, we should ask whether it is the propositional knowledge or the motor acuity that accounts for the fine-grained adjustment and modifications that distinguish, e.g., the gold medal performance on beam from the bronze. That is, we can ask, “is control to be understood as resulting from one’s propositional knowledge or from one’s basic, non-epistemic, low-level, subpersonal motor abilities?”

The first thing to notice is that neither [Stanley and Williamson \(2001\)](#), nor [Stanley \(2011a,b\)](#), nor S&K give any indication of how it is that propositional knowledge could be responsible for the fine-grained, detailed motor control that is developed through practice and training and expressed in the execution of skilled actions. S&K spend a lot of time discussing the propositions required for acting intentionally, but they do not even gesture towards an explanation of how knowing various propositions will govern the execution or implementation of those propositions in a nuanced, detailed, particular, controlled way.

Both because they ignore an account of how control could be guided by knowledge of propositions, and because they focus on the role of motor acuity in accounting for the fine-grained movements of motor skill, it seems reasonable to attribute to S&K the view that control is simply a matter of motor acuity. That is, since it is only in reference to motor acuity that any mention of fine-grained control is made, I can only assume that it is motor acuity that is supposed to account for the particular, detailed, nuanced, fine-grained control manifest in motor skills. But if this is the Intellectualist position, then the Intellectualist position is wrong. In what follows, I will argue that there are several reasons why control cannot be identified with motor acuity: (1) control, unlike perceptual and motor acuity, is learned through attentive practice, (2) control, unlike perceptual and motor acuity, is deployed voluntarily, such that subjects can make intentional mistakes in their execution of that control, and (3) if control is simply a matter of motor acuity then we lose the distinction between the knowledge involved in ordinary cases of intentional action and the knowledge involved in skill.

To be clear, my argument is not that motor acuity ought to be construed as a case of knowledge or intelligent processing. I am perfectly content to say that skill involves some low-level motor and perceptual processes that are not knowledge involving or intelligent. And I have no reason to deny that propositional knowledge is required for skill instantiation. I am happy to admit that all skill requires at least some kind of propositional knowledge. My claim here is simply that the control exhibited in the elegant, fluid, practiced execution of skilled actions cannot be identified with the subpersonal, low-level, mechanistic processes of motor acuity. Of course, S&K may hold that motor control follows directly from knowing a proposition, but then the burden of proof is on them to provide a reasonable account of how this is possible.<sup>19</sup> In the absence of such an account, Intellectualism cannot be deemed a satisfactory theory of skill.

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<sup>19</sup> I will not rehash arguments for why it is unlikely that propositional knowledge is responsible for the fine-grained control exhibited in skilled action. See [Adams \(2009\)](#), [Brown \(2013\)](#), [Devitt \(2011\)](#), [Fridland \(2012, 2013a\)](#), [Noë \(2005\)](#), [Wallis \(2008\)](#), [Williams \(2008\)](#) for various considerations.

### 3.3 Control and motor acuity

According to S&K there are two reasons why motor acuity, like perceptual ability, does not qualify as knowledge or skill: (1) perceptual and motor ability<sup>20</sup> improves in the absence of attention-guided practice and (2) one cannot make voluntary errors in the execution of perceptual or motor ability. These two factors disqualify low-level, motor processes from inclusion in the realm of knowledge. In what follows, I will argue that control cannot be thus disqualified. This is because control, like the legitimately intelligent aspects of skill, develops as a result of attentive, goal-directed practice and also, like skill, affords the agent with the possibility of making voluntary errors. I will address each of these features of control in turn.

