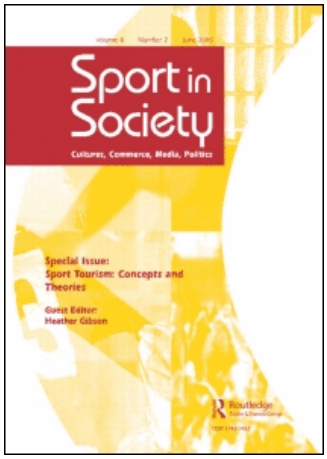

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Batting, Habit and Memory: The Embodied Mind and the Nature of Skill

John Sutton

Cricket is suffused in memory. Both playing and appreciating the game centrally involve various forms of remembering. This essay focuses on the distinction between explicit autobiographical remembering and the kind of habitual or 'procedural' memory involved in complex embodied skills like batting. Generally considered the province of psychology or cognitive science, the phenomenon of habit or skill memory has been largely neglected by philosophical anthropology and the philosophy of mind. However a number of intrinsically interesting questions concerning batting in particular arise when considered from this perspective. While drawing upon ideas from psychology and cognitive anthropology, the argument is supplemented with accounts from general testimony and cricket writing, phenomenology, and other investigations of the embodied mind. While starting from the prevalent view that thinking too much disrupts the practised, embodied skills involved in batting, the essay suggests that experts do in fact successfully learn mental techniques for how to influence themselves in action, and that the kinds of explicit thought and memory in question are themselves active, dynamic and context-sensitive.

> Suppose I am making a stroke in a quick game, such as tennis or cricket … When I make the stroke I do not, as a matter of fact, produce something absolutely new, and I never merely repeat something old. The stroke is literally manufactured out of the living visual and postural 'schemata' of the movement and their interrelations.
>
> F.C. Bartlett [1]

'Think? How can you hit and think at the same time?' the baseball great Yogi Berra is supposed to have said. [2] Many readers of this journal will be intimately, agonizingly familiar with the troublesome roles of thought in cricket batting. The intrusive rumination over my horrible shot last Saturday; the bizarre, fluttering irrelevancies

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which seep through mind and body as the bowler runs up; the vainglory after one sweet cover drive, a temporary manic narcissism which perseveres, skewing my allowable response repertoire as the next ball arrives and draws me into another flash, a nick, the gut-wrenching lurch, the swamping disbelieving misery, the self-criticism, the rumination … and so it goes. And yet the emotional rewards are compelling. 'There are few pleasures in the world greater than that of making runs and making them well', wrote Ranjitsinhji in *The Jubilee Book of Cricket.* 'A well-timed late cut is as sweet a thing as there is. A big drive, clean and true, gives a satisfaction that cannot be expressed in words.' [3]

This essay addresses, in a preliminary fashion, some questions about the relations between batting and thinking, by investigating the roles of different forms of memory in cricket. Mainstream philosophy of mind has long neglected embodied intelligent action in general: an inquiry into this one highly peculiar kind of skilled performance can demonstrate the philosophical and psychological importance of complex skills, and exemplify an interdisciplinary spirit in the study of the embodied mind in which phenomenology and cognitive science are natural allies rather than glaring antagonists. [4] A number of intrinsically interesting issues about batting – issues which matter to players and coaches, commentators and spectators – show up in new forms when considered in the light of these concerns about memory and skill. Readers who are not immersed in cricket can still, I hope, read through the emblematic case study to the independently-motivated theoretical problems, and move between domains with some of the multidisciplinary materials and puzzles I use and raise. I am much more confident that cricket can be useful to the cognitive sciences (that it is an important case study with some generalizable implications) than that these sciences can be directly useful to cricket. But despite reasonable scepticism among players about over-reliance on sports science, many are nevertheless intrigued by questions about habit and memory in particular.

The significance of memory in cricket batting derives from its nature as an 'open skill': within the game's structured patterns, the actions required for success in responding to the changing environment must be flexibly and minutely adaptable. [5] So batting is a form of regulated improvisation under (what can be) severe time constraints. It is, further, a dynamic interceptive action, in which the ball must be received and sent away within the same movement. [6] When all goes well, the ease with which experts achieve this is breathtaking. This combination of features was highlighted in the suggestive remarks quoted above from Bartlett's classic *Remembering: A Study in Experimental and Social Psychology,* one of the key precursors of recent ideas about situated cognition. [7] For Bartlett, my movement history animates my present actions even as I respond to the novel demands of the current situation. The way in which the past is thus alive in my embodied actions now is in fact typical of mundane human activities (cooking, making things, driving, talking) as well as more idiosyncratic acquired skills like batting. Bartlett took such skilled improvisatory performances as representative of remembering in general, arguing that *all* kinds of memory are forms of regulated improvisation.

