16
AUTOMATICITY, CONTROL, AND ATTENTION IN SKILL

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16.1 Introduction

Skill emerges from a shifting balance between automaticity and control over time as a result of learning and practice. Accordingly, explaining the dichotomy between automaticity and control is essential to an adequate characterization of skill. These notions are inextricably intertwined with agency. So, if automaticity and control are to be applied to agentive phenomena, we must understand the phenomena within which the notions get a grip, agency itself. I present a framework that locates both automaticity and control in the structure of intentional agency, and suggest how the balance between them changes as agency develops. My analysis pulls together disparate and opposing tendencies in theoretical work on these topics such that the concepts of automaticity and control can be consistently applied to every skilled behavior.

In what follows, I identify two different levels of analysis of these concepts. The first is at a coarse grain that focuses on the structure of action to ground a notion of automaticity and control in terms of a basic executive attitude, an agent’s intention. This level of analysis is as abstract as the content of the agent’s motivational attitude and fixes a causal structure that yields a sharp boundary between automaticity and control. We can think of this as a synchronic, or at least temporally narrow view of agentive control. Then, at a second, finer grained analysis, one sensitive to the diachronic aspects of skill acquisition and performance, I examine the specific features or properties of a concrete action that are identified as controlled or automatic given the content of the agent’s intention. At this second level, a “gradualist” aspect of automaticity and control can emerge in two ways: First, in how the membership of the sets of properties identified as automatic or as controlled for a given action changes over time, and second, in the tuning of specific action properties over time. I then use this account to provide a framework for experimental work on overt attention in batting sports and to formulate sharper questions to understand that form of skilled agency.

16.2 The psychology of automaticity and control

There have been extensive discussions of automaticity and control in psychology, and as there are various comprehensive reviews available, I shall highlight a few salient points in the history
of this dialogue (Bargh 1994; Logan et al. 1999; Moors 2016). What one finds in this literature is a tug of war between dichotomous approaches that sharply distinguish automaticity from control and a contrary pull toward gradualist conceptions that take the notions to lie on a continuum or to come in degrees. I shall argue that the two approaches can be unified in a conceptually rigorous way by appealing to the structure and dynamics of human agency. This unification is one reason to endorse the approach to be offered.

In psychology, initial theories endorsed what I call the Simple Connection, namely that automaticity and control are incompatible. Theorists began by defining one notion in terms of the absence of the second and the second in terms of a distinct feature such as attention or consciousness. In Schneider and Shiffrin’s seminal work (Schneider and Shiffrin 1977; Shiffrin and Schneider 1977), automaticity was defined in terms of the absence of control and control defined as requiring the involvement of top-down attention. LaBerge and Samuels (1974) argued that when reading becomes fluent, this involves the automatization of decoding of language so that attention is no longer required for that purpose and can be redeployed for comprehension. 2

Other views appealed to distinct features tied to behavior including the speed of processing (efficiency), the involvement of different aspects of consciousness, the lack of task interference, the presence of an intention or goal and so on (Moors and De Houwer 2006). Thus, Posner and Snyder (1975) emphasized three features tied to automaticity: the lack of intention, of consciousness, and of task interference. Bargh (1994) emphasized four features of automatic processes: they are efficient, uncontrolled, unintentional, and unconscious. More recent discussions have identified even more features. Palmeri (2006) lists 13 paired features that characterize automaticity versus controlled process while Schneider and Chein (2003) list no fewer than 17.

The ever-expanding list of individuating features exemplifies the pull away from strict dichotomies and was motivated by empirical evidence against that approach. If a theorist claimed that automatic processes are to be identified by feature F (or some subset of features), then assuming a dichotomous relation to control processes, the presence of F should be necessary and sufficient to pick out an automatic process, or alternatively, its absence should be necessary and sufficient to pick out a controlled process. Yet for any F proposed to individuate (say) automatic processes, experimental work consistently showed that F was found in pretheoretically accepted controlled processes. For example, initially, attention was taken to be necessary and sufficient for controlled processes, and yet it was demonstrated that there are automatic processes that are dependent on attention (e.g., the Stroop effect).