### 3.4 Control and attention-guided practice

In attempting to differentiate motor acuity from knowledge and skill, S&K claim that motor acuity is directly analogous to perceptual acuity or ability. Like skill, perceptual acuity is subject to improvement through experience and training. However, unlike skill, “perceptual ability can be improved in the *absence* of attention” (p. 7 emphasis in original). As such, as S&K argue, “If perceptual ability can be acquired and improved in the absence of attention, then its acquisition and improvement cannot be due to the exercise of skill in (say) training, because one does not in these cases exercise even indirect voluntary control” (p. 7). For S&K, development and improvement in the absence of attention or contrary to the intentions of the agent disqualifies perceptual and motor acuity from being a genuine case of knowledge or skill.<sup>21</sup>

In light of these considerations, whereas S&K say that “skill can be considered the practice-related improvement in a goal-directed action” (p. 5), I suggest that we amend this definition to include explicit reference to attention. After all, if perceptual and motor abilities are ruled out as instances of skill because they can be developed in the absence of attention, then surely being developed with attention is a necessary feature of skills.<sup>22</sup>

Taking attention-governed, practice-related improvement as a criterion of skill helps us to see why control falls smack dab in the middle of this category. After all, athletes regularly and painstakingly practice their skills with special attention to motor control. For instance, the yoga practitioner trains to make sure that, in warrior poses, her knee is at an *exact ninety-degree angle*, the gymnast practices to ensure that her hands are

<sup>20</sup> Following S&K, I am using “ability” and “acuity” interchangeably.

<sup>21</sup> See a similar claim for motor acuity, where S&K cite evidence that adaptation of motor ability occurs contrary to the agent’s intentions (Mazzoni and Krakauer 2006) as being relevant for disqualifying such learning as knowledge (p. 15).

<sup>22</sup> To note, this idea accords nicely with Fridland’s claim that skills are a special class of abilities. On my account, what differentiates ability from skill is not that latter develops or improves with experience while the former does not, but, rather, that skills develop and improve in a particular way. According to my, skills are “the sub-class of abilities, which are characterized by the fact that they are refined or developed as a result of effortful attention and control. As such, only if a subject develops an ability with explicit attention to that ability itself” should that subject qualify as possessing a skill (Fridland 2013a, p. 12)

*directly below* her shoulders in a back-walkover, and the piano player drills to ensure that her wrists and fingers are in *precisely the proper* configuration.<sup>23</sup> These aspects of skill are refined with explicit attention during practice, drilling, and training. That is, agents regularly attend specifically to various aspects of their movements and limb positions in order to develop the appropriate control over them.

It seems natural to conclude that if hours and hours of effortful, attentive, intentional practice are needed to refine the control exhibited in skillful action, then this control should qualify as a kind of knowledge. After all, if intentional learning is always of knowledge, then surely, the control that results from intentional practice ought to count as a kind of knowledge. But this means that control cannot simply be identified with motor acuity. That is, even if there are low-level motor attunement mechanisms that develop during practice in the absence of attention, which I'm sure there are, these aspects of skill are not the same as those other aspects of skill that are the objects of explicit attention during training, refinement, and practice. It is these latter aspects of skill that I am calling control and it is precisely these aspects of skill, which the Intellectualist has no adequate account of.

### 3.5 Control and voluntary errors

A second demand that S&K place on skill is that a skilled agent can, in addition to performing a skill successfully, voluntarily make mistakes. Following Aristotle, S&K claim that “a mark of being skilled at an action is that one can make voluntary errors” (p. 5). S&K also attribute this position to Ryle who writes that, “It is an important fact that if a person can spell or calculate, he can also misspell and miscalculate” (Ryle, p. 130).<sup>24</sup> It is precisely because perceptual ability is not under the voluntary control of the agent, that is, because one cannot choose to misperceive a line, a table, or a color, that S&K exclude perceptual ability from membership in the class of skills. The same point, I take it, should apply to motor acuity—that there are certain kinds of motor processes that one simply cannot voluntarily execute erroneously.

I'll grant S&K the point about agent's not possessing the capacity to voluntarily make mistakes in executing certain kinds of automatic, low-level, brute motor procedures. I'm not sure that this is true, but for the purposes of my argument, it won't matter. What surely is true is that the kind of fine-grained, nuanced control that is

<sup>23</sup> Though it is not my main agenda in this paper to argue that propositional contents cannot account for motor control, in the cases mentioned here, we should notice that practicing agents know the proposition governing their actions. For instance, the practicing yogi knows that her knee should be at 90°. She can even put herself into the appropriate position at certain times (so, she can represent the proposition under a practical mode of presentation). The practice, however, is to refine this knowledge in order to make it more precise and more exact when instantiated. It seems to me that this is what improving one's control requires and it isn't at all obvious how knowing a (fairly general) proposition is going to account for the fine-grained improvements, developments and changes that result from attentive, effortful, intentional practice.