Although I share this view and return to it at the end of the essay, there are still two distinctive ways in which batting involves remembering.

Cricket in general is suffused in memory. Both playing the game and following it centrally involve personal memories, embedded in rich associative webs of autobiography and shared emotion. Great pleasure is brought by thinking and talking through our memories of the run-stealers who flickered to and fro in the games of our youth; [8] and a batsman's specific past experiences can be among the most vivid and distinct of autobiographical memories. [9] I clearly remember, and still with a visceral cringe, flaying at and (horribly) edging a wide half-volley when going well (on 32) in *that* season's huge game against our arch-rivals. Some lifetimes are partly defined and anchored by such moments, which can play ongoing cognitive and affective roles in structuring autobiographical knowledge of whole periods of the personal past. Even when the dates or some contextual details of such memories go astray in the reconstruction, as they can, they are more often 'false-in-detail' than 'completely-false', and the specific episode at their heart can at least in principle be located as having occurred at a particular past time in personal history.

This kind of explicit personal/autobiographical memory of specific events in the personal past is not, on first appearance, Bartlett's topic in the above quotation. Batting also involves what seems to be a different bundle of memory capacities, which I will call 'habit memory' or 'skill memory'. It is in this sense that I still remember (fallibly, of course) how to get right forward and smother an off-break, after all the years of practice since childhood; or (even more fallibly) how to sweep backward of square leg with bat coming horizontally, low and hard across the front pad, head still, taking it early if I've judged the length right, balanced and watching it right onto the face, or swivelling slightly with the stroke if I'm taking it from outside leg stump and placing it finer. Like riding a bike or playing the flute, executing competent cricket strokes requires this kind of 'know-how' which goes by many theoretical labels, from 'tacit knowledge' to 'procedural memory'. [10] Suggesting the alternative term 'kinaesthetic memory' for such distinctive felt movement dynamics, Maxine Sheets-Johnstone describes everyday flowing human movement in terms close to our Bartlettian picture of batting: 'a kinetic dynamics unfolds that is at once both familiar and yet quintessentially tailored kinetically to the particular situation at hand'. [11]

In sections 2 and 3 I present two different pictures of the relations between these two forms of memory, both partly supported by cricketing common sense as well as by philosophical and empirical considerations. But first, to introduce the general problem about how the two forms relate, I need to underline further the most obvious differences between them. As noted above, my personal memories of a particular off-drive in one innings, of top-edging that pull shot onto my nose, or of hitting my fourth ball straight to mid-off last week, derive from single, specific events. But skill memory (sadly) can only derive from long, repeated training, from routines and practices, from many related experiences rather than one. Further, in exercising the former kind of memory, but not the latter, my mental state is explicitly *about* the past event from which it derives. It is as past that *that* old top-edged pull appears to me

now, whereas in actualizing my skill memory while playing another defensive shot I need not be aware at all of the role of my past experience in my current activity (indeed it is often crucial that I am *not* aware of anything outside the present context). Autobiographical, personal or 'episodic' memory has thus been called a form of 'mental time travel': [12] where this form of memory is in play, I can in principle distinguish *that* particular time I was caught in the deep off that left-arm spinner from all the other times I may have played the same shot to the same bowler with the same unhappy result.