Theorists began looking to other features or to combine features, but no solution was found. Bargh (1992: 183) claimed that all approaches were faced with internal inconsistency in the following sense:

The problem with the unitary, all-or-none definitions of automaticity and controlled processing is that they have been repeatedly disconfirmed empirically over the past 10 years. The defining features just do not hang together in an all-or-none fashion, but rather seem to be able to co-occur in just about any combination.

Currently, for many theorists, talk of automaticity and control is linked to a set of features which correlate with but do not provide necessary or sufficient conditions for those processes. That is, they moved away from a simple dichotomous conception of automaticity and control to viewing those terms as describing ends of a continuum characterized by a variety of features.
It is possible, however, to incorporate disparate insights regarding automaticity and control as found in much of the past work on the topic. First, the Simple Connection can be maintained by drawing on the philosophically explicated causal structure of intentional action. The analysis identifies sets of features that are either controlled or automatic but never both simultaneously. Thus, a strong division between automaticity and control can be established. Second, these sets of features exhibit relevant gradations across time as an expression of the development of skill during learning, practice, and performance. Recognizing this is fully consistent with dividing automaticity from control. There need be no tug of war. We are all pulling in the same direction.

16.3 The coarse grain: an analysis of automaticity and control

Descriptions of skilled agency advert to automaticity and control. On the one hand, experts in their skilled actions exert an exemplary capacity for control. On the other hand, their expertise is exemplified in pervasive automaticity due to training and practice. Part of the point of this acquired automaticity is to disengage control from certain aspects of behavior so that it is free to exert influence elsewhere. A theory of skilled agency must capture this give and take between automaticity and control within action. Skilled agency is, of course, a form of agency, so we might hypothesize that the basis of automaticity and control as central aspects of skill will be explicated in the structure of human agency. Irrespective of any additional usage in cognitive science, say in the description of subsystems in the agent’s brain/mind as involving control and automaticity, an agentive construal of automaticity and control is primary. It links discussions of agents in philosophical, empirical, and folk theories of mind. ³

Accordingly, the primary motivation for a philosophical account of automaticity and control is in making sense of human agency. This means that the account must clarify central claims that invoke the notions. Consider three claims that seem to be jointly inconsistent and yet each of which seems to be true:

1. Intentional action expresses agentive control: we exert control in acting intentionally.
2. Human actions involve substantial automaticity.
3. Simple Connection: If something is controlled, it is not automatic and vice versa.

Proposition 1 is central, and it motivates our approach. In thinking of skilled behavior, agentive control is tied to intentional agency as its fundamental expression. If agents exert any control, it is through their intentional action. That is, if we provide analyses of control that cannot make sense of how intentional agency exemplifies it, then our theories will have missed the central case. Yet when we consider any instance of intentional agency, we find it imbued with automaticity as per Proposition 2. We might walk intentionally to the store or drive there in our car, but many of our movements are automatic: the way we shift our legs, the sequence of joint movements, our speed, the way we flick on the turn signal, and so forth.

The first two propositions express basic truths about human action (see Wu 2013 for an initial discussion), where the notions of control and automaticity are part of a conception of human agency as a subject-level phenomenon. No doubt the notion of control has its place in other theories concerned with mechanisms that might explain agency or other behaviors, but agentive control as given in Proposition 1 is fundamental from a philosophical conception of actions as what people do. I start here rather than, say, with optimal control theory (Fridland 2017b), because my level of analysis is that of the subject-agent and not the motor control systems that contribute to explaining aspects of her agency. This is where the notion “control”
Wayne Wu

needs to be used with care since it crosses levels of analysis (similar worries apply to “attention” as used in philosophy and cognitive science, see Wu 2014).