<sup>24</sup> As a side note, I've always taken Ryle to be making a rather Wittgenstein (1953) point here—where there is no room for something to be false it makes no sense to say that it can be true. After all, Ryle says nothing about making these mistakes voluntarily, deliberately, or on purpose. For the purposes of the argument, however, nothing much hangs on the accurate historical interpretation of this quote. The S&K point is well taken regardless of whether Ryle was making a similar point or not.

developed through attention-guided, intentional practice is certainly the kind of control that an agent has the ability to execute in error. For instance, the yogi who was practicing placing her knee at exactly  $90^\circ$  in her warrior poses may become a teacher. As a teacher, she may demonstrate the kinds of common errors students make in these poses.<sup>25</sup> In demonstrating this, she may bend her knee too far over her ankle or not far enough. Both of these would be voluntary mistakes. Likewise, the gymnast who has mastered the control necessary for holding her shoulders directly over her hands in a back-walkover may demonstrate common incorrect positions where novice gymnasts place their shoulders in relation to their hands. The important point here is that not only can the gymnast make one mistake but she can make many, And all of them voluntary. She may reach her shoulders too far back, slightly back, slightly forward, way too far forward and with an endless number of variations in between. Interestingly, the more skilled she is, the more control she has over the mistakes that she can make.

In thinking about control and motor acuity, we are once again forced to admit that the nuanced, particular, precise movements that are practiced and refined during skill learning are not the same as those movements that constitute motor acuity. The movements that are under the direct control of the agent are not simply unintelligent, non-epistemic processes that one can identify with procedural abilities. As such, an account of skill that appeals to the low-level processes of motor acuity in order to take care of the fine-grained, specific, detailed movements that are the results of intentional practice and centrally implicated in manifestations of motor skill has left something out: such an account has not provided us with an account of control. Again, it may be that an account of control as guided by propositional knowledge is possible to construct but then the Intellectualist owes us such an account. That is, the Intellectualist has to explain how personal-level propositions that can be used in inference, reasoning and reflection on various occasions and in multiple circumstances are capable of guiding the fine-grained, context-dependent particularities required of skilled motor control.

The fact is that Stanley's most recent attempt to account for the fine-grained movements involved in skill misconstrues the nature of skilled control by reducing it to a low-level, subpersonal, brute mechanism. In the same way that Dreyfus overreaches in his Anti-intellectualism, reducing skill to a non-cognitive, non-intelligent activity, so S&K, overreach in reducing the intentional, voluntary, practice-refined control inherent to skill instantiations to low-level, subpersonal, unintelligent processes. Surprisingly then, for very different reasons and with very different agendas, both Stanley and the Dreyfus end up with an inadequate account of skill for the very same reason: both are overzealous in reducing control to an unintelligent, mechanistic, stimulus-response process. Sadly, both Stanley and Dreyfus present an unsatisfactory account of skill because they both lose control.

### 3.6 Skills and intentional actions

One last thing to notice about defining skills as intentional actions with motor acuity components is that such a move fails to distinguish the intelligence expressed in the

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<sup>25</sup> In fact, this is exactly what Iyengar yoga teachers do.



execution of a skilled action from the intelligence expressed in ordinary cases of intentional action. This is because if all there is to skill is propositional knowledge about how to initiate and perform a particular action plus the possession of the motor and perceptual acuity to do it then the intelligence of skill will be identical to the intelligence of unpracticed, intentional actions. Both kinds of actions contain propositional knowledge plus motor and perceptual acuity.