So in personal memory we do more than understand and respond to typical sequences of events or routines: we grasp the causal connectedness of events in the personal past, and the asymmetry of experienced time. [13] It is tempting to speculate that memories of getting out are paradigmatic cases of autobiographical memory: the awful singularity of the moment of dismissal is intrinsic to the nature of batting, an all-consuming dissolution of possibilities which even the most casual park cricketer takes time to shake off. Remembering such unique, irreversible moments underlines the way in which, as the philosopher Christoph Hoerl puts it, personal memory grounds our awareness of the singularity of events and especially of actions: for Hoerl, we are thus 'sensitive to the irrevocability of certain acts', so that we, unlike other animals and (perhaps) some severely amnesic patients, incorporate a sense of the uniqueness and potential significance of particular choices and actions into our plans and our conceptions of how to live. [14] Batting – still being in, not getting out – is emblematic of temporary success at being in time, each action and each ball offering stark possibilities of an irreversible change of fortune. [15]

There are further obvious differences between the two forms of memory. Skills, habits and embodied movement capacities are to some extent both consciously inaccessible and verbally inarticulable. Some coaches are better than others at helping batsmen into the groove of knowing how to read the googly, or how to sweep on a turning track; and of course some writers and commentators are better than others at finding explicit descriptions for V.V.S. Laxman's flick through mid-wicket, while the rest of us gasp at its ineffability. But such description, we accept, is an entirely *different* skill from the batsman's relevant skill, which relies more on swift pattern-recognition and the other coordinated embodied perceptual-motor-memory capacities that no-one really understands.

This is the starting-point for my first pass at an account of the relations between the two forms of memory in section 2. I pick up on some cricketing commonplaces about how thought gets in the way of successful performance, and introduce some initial theoretical options for understanding practices of embodied coping like batting. But I then complicate this picture, which is deeply ingrained in cricket culture, though I do not reject it: I argue in section 3 that truly expert performance in batting does in fact need to be responsive to many 'high-level' factors which can't, it seems, be left to skill memory and the wisdom of the practised body alone, but which require us to be able to influence ourselves. Somehow, sometimes, thought and personal memory can reach and sculpt the inarticulable sources of grooved habitual performance. The conceptual

framework being tentatively developed here is more important, and I hope more robust, than the specific and speculative picture I sketch here about the relations between the two forms of memory.

'You don't think about *anything*': The Independence of Habit and Thought

Thinking too hard about your game, in cricketers' lore, is usually not a good way to go, a sign that something has gone wrong. In the extreme, self-conscious attention either to the mechanics of batting or to the possible consequences of failure or success can cause or entrench a severe breakdown of abilities. When utterly out of form, for example, or just outclassed by bowling and conditions, the usual grooved actions break down, shot selection disintegrates, deliberate trying overwhelms once-fluid habits, both bat and body become encumbrances rather than enabling media of skilled performance. This doesn't happen only to overly introspective club players, of course: some of the very greatest batsmen suffer it. In the 1960s, Ken Barrington described to his ghost writer an extended and notorious loss of form:

> *Everything* went wrong with my batting ... You can't change a habit instinctively. When you're playing well you don't think about *anything* and run-making comes naturally. When you're out of form you're conscious of needing to do things right, so you have to think first and act second. To make runs under those conditions is mighty difficult. [16]

This is an admirably clear example of themes so common in top cricketers' self-descriptions that they are close to cliché. I'll return to the specific problems of loss of form later, but for now note Barrington's contrasting vision of flow: 'when you're playing well you don't think about *anything*'. The theme is not new: in his 1922 coaching book the great Australian captain Warwick Armstrong described successful, constant batting practice as leading to a time 'when we are unconscious of any hesitation at all, acting as if by instinct; for the occasion prompts the action. Then we play naturally; that is, we have made habit second nature.' [17] And in recent times, Sandy Gordon, who has worked extensively with the Australian side and is easily the most successful professional cricket psychologist, lists in his fundamental assumptions for success that 'You absorb yourself in the moment and have a present focus. This is a critical skill in cricket.' [18] Being aware of what has happened in the past or of what might happen in the future takes you away from the immediately pressing perception-action cycle, and so young players are encouraged not to overindulge in memory or imagination almost as much as they are instructed to manage and control their emotions and to avoid the dangers of theory. [19] These default assumptions among cricketers thus stress the independence of acting and thinking: they see the successful doing involved in the execution of the long-practised, habitual, semi-improvisational embodied skills required for batting as independent of more explicit conscious or verbalizable forms of knowing such as those involved in autobiographical remembering. *Having* such batting skills and embodied memories, and being able

to employ them, is utterly different from *knowing* about them, or being able to describe them, or even remembering your earlier exercise of them: practitioners differ profoundly from coaches, critics and commentators. Because the movements are in one sense new and fresh every time a shot is played, and because – as noted above – nothing in the occurrent activity *refers* in any straightforward way to its history or to the source of the skill, it is easy or perhaps vital to forget that the past is called into play at all: the social theorist Paul Connerton describes such habitual capacities as 'traceless practices', which neither explicitly call on nor directly leave specific or single signs or records. [20]