The problem arises when we add the Simple Connection which animated psychological approaches to automaticity and control, for now, it looks like an action that is controlled cannot be automatic, so Propositions 1 and 3 seem to imply the negation of Proposition 2. If so, we have an inconsistent triad. The resolution might seem obvious: reject Proposition 3 given the history of work on automaticity and control in psychology. The problem, however, is not the Simple Connection but how it was implemented in psychology, with its focus on specific experimental tasks, rather than the basic structure of intentional action. If it turns out that a way of making the propositions consistent was missed, one that is compatible with the fruits of empirical labor, then we have good reason to endorse the resulting analysis. We will see how to save a simple idea that motivated empirical research on automaticity and control in respect of tasks by merging it with philosophical propositions about action. We render the three propositions consistent. I submit that a sufficient condition of adequacy for a theory of automaticity and control as agentive phenomena is that it shows how the inconsistent triad is in fact consistent, and in a way that does not run roughshod over relevant empirical work, but links it to philosophical concern.

To do this, we reinterpret the Simple Connection to focus on a feature of a process as either automatic or controlled but not, at the same time both. This relativization of control and automaticity to action properties allows us to render the three claims consistent. That is the motivation for this shift in conceptualization, away from the standard scientific conceptualization of processes themselves as simply automatic or controlled. For if a feature of a process is either controlled or automatic at a time (or stretch of time) but not both at that time (or stretch of time), then when considering an action, we can describe it as controlled and automatic relative to specific features. Processes can be both automatic and controlled, relative to their features. There is then nothing odd about intentional action being controlled and yet also exemplifying much automaticity as per Propositions 1 and 2. Thus, the proposed schema resolves the seeming paradox we have noted.

With this in place, we define automaticity in terms of the absence of control, as per the Simple Connection, and then control in terms of some individuating feature. At this point, the first proposition indicates how we should analyze control since the relevant form of control is exemplified in intentional action. Specifically, we find control in the structure of intentional action, and the salient aspect of that structure is the role of the agent’s intention in action. Although one can say more about the details of that structure, it suffices for our present purposes simply to recognize the executive role of intention which allows us to pin control to it (for more detailed unpacking of the structure of intentional action, see Wu (2016)). To find control in action is to understand it in the influence of an agent’s intention.

An intention represents a type of action to be done, say when one intends to F, and when the intention performs its functional role, it generates an action that is an F. Thus, when one intends to pick up that mug to drink from, then the intention generates an action which is a picking up of that mug. We can treat the action kind intended, namely F, to specify a set of properties such that if the resulting action has those properties, then the intention is satisfied in that the resulting action is intentional under the relevant description (Anscome 1957). We can then say that a property F of an action A is controlled relative to an intention if and only if the intention’s representing an F-action as to be done brings about the action A’s having F. Otherwise, the property is automatic. Simply put, an action is controlled relative to F iff its having F is a result of the agent’s doing F given an intention to do so (doing F is part of the content of the intention). Not surprisingly, the bulk of the properties of an action are automatic in the technical sense just specified.

210
This leads to the following analyses:

S's doing an action A with property F is agentively controlled with respect to F iff A's having F is the result of S's intention to A in an F way.

An action instance A with property F is automatic with respect to F iff A's having F is not agentively controlled [i.e. the revamped Simple Connection].

An action instance A is passive (fully automatic) iff for all properties F of A, F is automatic.

An action instance A is fully controlled iff for all properties F of A, F is controlled.

Clearly, only an omniscient being could fully control A, this requiring that the agent has cognized every feature of action in a corresponding intention and brings about those features because they are intended. Only God could do that. In contrast, there are instances of (defective) human action that are plausibly passive, say passivity phenomena in schizophrenia (Cho and Wu 2013).

Ellen Fridland (2017a) asks why we should emphasize intention in the analysis rather than some other feature such as consciousness or dual task interference. I hope the answer is now clear: control must be rooted in our conception of the structure of human agency as a subject-level phenomenon. Intentional action is at the core of that conception. So, I take Proposition 1 to be a conceptual truth that provides the motivation for starting with intention in understanding agent-level control. Further, the specific analysis is motivated precisely because it resolves the paradox generated by the three putative truths that we noted earlier. We have maintained the Simple Connection and shown it to be consistent with two truths about human agency.