To demonstrate, let me introduce the following example: Carrie wants to improve her basketball playing skills. Carrie has played basketball before but she's just not terribly good yet. She wants to become a skilled basketball player. Now, before Carrie begins practicing in earnest, let's take a tally of what she knows: She knows that in order to play basketball, she needs a basketball and a basket and she needs to pick up the basketball in order to start playing (that is, she knows how to initiate her basketball playing actions)<sup>26</sup>, and she also knows how to hold the basketball and shoot and dribble (with her arms bent and wrists back, with her palm flat, etc.—she's played before!). Now, if all there is to developing her expertise at basketball is knowing these things plus improving her low-level motor acuity, say, reducing the variability in the trajectory of her finger, wrist, and elbow movements, then Carrie is as skilled before she practices as after. This is because reducing the variability in her movements is just basic, non-epistemic, non-intelligent procedural stuff and skill is not this sort of stuff but knowledge—it is knowledge how. If this is right, however, then the intelligence of skilled action and the intelligence of unpracticed intentional actions are exactly the same.

After all, according to Intellectualism, the skilled part of skilled action has to be accounted for in terms of propositional knowledge. However, before Carrie develops her motor acuity she has all sorts of knowledge about basketball playing. And, following the latest Intellectualist line, when she learns to play basketball well, that is, when she learns the right kind of control over her basketball playing movements, she is simply improving her motor acuity. So, her knowledge before learning to play well and now, knowing how to play well, has not changed. I repeat: motor acuity is not knowledge. But this is a strange account. Certainly, we want the intelligence of skill to be something more than the intelligence of an unpracticed intentional action. Otherwise we'd have to say that both the expert basketball player and the non-expert have the same amount of skill. This seems like a problem.

Of course, it is open to the Intellectualist to say that Carrie also learns a variety of propositions that are capable of governing the control that she exhibits after she practices playing basketball. However, such an account has not been offered. The only account of the detailed, nuanced, particular adjustments and modifications exhibited in skilled action that is currently on the table is one that identifies fine-grained motor control with motor acuity. The burden of proof is now on the Intellectualist to provide an adequate propositional account of this aspect of skill.

To conclude, at this point, we simply have no idea what the special kind of knowledge that can give rise to the control involved in skill might be. It isn't motor acuity since that's not knowledge. So, it has to be propositional knowledge that is capable of

<sup>26</sup> In line with S&K's account, "part of having the skill is having the knowledge of what to do to initiate the actions manifest in skill" (p. 8).

accounting for the elegance, precision, and nuance expressed in the control of skill. But (1) this seems unlikely because if the same proposition can guide action on different occasions and in different circumstances then it cannot be the proposition alone that accounts for the control exhibited in various manifestation of the skilled action. This is because the control will, of necessity, have to be different at different times. But, more importantly for today, (2) even if an account where propositional knowledge governs control is *not impossible*, we have not been given such an account.

#### 4 Three levels of control

In this final section, I'd like to zoom out and present the three kinds of control for which any theory of skill must account: strategic control, selective, top-down, automatic attention, and motor control. I take it that each kind of control is present in each instantiation of a skilled action. Further, each kind of control that I will discuss below is acquired with explicit attention to improving or refining an ability; that is, the kinds of control that I consider are acquired as the result of practice.

As we saw above, Dreyfus reduces skill to the strength of the neural connections acquired through practice whereas Stanley-style Intellectualism gives us a two-aspect account of skill—combining strategic control with motor acuity. As such, Dreyfus's account lacks an explanation of all three levels of control. And Stanley's account, though it can handle strategic control, cannot explain how the intermediate levels of selective, top-down, automatic attention and motor control are related to and integrated into skillful action. In what follows, I will briefly review the relevant characteristics of each level of control and elucidate how each contributes to skillful action.

##### 4.1 Strategic control

Strategic control ought to be identified with the goals, plans, and strategies that the agent uses in order to guide various instantiations of motor skill. For instance, when a baseball pitcher decides to throw a curveball instead of a fastball, this decision is an instance of strategic control. Also, many states of knowledge are implicated in strategic control. For instance, knowing what one has to do to in order to initiate an action is part of strategic control, i.e., to play tennis, one must pick up a racket; in order to do a cartwheel, one must put one's hands down onto the ground one after the other. Further, choosing various appropriate ways to instantiate one's skills in response to various environmental and historical circumstances should count as an instance of strategic control. For example, deciding to ride one's bike slower in the rain or deciding not to play as hard against one's opponent in the quarter-final match are both instances of strategic control.