In recent philosophy, the framework most relevant to understanding this kind of flexible intelligent embodied activity, and its differences from explicit reasoning, is Hubert Dreyfus's phenomenology of everyday expertise. Both in sustained critiques of classical cognitivism and in constructive mode, Dreyfus has argued that there are two dramatically 'distinct kinds of intentional behavior: deliberative, planned action, and spontaneous, transparent coping'. [21] While we do need consciously and deliberately to follow rules in the initial stages of (for example) learning to drive or learning to play chess, the slow transition from novice status through competence to genuine expertise involves, according to Dreyfus, gradually relinquishing one's reliance on explicit rules. Truly skilled practitioners do not rely on verbally articulable propositions behind their decision and action, nor need they have conscious control over, or even conscious access to, the processes by which they act: 'an expert's skill has become so much a part of him that he need be no more aware of it than he is of his own body'. [22]

In ongoing development of a positive alternative account of expertise, Dreyfus and his colleagues seek to combine the insights of Merleau-Ponty's phenomenology of embodiment with post-connectionist dynamical approaches in cognitive science: in absorbed, skilful engagement, as when playing tennis (sometimes!), we are immersed and interwoven in the situation, reliant on and inhabiting an embodied 'intentional arc' in which our past and future is embedded and projected. [23] Although the rest of this essay will raise some questions about whether expertise is so completely cut off from conscious or articulable influence, Dreyfus's picture is in broad outline clearly applicable to the case of batting, and close to the default cricketers' assumptions mentioned above.

It is also worth noting briefly that the central target of Dreyfus's critique – mainstream classical computationalism in cognitive science and Artificial Intelligence – makes its appearance too within sports psychology, and can be criticized along similar dynamical and phenomenological lines. [24] The line of thought in question does not deny the differences between explicit knowing or remembering and embodied habitual skills: but it does understand the latter in terms of the former, turning doing into a particular kind of knowing.

On this view, stable expert performance is driven by mental representations of the domain in question – cricket, chess, or whatever – which mediate between perception and action: the expert's superior performance is primarily due to superior knowledge of, or memory for, the task domain, knowledge which is acquired through long

deliberate practice and stored perhaps in 'long-term working memory'. [25] The 'proceduralized' rules or knowledge structures are assumed by most mainstream cognitive scientists to be unconscious, perhaps in the form of 'if-then' production rules: this explains the different phenomenology of expert performance (the fact that experts aren't consciously aware of searching through a space of possible options, but find themselves spontaneously engaged in appropriate action), without Dreyfus's assumption that there are no representations underlying that performance. [26] But many sports psychologists working in the cognitivist tradition think that, nevertheless, the underlying procedures and knowledge can be (at least partially) accessed with the right methods, such as verbal self-report protocols or 'thought sampling', in which experts describe what they are doing and why, either at the time of performance or as soon as possible afterwards. Further assumptions are that performance must be consciously controlled and deliberately monitored to become effective; and that skilled performance is impeded if the 'proceduralization' is excessive, because the expert must be able on demand deliberately to access and strategically re-route any semi-automated routines. [27]

However, this classical kind of cognitivism looks immediately dubious in the cricket context. Those players who can give more detailed verbal accounts of their own batting are rarely the most successful; highly talented cricketers are often said not to have realized their potential just because they were overly introspective, thoughtful or self-conscious. It is better, the cricketing community assumes, to be a brilliant player utterly unable to articulate your gift. [28] As spectators, we are often disappointed, when breathless after watching a truly great innings, that the interviewed batsman can't tell us how he did it, how he drew on the massed resources of his embodied experience to play these shots, that way, in those circumstances.