That said, it is important to note that the analysis I have provided, though focused on the subject level, identifies a basic schema for discussion of control in other domains such as empirical discussions of systems within the mind or brain (e.g., top-down modulation of attention, see Wu (2017)). It is, then, of general use to cognitive science. In the case of intention, we envisioned a structure where intentions represent an action to be done and then influence the agentive capacities whose expression yields the action. Thus, there is a general control structure, a representation of some feature such that this representation generates a process with that feature. I have focused on intentions as the relevant action representations as first in the order of philosophical analysis, but the structure can be iterated for any representation that plays a causal role in influencing behavior in light of that representation's content.

Assume that we are interested in a hierarchically organized system where a top-level T plays a role in modulating the activity of a bottom-level B. We can then speak of B-type processes as controlled relative to some feature F if T plays the appropriate role in bringing about F, namely by representing the B-process to be produced as having F. For example, if one wished to speak of goals as mental states that represent ends which are to be reached by implementing specific intentions, then to the extent that the goals play a role in shaping behavior so that, when successful, the resulting behavior satisfies the goal, we can speak of teleological control, namely control by the goal. Thus, we can say that an action instance A with property F is teleologically controlled with respect to F iff A's having F is the result of a goal to achieve F.

Consider also the case where a subject knows that a certain undesirable outcome will obtain in doing something intentionally. Thus, one wants to achieve some action X but recognizes that the undesirable outcome Y will also obtain. Thus, one might be said to intentionally bring about X and Y. Still, talk of intention doesn’t quite separate two different aspects of the control structure.
The primary form of control is agentive control that is tied to an intention to X. Still, as we saw for goals, knowledge and other higher order states might play a role so that we can use them to render salient in our descriptions of an action certain of its features. If we wish to highlight known but undesirable outcomes, then we could in principle speak of knowledgeable control: an action instance A with property F is knowledgeably controlled with respect to F iff A intends to do A knowing that F will result. In this case, it need not be true that one’s knowledge brings about A’s having F in the way that an intention might have brought F about. Nevertheless, knowledgeable control makes F salient in the sense that the agent is aware of it, and this can engage with concerns about responsibility and blame. In any event, different notions of control draw on the basic schema I have provided, namely relating higher level representations to action features. The usefulness of these further distinctions will rely partly on their highlighting different forms of top-down influences on action that are theoretically salient.  

There can be as many different notions of control as there are hierarchical structures in the generation of a process, these structures exemplifying an interaction between representations and the processes they influence. This proliferation need not be problematic so long as we are clear which structure we are interested in, say the influence of memory, desires or emotions on action or in the generation of processes at lower levels of analysis. What matters will then be fixed by our theoretical concerns. Yet what fixes the idea of control is the schema revealed in reflecting on intentional control of action, that structure which is first in the order of explanation if we are interested in human agency, a subject-level phenomenon. Correspondingly, any talk of automaticity will, given the Simple Connection, also need to be relativized to the control structure with which it is contrasted. For most philosophical purposes, and related empirical approaches, intentional control will be primary.

16.4 The fine grain: gradations in automaticity and control

As I noted earlier, there were severe pressures on attempts in psychology to draw a sharp division between automaticity and control, and these led to a more gradualist approach, or at least to the emphasis of correlated features, many of which are graded (e.g., response measures such as reaction time, speed, or efficiency). It is an advantage of the current approach that it allows one to draw a sharp distinction between automaticity and control and also to take on board the gradualism that has saturated current theoretical discussions. This section shows two ways that a gradual approach is consistent with drawing a sharp dichotomy.

As I have implemented the Simple Connection, control and automaticity are fixed relative to a set of features of a given action in light of a background intention that generates that action. So, let the features of action represented by an intention be captured in the set \( \{F, G, H, \ldots\} \) and the features of action not represented be the set \( \{X, Y, Z, \ldots\} \). We can say, if we wish, that automaticity always swamps control in that the number of controlled properties will be limited by what the agent can represent in an intention, something not true of automatic properties. That is a clear type of capacity limitation, rooted in representational capacity limits of a finite mind. Accordingly, at any point in time in the performance of an action kind, there will be a balance between control and automaticity tied to the agent’s representational capacity. This is a synchronic perspective on how automaticity and control are “graded.”