Strategic control is that part of skill that we would most readily categorize as cognitive.<sup>27</sup> It is that part of skill that is often, though not necessarily, conscious. Conscious or not, states of strategic control are, at least in principle, accessible to the agent. They are easily integrated with uncontroversially conceptual, propositional,

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<sup>27</sup> See Christensen et al. (in progress) for more on cognitive control.

personal-level states. For instance, the states that comprise strategic control can easily enter into practical reasoning, deliberation, reflection and inference. Moreover, these are the kinds of states that are central to voluntary, direct, agential control. That is, these are the kinds of states that are regularly implicated in intentional action.

Importantly, as Christensen et al. (in progress) have argued, this kind of control does not interfere with expert action. Rather, strategic control guides motor skill by integrating fine-grained automatic routines with the personal-level goals and intentions of the agent. So, though certain kinds of conscious contemplation can prove devastating for skilled action,<sup>28</sup> it does not follow that any and every kind of conscious attention interferes with expert action. I submit that strategic control is an example of intentional guidance that does not undermine or interfere with skill. Rather, strategic control does justice to the fact that expert athletes, throughout their performances, are guided by strategic decisions to play in certain ways, e.g., aggressively or with caution and with different ends in mind, e.g., to save one's energy or to win by a landslide.<sup>29</sup> Importantly, it would seem that experts are both better at implementing their skills and in choosing which skills and which strategies to employ in various circumstances.

Another important feature of strategic control is that it does not automate.<sup>30</sup> That is, while many aspects of skill are learned over time and become automatized into routines that can be run in the absence of explicit attention, strategic control does not. This is largely because strategic control is concerned with the global, non-domain-specific features of a performance. For example, it is the role of strategic control to determine how much energy an athlete ought to expend during qualifying round play. And this kind of decision should be subject to various kinds of considerations, including those of other people. For example, an agent should have the opportunity to incorporate her coach's advice into her decision about how to play. As such, determining the right way to instantiate one's skills at the level of strategic control is not something that a modular, input system can do.

Lastly, it seems plausible to assume that strategic control is more prominent in challenging conditions. As Christensen et al. write,

Cognitive and automatic processes are tightly integrated, with cognitive control tending to be focused on strategic aspects of task performance, and more prominent in challenging conditions. Thus, a musician may focus on expression rather than technique, and employ more cognitive control when performing pieces with greater interpretive complexity. Likewise, a sportsperson may focus on the strategic and tactical demands of the situation, relying on their exquisitely-honed technical and motor abilities to handle the detailed implementation of action (in progress).

As such, when an agent is faced with unpredictable or abnormal conditions, we should see an increase in strategic control. In ordinary cases where skills can be run on

<sup>28</sup> Dreyfus (2007), now infamous, example of Chuck Knoblauch has highlighted this phenomenon, where thinking about what one is doing undermines the success of the action that one is performing.

<sup>29</sup> See Papineau (2013) for more on the guiding intentions, which are involved in skillful action.

<sup>30</sup> Also, see Christensen et al. (in progress) for more on this aspect of strategic control.

automatic pilot, strategic control need not be centrally engaged. That is not to say that some skills will not require strategic control, but it is to say that the amount of strategic control necessary for a skill instantiation will vary according to circumstance.

To end, any sufficient account of skill ought to have something to say about how the content of goal states and strategies are integrated into skilful action. That is, any account of skill that does not provide an explanation of how it is that the particular, precise instantiations of motor skills are able to respond to the personal-level goals and strategies of the agent has left out an important feature of skill actions.