So the idea that good performance derives from a rich array of mediating representations of the task domain, which intervene between perception and action as the player selects an appropriate response from an existing repertoire, runs into difficulties in the case of batting, in relation both to the putative representations and to the putative mediation. Firstly, it is not clear that there *could* in principle be a correct and exhaustive psychological map of such a dynamic task domain. Physical and physiological rules governing the interactions between body, bat and moving ball do not seem likely to be the kind of principles which are psychologically encoded, whether unconsciously or not: to think otherwise would be like suggesting that the way to become a great skier is to master Newtonian physics. [29]

Any psychological principles or maxims which *are* used by beginners and merely competent players are likely to be only partially accurate, not responsible for the full panoply of flexible performance. To use Dreyfus's analogy, they are more like training wheels which the expert cyclist will have long abandoned. And, in turn, experts who *do* offer accounts of the reasons for and processes behind their decisions and actions, as cricket-watchers know, are often able to give us no more than 'a retroactive *rationalization* that shows at best that the expert can retrieve from memory the general principles and tactical rules he once followed as a competent performer'. [30] Even

when such autobiographical narratives of success are not packaged for some specific public context, they are often marked, chunked and moulded by the available sub-cultural genres of self-description. If cricketers' self-analyses are in general unconvincing, this is not because they are less honest and more self-deceiving than anyone else, but because of the great intrinsic difficulty of accessing the springs of action.

Secondly, the dynamic adaptability of successful batting under severe time constraints gives us reason to be sceptical about a distinct cognitive step mediating between perception and action. A focus on fast, fluid skills like batting helps to challenge the picture of cognition as an inner process 'sandwiched' between pick-up of information and behavioural output: instead, understanding of such flexible intelligent action in real time requires attention to the continuous coupling of perception and action, and the mutually modulatory dynamics operating between brain, body and world. [31]

Specifically, batting is less a matter of producing a well-formed plan on the basis of perceptual input and then executing it, than of just acting on and in anticipation. Good players in a sense live in the future: success in batting, against bowling of any pace at least, depends more on the time-constrained *prediction* of the ball's motion than on accurate perception of where the ball already is. [32] So successful shot selection depends in part on the use of advanced cues. Contrary to coaching lore, the best players 'do not watch the ball continuously' from its release to the point of impact: instead, they focus on the point of release and then make an 'anticipatory saccade', looking *ahead* of the ball, so the fovea is lying in wait for the ball, so to speak, at the point where it is predicted to bounce. They then track the ball only briefly after it has pitched, before again jumping ahead of its trajectory as eye and head move rapidly down to try to track the ball's final approach to the bat. The most significant difference between experts and novices in this regard, according to Land and McLeod, is that the top players' initial anticipatory saccade starts earlier: the better you are, the *less* time you spend watching the ball, and the more you leap into the future. [33] The smartness of the mechanisms involved in batting lies neither in primitive psychophysical differences in the perceptual system, nor in a larger or richer internal knowledge base. Rather it lies in the acquired embodied ability to extract relevant information afforded by all available sources to constrain the perception-action coupling so as to respond in timely fashion. [34]

Another demonstration of this point comes from comparing the timing and coordination patterns of batsmen facing a bowling machine with responses to a live bowler: good players initiate their backswing considerably *later* when facing a bowler, presumably because they have already been able to pick up vital cues from watching the delivery stride and action which are not available from the bowling machine. [35]

The equivalent point specifically in relation to memory is that there is no need to record or retain in personal memory each specific exercise of the acute, familiar skills. Batting requires a focus on the present and the immediate future, and there is no obvious gain from attending too closely to the past. Those who dwell on that last waft outside off stump are unlikely to be freshly tuned for the next ball, whereas those who

live most fully in their skills, who *inhabit* them, do not need explicit memory for each distinct stroke they have played. Sian Beilock and colleagues have shown that, in some sporting contexts, novices have much *better* explicit recall than experts of the specific steps and processes involved in a sequence of performances. [36] This 'expertise-induced amnesia' for the details of individual activities in sport is part of the anti-cognitivist picture I have been discussing, because experts who do not rely on explicit, top-down attention and control during performance – but rather let their grooved embodied skills unfold in flow – do not need or have the kind of conscious monitoring which supports distinct encoding in *personal* memory. This is compatible, of course, with experts having much more extensive *general* knowledge or *semantic* memory for their domain of expertise. [37] It is also not to say that experts do not, or do not need to, think about or monitor specific incidents or shots *afterwards*, or to pay attention to the minute details of their mechanics in performance during *practice*. It is telling, however, that in such contexts attention and memory are now often supported by external recording media, with video technology and other external memory systems (including analysts and coaches) holding long-term information so that the player's own onboard systems are not overburdened. [38]