If we take a diachronic view of behavior, given that we are interested in the development of a skill, then we can see a shift over time in the membership of the set of controlled properties. This dynamic is simply a function of how intentions change over time. A basic intuition is that initially when first carrying out an action, many basic facets of the behavior must be explicitly kept in mind as part of what we intend to do. As skill increases, what we must keep in mind...
moves to higher level properties (or indeed, given specific situations, to fine-grained lower level properties). This shift in intention thereby changes which features of the action are controlled and which are automatic. Thus, as one is first learning a piece on an instrument, one might be explicit in one’s intention of certain basic movements, say a tough fingering in a tricky passage, but as one practices, the need to think of the sequence of movement disappears. When one reaches that passage, one just plays the notes. Consequently, one can now think about how to play that sequence of notes, say at what speed, intensity, and so forth. Thus, the first diachronic gradation in automaticity and control will lie precisely in this push and pull of the members of the set of relevant properties over time.  

Second, we can see gradations within automatic and controlled properties. Of most interest are the properties that have been traditionally correlated with automaticity. On these, Logan (1985: 373) notes that “each of the properties of automaticity change more or less continuously as a function of practice.” We can understand his reference to properties of automaticity as meaning those properties that traditionally are associated with automaticity: speed, diminishing of dual task interference, load effects (e.g., attention understood as a limited resource). Note that the Simple Connection does not see any of these as individuating automatic processes, nor would most empirical theorists of automaticity. Rather, these are features of an action that can become, or are, automatic in the technical sense defined, but also are features that change their profile over time. For this reason, we can take on board the empirical results concerning automaticity and affirm the Simple Connection as explicated earlier.

To take an example, the speed of response is not always something we intend. When learning to play a difficult passage, the goal is not to play the passage quickly (at least initially), but to play it correctly. But as one focuses on ordering one’s fingers in the correct way, as defined by the music score, it also happens that one’s playing of the passage increases in speed. At some point, the playing of the passage becomes automatic in that our intentions are not so fine-grained as to be concerned with representing the exact sequence of finger movements. At the same time, that exact sequence of finger movements becomes faster in execution over time. So, we have two transitions: the automatization of the finger movements in that the intention no longer is fine-grained in representing them and the changes in the quality of this specific automatic feature of the action, one’s fingers moving in that way, which increases in speed over time with practice. The same can be true of many features that cognitive scientists have associated with automaticity. We can speak of this change in specific properties that reflects practice and training as a type of *tuning* which does not define the action as automatic or controlled, but reflects the ongoing dynamics of automaticity and control.

As theorists (and indeed, as teachers or coaches), which properties we choose to focus on will depend on our interests, but no matter what the given theoretical context renders salient in respect of automaticity and control, the analysis of this section shows how we can maintain a sharp boundary between automaticity and control while also allowing for talk of gradation. This is the first way that we can accommodate both the original insight of the Simple Connection and later empirical concerns with gradualism in automaticity and control, one that respects a philosophical theory of action.

16.5 Skill as such

Assessments of skill are relational: we pinpoint skilled behavior by contrasting it with some relevant contrast class. The contrast class I shall focus on is that generated by looking at the agent’s history, following the agent’s developmental trajectory in learning an action and examining how the action changes in profile over time. The first dimension focuses on how the agent...
conceptualizes the target action in the initial intention, as she first learns the skill, and how this conceptualization, which fixes the initial controlled features of the action, changes over time, and consequently, how the features that are identified as controlled or automatic change over time. Again, an intuitive shift is from the initial explicit representation in one’s intention of low-level features of the action (e.g., in learning a musical piece, representation of finger movements and sequences) to an intention that no longer needs to represent these features, but shifts to higher level features (e.g., in representing the intensity or speed at which the piece should be played, and perhaps later, in representing higher level aesthetic properties of the performance). The shift in the content of the intention then fixes, at the relevant points, the sets of properties that count as automatic and as controlled.

Drawing on this intuitive starting point, when we look at the skilled agent, we consider the way she conceives of her action, especially in higher level features that are made available precisely because many lower level features have become automated, freeing up conceptual space. Thus, automatization opens up other avenues for control and the possibilities of control not only are indicative of her expertise, but also differentiate her from other highly skilled agents. For example, in music, we reflect not just on her technique, which reflects the automatization and tuning of basic skills, but on the subject’s artistic choices in how the piece is played. In speaking of performance as cerebral, spontaneous, inspired, programmed, etc., we can map these intuitive notions on the action. We need only understand the structure of acquired skilled agency in respect of automaticity and control, synchronically and diachronically.