#### 4.2 Selective, top-down, automatic attention

The second variety of control that is relevant for any theory of skill to take into account is what I call, following both Wu (2014) and Pylyshyn (2003), selective, top-down, automatic attention. This kind of attention is responsible for selecting the relevant features in an environmental array that a skilled agent should gather information about and respond to, given her goals, plans, and strategies. Importantly, this kind of attention improves with training, is automatic, and is sensitive to the semantic content of the intentional states of the agent.

As Pylyshyn (2003) has argued, many of the perceptual improvements observed in skilled agents can be attributed to the development of selective attention. He writes,

In most cases the difference between sports novices and experts is confined to the specific domains in which the experts excel—and there it is usually attributable to the ability to anticipate relevant events. Such anticipation is based, for example, on observing initial segments of the motion of a ball or puck or the opponent's gestures (Abernathy 1991; Proteau 1992). Except for a finding of generally better attention-orientation abilities (Castello and Umilta 1992; Greenfield et al. 1992; Nougier, Ripoll and Stain, 1989) visual expertise in sports, like the expertise found in the Chase and Simon studies of chess skill, appears to be based on the nonvisual abilities related to the learned skills of identifying, predicting and therefore attending to the most relevant places (2003, p. 85).

As we can see, selective attention is implicated in skill learning and development since significant differences between novices and experts can be observed here. As such, we ought to conclude that learning a motor skill requires more than learning how to control one's body, it also requires learning how to control one's attention. That is, learning to attend to the right things at the right times. Accordingly, an account of skill should have something to say about how selective attention functions and develops.

Importantly, we should notice that though selective attention is centrally implicated in skilled action, this kind of attention does not deploy as a result of explicit intentions. That is, the agent need not consciously direct her attention toward particular features, areas, or segments of her action space. Skilled hockey players, for example, do not have to tell themselves to attend to the initial segment of the puck's trajectory. Rather, selective attention is deployed automatically, once the trained agent initiates intentional action. In fact, we know that skilled agents do not deploy selective attention consciously because skilled agents often do not know which features of their bodies and their

environments they are attending to. That is, consistently, experts either fail to report or falsely report, the cues to which they attend during skillful action (Reed et al. 2010; Wallis 2008; Berry and Broadbent 1984; Brehmer et al. 1980; Reber and Lewis 1977). As such, we can be sure that the attention deployed in skill is not being guided by any conscious intention to attend to various features.

Despite usually not being consciously deployed and often remaining inaccessible to the agent, it is important to notice that selective, top–down, automatic attention is semantically integrated with the personal-level, intentional states of the agent. That is, selective, top–down, automatic attention cannot be construed as a cognitively impenetrable process. In fact, we see that automatic attention must be sensitive, not simply to the existence, but to the content of the goal states and strategies that the agent possesses at the level of strategic control. As Wu writes, in discussing Yarbus's (1967) study,

Attention in the form of eye movements tracks intention, even where the intention is not explicitly to attend in that way. It won't be strange, colloquially, to say that once the person starts looking, a pattern of eye movements happens automatically which makes perfect sense given what the person is looking for. The specific pattern of the movements is a feature of the subject's attention, one that is not represented in the content of the intention...At the same time, this automatic feature is clearly influenced by the goals we have, for the pattern of movements makes sense given the intention, so it is top–down influenced (personal communication).

Thinking about attention in this way, we can see why, e.g., a baseball player who has decided to steal second base will automatically shift his focus to certain relevant features of the pitcher's delivery whereas the player who has decided to wait for the a hit to advance, will perceptually attend, automatically, to different relevant features of the play. These observations seem obvious, but they go a long way in undermining the idea that automatic processes are brute, non-cognitive, and cognitively impenetrable. Selective attention, we see, is both automatic and sensitive to the contents of personal-level, intentional states. That is, automatic attention is both automatic and mindful.<sup>31</sup> And this finding is striking given that, according to at least one extremely influential view of the mind, automatic and informationally encapsulated processes go hand in hand (Fodor 1983).

So, we see that the automatic attention, which is sensitive to the contents of intentional states, but deployed without explicit volition or awareness, functions as an integral part of skilled action. We see this because we see significant differences in how and what skilled and novice agents attend to. As such, it seems that an account of skill ought to have something to say about selective, top–down, automatic attention.