There is no systematic evidence about experts' personal/ autobiographical memory for batting, and it would be instructive to try to replicate demonstrations of expertise-induced amnesia in the cricket context. Anecdotal evidence suggests that there are significant differences across cricketers on this dimension, connected both to skill level and to personality and other individual differences. Club players in general hang on more tightly to the meagre memory of their few good shots: but perhaps, as one distinct symptom, those who precisely count their runs might also be those who retain more explicit records of each shot for later recall. Among top players some remember their innings in great, laborious detail, while others take pride in not caring or being able to recall particular episodes. It can be no more than speculation at present, but perhaps there is some systematic connection between different players' batting psychology and the kind of memory they retain: crudely, the more effortful, attentive or deliberately focused a batsman is in style and in building an innings, the richer and more extensive might be their episodic memories.

The notion of expertise-induced amnesia, if it indeed applies in cricket batting, may also offer some new ways of understanding the experience of losing form, as described by Barrington and many others. As in the more extreme forms of performance breakdown apparent when top-class bowlers or golfers suffer choking or 'the yips', [39] an initial failure or piece of bad luck can lead to a reinvestment of conscious thought. It is just because ordinary expert performance is successfully automated that pressure disrupts it, by reintroducing attention and the attempt to control what were previously finely-honed actions. [40] Thus arises the familiar and bewildering feeling that perfectly routine shot selection and execution is crumbling the more you work at it, either as a sequence of low scores continues, or in a single gruesome net session. A particular sense of unease or of poor coordination about the way you're playing the cover drive just now, or how you're dealing with the good-length ball aimed in at the

legs, manifests itself in the simultaneous absence of sensorimotor comfort and affective confidence as well as in an actual cramping of performance, till lifted by resolution, repetition and luck.

So results from the sciences of perception and action in batting are, I suggest, entirely compatible with the more phenomenological assumptions with which we started, by which in playing well you do not think about anything. Personal-level descriptions of the subtle and intuitive responsiveness which characterizes expertise underline the additional importance of affective immersion in the task, when in Merleau-Ponty's words 'we merge into this body which is better informed than we are about the world'. [41] But we have now seen some different routes – from cricketing folklore, from Dreyfusian phenomenology and from dynamical sports science – to the idea of a sharp distinction between knowing and doing, between any explicit or conscious thought or memory and the embodied or kinaesthetic memory which underlies skilled performance. This may seem a rather crudely dualistic scheme, reinstating tired dichotomies between reason and the body, and I will, indeed, argue that it does need qualification. One such strategy is to stress that conscious autobiographical memory (and explicit thinking in general) is equally embodied. My different but complementary focus here is on the intelligence of the body and the diverse forms of interaction and mutual influence – cooperative as well as competitive, harmonious as well as disruptive – between thinking and doing: accepting that habits and skills are genuinely independent of conscious thought should not blind us to the ways in which genuine expertise allows, and sometimes requires, their sculpting and shaping. Other aspects of ordinary practice and lore militate against overstressing the independence of habit and thought, skill memory and personal memory: we also need some theoretical understanding of more complex kinds of integration and links between knowing and doing.

Active Thought and Dynamic Memory in Action

I have shown that both phenomenological philosophers and cricketers, in some moods at least, minimize or downgrade the role and practical utility of explicit thinking, of the use of symbolic labels, and of top-down conscious investment. This is apparent also in scepticism about the understanding of the game available to commentators and critics. In a different sphere, Dreyfus and his colleagues forcefully and negatively compare professional political commentators to 'articulate chess kibitzers, who have an opinion on every move, and an array of principles to invoke, but who have not committed themselves to the stress and risks of tournament chess and so have no expertise'. [42] Practical experience of the stress and risks of high-quality cricket is widely seen as a necessary condition for the different skill of talking a good game, with the majority of cricket journalists, commentators and coaches now being ex-players. This again suggests the primacy of embodied performance, and the secondary and derivative role of thought and talk about the game, as if acquisition of explicit knowledge *about* batting or explicit memory *of* batting, for example, is an incidental

by-product of skilled performance rather than a contributing factor in the exercise of that skill. Labels, abstract principles and general maxims on this view are only tools for the beginner, who must temporarily rely on explicit rules and structures, and playthings for the theorist and the public sphere.