Concomitant with these global changes in automaticity and control, the action properties made salient to the theorist in the automaticity-control context also change their character over time. This is clearest for automatic properties. Thus, we can see changes along a continuum in terms of measured features such as reaction time, load effects, interference effects, and so on. One measure of the subject’s increased efficiency is a change over time as we compare performance now to past performance. Thus, even if the agent does not intend to be able to play a passage faster and faster, over time, this sharpening of motor capacities might happen automatically (as we normally say). This would constitute a change in her skill, but not one brought about intentionally even if brought about by intentional practice.

This leads to a schema where we assess the skill of an agent diachronically to the agent’s past performance, if we are interested in the agent’s learning, or synchronically relative to the performance of others if we are interested in an intersubjective assessment of skill level. This assessment then draws on two levels of analysis:

1. The shift in properties in the set of controlled and of automatic features.
2. The shift in the character of those properties, typically as measured in performance.

How we assess skill will be contingent on the properties that we think salient to the skill in question.

16.6 Skill in attention

The theoretical should engage the practical. A theoretical apparatus used in characterizing skilled behavior should engage with understanding actual expert behavior. We are only at the beginning of merging these perspectives, and there are substantial challenges. I shall illustrate this by examining overt visual attention in cricket batters, and recent experimental work probing such attention. Regarding attention, I work with a notion central to the science of attention which yields a basic guidance condition: if a subject selects X to inform their performance of a task T,
then the subject thereby attends to X (Wu 2014). The hypothesis is that as batters become more skilled, their visual attention to the ball will change character, a shift from control to more automatic and tuned attention. Unfortunately, the experimental results are noisy. There is much to be done including systematization of results under a theory of batting action as well as probing skilled batting in more natural contexts.

A coaching adage regarding attention in batting is to “keep your eye on the ball.” It might seem difficult to do so with projectiles at high speed such as a ball delivered by a fast bowler in cricket, a fastball in baseball, or a first serve in tennis. In cricket, ball speeds can range from 17–25 m/s (slow to medium bowlers) to up to 44 m/s (fast bowlers). When facing a fast bowler, the time from ball release to its reaching the interception point with the bat can be shorter than the time required to execute a batting movement, so batting expertise involves gathering prerelease information to aid prediction of the flight of the ball. Again, we have a demand for appropriate attention: what aspects of the bowler’s delivery provide information relevant to increasing performance and can the batter efficiently select that information to guide behavior? How does one learn this? There is positive correlation between the number of structured hours spent in batting practice and the level of expertise (Weissensteiner et al. 2008; Ford et al. 2010).

Still, uniformity in the data is somewhat elusive. An initial notable study by Land and McLeod (2000) identified a consistent pattern of eye movement across three cricket batters of different skill levels. Balls were delivered by a bowling machine at 25 m/s. All three batters initially tracked the flight of the ball at its release but then made a predictive saccade to the bounce point of the ball. Land and McLeod observed that the more skilled batters made earlier saccades. One hypothesis is that with more skill, batters are better at extracting information. Croft et al. (2010) worked with sub–elite to elite batters below the age of 19 in New Zealand at slow to medium ball speeds (17–25 m/s). They observed a variety of eye movements. Some batters were able to maintain fixation on the ball throughout the duration of the flight; some tracked the ball initially, broke off foveation, and then caught up with the ball to maintain fixation; some only tracked the ball near the end of the flight while some did not track the ball by fixation but kept the ball in a parafoveal region. Clearly, the data is noisy. Mann et al. (2013) studied the batting of two elite batters (“two of the most accomplished cricket batters to have played the game”) with a machine delivering balls at speeds of 33 m/s, faster than the previous two studies. Strikingly, these batters were able to keep the ball at a constant egocentric position relative to the head and they were consistently able to direct their gaze at the contact point between bat and ball:

the elite batters appeared to do whatever was necessary to ensure that their gaze was directed towards the location of bat-ball contact: usually they made two predictive saccades, but even when they produced only one, they shifted gaze to the anticipated location of bat-ball contact rather than to ball-bounce.