### 4.3 Motor control

The third variety of control that a philosophical account of skill ought to address is motor control. I take it that in combination with selective, top–down, automatic

<sup>31</sup> See Sutton et al. (2011) and Sheets-Johnstone (2003) for similar points about the possibility of intelligent, automatic processes.

attention, motor control is crucial for accounting for the exact, nuanced ways in which a skilled performer modifies, adjusts and guides her skill instantiation. Motor control is constituted by the automatized motor routines that are learned through practice and training. As I emphasized above, the practice that results in motor control incorporates explicit attention to improving the motor control itself. Further, though motor control is run automatically, it can be modified in various ways and voluntarily interfered with by the agent.

As I stated above, skilled agents regularly practice and train in order to refine their control. That is, skilled agents regularly practice their skills with specific attention paid to various aspects of their exact movements and limb positions. Moreover, it seems that part of why painstaking practice is necessary for skill is not only because skill requires refined motor control but also because such control needs to be automatic. That is, agents need to have the cognitive resources to focus on pressing situational demands such as adjusting their goals and strategies in the appropriate ways while allowing motor routines to run on their own.

Accordingly, the trained expert need not voluntarily deploy any particular motor routine when executing a skill. Rather, the right motor routines are deployed as a result of the agent initiating her skilled action together with her capacity to selectively attend. Importantly, we should notice that simply because the motor routines that constitute motor control are automatic does not mean that they are fixed. In fact, an important feature of skilled action is that it allows for diachronic improvements in the motor routines that are automatically deployed in various instantiations of the same skill. Presumably, such diachronic improvements explain why experts continue to practice their skills long after they've been learned and automated.<sup>32</sup>

To support the possibility of diachronic changes occurring in automatic routines, we can look to empirical evidence that suggests that automatic processes are not simply processes that are executed quicker or more efficiently than those that are not automatic, but rather, that in their automation, processes undergo distinctive processing changes (Saling and Philips 2007; Chen 1985; Ericsson and Charness 1994; LaBerge and Samuels 1974). That is, as Saling and Philips (2007) suggest by the title of their paper, "Automatic behavior is efficient but not mindless." What they mean is that automatic behaviors don't just implement the same algorithm as non-automatic behaviors but faster. Instead, the computational steps processed by automatic processes change through automatization. And there is good reason to believe that these more appropriate algorithms continue to develop after their initial automatization. Once again, we see that automatic processes ought not be characterized as brute, mechanistic or fixed.

Lastly, in addition to being learned with explicit attention and becoming automatic, motor control, as I argued above, is also under the voluntary control of the agent. That is, even if the agent cannot consciously guide her automatic motor routines, since such conscious attention is notorious for interfering with elegant, fluid, successful action, it is still the case that motor control can be intervened upon at various junctions. In

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<sup>32</sup> As Montero (2013) writes in a recent New York Times piece, "And improving, especially after you have acquired a high level of skill, typically requires an enormous amount of effort. Sometimes this effort is physical—and it certainly involves more physical effort than philosophy—yet it also involves concentration, thought, deliberation and will power."

fact, as I argued above, the more skilled an agent, the more ways in which she can interfere with her motor control. This makes it possible to make voluntary mistakes in the execution of one's motor routines, as the examples of yoga and gymnastics that I discuss above indicate.

I hope this discussion in combination with the above considerations make it abundantly clear why any theory of skill is going to have to give an account of motor control.

## 5 Conclusion

In this paper, I first presented what I take to be that feature of skillful action that is not accounted for either on the Intellectualist or the Anti-Intellectualist view: control. In Sect. 2, I argued for why Anti-Intellectualism of the Dreyfus variety cannot give an adequate account of the control central to skillful action. In Sect. 3, I proceeded to argue for why Intellectualism of the Stanley variety cannot account for control either. In the final section, I described the characteristic features of control at three different levels, which I insist that any adequate theory of skill must account.

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