However, this sharp separation of knowing and doing is not at all the whole story about batting. For experts too, batting is *also*, in different ways, about concentration, deliberate mental focus, conscious effort, thinking specifically and clearly, and remembering particular relevant instances to bring to bear on current problems. We can take the simple maxim 'watch the ball' as a test case. The work of Land and McLeod cited above shows, to put it dramatically, that the best players in fact look *away* from the ball earlier. So any residual role that verbal hints or self-instructions like this may have is not a matter of directly and accurately making the body do exactly what it is told: relations between personal-level psychology and the subpersonal mechanisms underlying skilled performance are more tangled than that. On the Dreyfusian perspective outlined in the previous section, this would mean that such high-level explicit symbolic thinking would be useful only in the early stages of skill development, where such a maxim might play some indirect and poorly-understood developmental role in training and constraining the visual system into action. But this doesn't seem right, for a couple of reasons. I have already referred to the first, that experts are not always in the thick of competitive performance: when practising and especially when for some reason 'going back to basics' or reconstructing some embodied sequence, it is common to reintroduce a focus on explicit hints and labels of this sort. Coaches can sometimes successfully realign a broader pattern in a player's technique by reminding them of a simple principle: or, again, self-monitoring by explicit analysis using video can help in reshaping routines. Secondly, even in the heat of the real-time game situation, some players find more direct roles for labels, hints and maxims in the ongoing sculpting of their online allowable response repertoire. This is not a simple top-down reprogramming of the body-machine by purely verbal or conscious instruction, but a process of rebuilding from the inside using temporary scaffolding for well-formed routines. I will explain this point first with an example from a different domain, and then return to batting.

The sociologist and jazz pianist David Sudnow describes how explicit verbal phrases and maxims actually became *more* useful as his skills in improvised jazz piano increased, just as he came more fully to inhabit his own kinaesthetic memory. In his agonizingly precise account of learning jazz, *Ways of the Hand,* Sudnow explains his frustration at his teacher's compressed sayings, such as 'sing while you're playing', 'go for the jazz', 'get the time into the fingers', or especially just 'jazz hands'. These at first make no sense, as the novice pianist is all too conscious of the embodied insecurity of his playing: but as Sudnow gradually starts to 'behave wayfully singing with the fingers', to be sure that each key is 'entered with its future and past wheres securely present in a route-finding hand', he realizes the use of such phrases as 'instructional nudges', embodied maxims which have condensed themselves into the arms and shoulders. So what seemed like just vague words to the novice has now become very

detailed practical talk, a shorthand compendium of 'caretaking practices' for toning and reshaping the grooved routines. [43]

In the case of batting, the parallel 'instructional nudges' may, but need not, be more idiosyncratic than 'watch the ball' or 'get the feet moving'. Language has cognitive functions quite apart from its role in communicating or in translating our thoughts for public consumption, and the extent to which we talk to ourselves (from early childhood onwards) is one symptom of these other cognitive roles of words. The artificially frozen nature of words and phrases can, for example, stabilize the cognitive flow just enough to help us reorient it. We use such tags to (try to) manipulate our own thought and action, or to work temporarily to dampen or control, anchor or coordinate, certain habits and tendencies. [44] When the immediate environment is rapidly changing, these cognitive short-cuts can sometimes give us just that bit of extra flexible independence to adjust the way we respond to its demands. So the expert's occasional use of simple maxims like 'watch the ball' or 'get the feet moving' are not instructions sent from mind to body, translated first out of some cognitive-representational code, transmitted via public language, and then translated again into some format suitable for neuromuscular responses: instead they are themselves material symbols with temporary but crucial causal roles as 'a new fulcrum for the control of action'. [45] Thus a complex bodily pattern or set of possible movements can be compressed into and partly cued by a phrase or memory or ingrained image, bringing the player back to, rather than away from, the well-learned habits.