Mann et al. 2013: 8

One challenge to all of these studies is the low number of subjects as well as non-natural conditions since balls were delivered straight at consistent speeds making prediction easier. Sarpeshkar et al. (2017) attempted to reproduce earlier results as well as introduce more uncertainty in ball trajectory by mixing curved with straight deliveries and contrasting elite with competent batters. They were unable to replicate some earlier observations: They did not observe earlier saccades in any of their subjects, even in the condition where balls were consistently delivered straight at about 33 m/s, one of the central findings in the Land and McLeod (2000) study. They did replicate the finding that elite batters initiate more saccades toward bat-ball contact and orient their gaze in the direction of the ball at the moment of contact.
batters’ gaze was more likely to lag relative to elite batters, perhaps the result of less efficient prediction. What is clear is that there are different patterns of attention within each paradigm in relation to the ball and to bodily movements. In several of the studies, expert behavior differs from less skilled behaviors in respect of attention-based tracking of the ball. For example, the Land and McLeod study demonstrates that under conditions of fairly high predictability at low to medium ball speeds, expert ability correlates with predictive saccades. The results of Mann et al. need not contradict this, since they used faster ball speeds, but their concern about ecological validity is well taken.

How does one learn to be an expert? How does effective training in batting make salient aspects of the information available to the batter? Given our discussion about automaticity and control, we can formulate a set of experimental questions that can be generalized to other skilled behaviors and which draws on the definition of automaticity and control I have given:

1. What visual information is necessary to bat effectively?
2. What is the pattern of attention in a novice?
3. What instructions help the novice to shift attention so as to acquire more skill?
4. What are the patterns of attention at different skill levels and how are instructions tailored to tune attention?
5. How do the intentions shift over periods of training, and thus what features become automatized over time?
6. How are the automatic and controlled features tuned over time?

The framework presented provides a uniform structure to apply to any skilled activity, helping us formulate sharper questions. One goal of philosophers in this area should be to work with the experimentalist in constructing hypotheses and theories, a merging of the theoretical with the practical. In doing so, a harmonious philosophical and empirical picture of skill at a time and over time will emerge.9

Notes

1 Or more broadly, states that motivate actions by representing the action kind in question as to be done, say a belief-desire pair.
2 This issue is complicated by evolving conceptions of attention at that time, from Broadbent’s (1958) “single channel” view, where attention acted as a filter, to a shift to a conception of attention as a limited resource or capacity. I set aside these complications here.
3 See also the recent literature on know-how for related discussion (Hawley 2003; Pavese 2015a, 2017, 2018). I hope to engage this link more fully elsewhere.
4 For an echo of this idea in the empirical literature, see Moors (2016) who writes of control: “A has control over X when A has a goal about X and the goal causes fulfillment of the goal” (265). Carlotta Pavese reminds me that this presumes that the causal links are not deviant. On how to deal with causal deviance in action by appeal to attention, see Wu (2016).
5 This concurs with Moors and De Houwer (2006) when they claim that intentional actions are a subset of controlled behaviors.
6 The issues regarding knowledgeable control will intersect intellectual positions regarding know how. These are important matters to take up elsewhere. See, among others, Stanley and Williamson 2001; Stanley and Krakauer 2013; Pavese 2015b, 2017, 2018, 2019.
7 In principle, the set of automatic properties is an infinite set while the set of controlled properties is, given our finite minds, finite. Our explanatory interest restricts the set of automatic properties that we dissect experimentally or theoretically.
8 Ellen Fridland suggests to me that skilled action involves more control. I think that skilled action involves a different kind or pattern of control (vs unskilled action). Training changes the nature of one’s control.
Novices exert control of a certain kind, focused on some features that become automatized. That said, if one wanted to quantify control, the theory offered does provide a way to do so.

9 I am grateful to the editors for their encouraging and helpful comments.

References


Wayne Wu