Of course in batting this is often done in high-pressure situations by another person: reminders from one's accustomed batting partner at a very specific level of technical detail, or at a general motivational level, can be more effective than any self-monitoring. A full treatment of the stratagems used by batsmen to influence themselves would acknowledge the importance of batting together, for two players with a rich shared history can develop a powerful transactive memory system in which know-how is distributed across the pair. But in general such instructional nudges, whether internally or interpersonally generated, need not be verbal at all to play the relevant caretaking symbolic role: individualized 'pre-ball routines' as the batsman prepares and takes guard act in just the same way, as a transportable sequence of consistent and comfortable signs which prepare the mindful body for action, minimizing the voluntary effort required for alert attunement 'under varying conditions and match situations'. [46] The use of imagery and well-practised visualization is another common habit among experts which has barely been studied psychologically in the cricketing context.

These are examples of high-level mental skills which may be drawn on differently by different experts, and at different times. In other respects, however, experts *require* their embodied routines to be continually responsive to those varying conditions, and thus must have learned to influence themselves. Intelligent action must be flexible: the state of the game and other features of the context have to seep in to the unfolding mechanics. Players who notoriously cannot adjust their game or their tactics to suit the needs of the team and the moment will struggle: at the minimum, more

idiosyncratically individual regimes of mental discipline and motivational habits have to be schooled and civilized into the prevailing cricket culture. So at different timescales, in performance as well as in development, fine-grained verbal, emotional and mnemonic input must sculpt performance. The springs and roots of action deep in kinaesthetic memory may seem inaccessible as well as inarticulable: but even in the flowing melodic dynamics of successful stroke-play, there is a kinaesthetic awareness of movement as familiar, revealed for example in an immediate feeling for something going differently or awry, or rather 'a gamut of possible awarenesses from marginal to maximal'. [47] Attention in batting is pulsing rather than absent, there or ready to be there even before any reflection or verbalization or conscious comparison with past experiences is initiated. I'll give examples at two different timescales at which we might influence ourselves.

Take the case of 'premeditating' a shot. On the standard notion of premeditation, by which it is entirely to be resisted, the batsman decides to play a particular stroke – to slog-sweep the off-spinner over midwicket, for example – no matter what specific kind of ball is bowled by the bowler. This 'pre-programming' violates all kinds of beginners' maxims ('play every ball on its merits'), and indeed does lead to disaster at all levels of cricket when attempted by batsmen without the requisite talent or training or luck. One of the few psychological studies of elite specialist batsmen's thoughts while batting in fact picks out premeditation as an example of 'inappropriate strategy choice' and cognitive distortion. [48] But on a slightly broader notion of 'premeditation', such strategy choice has a vital role in expert batting under highly dynamic conditions. When the match situation is changing rapidly and continually – over the crucial dying overs of a decisive one-day game, for example – good players will be constantly resetting their response repertoire in ways which may have been discussed or partly planned out in advance, either deliberately or simply as the result of the sedimented history of relevant experience. This does not mean deciding in advance that only one stroke is allowable 'no matter what', but rather altering the probabilities of attempting certain shots to certain ranges of possible deliveries. Part of what it means for embodied procedures to be genuinely inhabited and alive is that they alter and develop further: this depends on the existence of a flexible set of links between doings and knowings, between skills and plans, between action and memory. One successful case was when, during the one-day internationals before the 2005 Ashes series, Andrew Strauss set himself more than once to get way across to the offside, outside the line of good-length balls from Jason Gillespie and use the pace to lift them over fine leg, a shot unthinkable in less audacious circumstances. More typically, this alteration of the allowable response repertoire is just continuous with good batting, with lifting the tempo by gradually looking for more strokes or, by contrast, slightly restricting one's range during a particularly testing spell. The notion of 'premeditation' is not *quite* right here, for it perhaps overemphasizes the deliberation involved: but at least it counters the idea, central in section 2 above, that there is and should be *no* direct involvement of thought in online embodied skill-based action. If we see thought itself as more active, more a poised embodiment of an

idiosyncratic history than a static imposition of control, the temptation to quarantine it from action diminishes.

In addition, however, to the longer-term layering of relevant experience which grounds the possibilities for, and the realization of, a particular stroke in a match context, there is a shorter timescale on which thinking and, especially, episodic memory for specific, relevantly similar occasions influences the unfolding decision-making and execution of shots. In getting used to a particular track and attack, a new batsman must very quickly adjust the possibilities for shot selection, selecting from or orienting the basic repertoire to meet the characteristics of the moment. As noted above, this process need not be conscious, deliberate or easily reportable, so it is not a matter of simple top-down control of embodied habits: but it must be precise and respond to very particular information and experience. To take a simple example, receiving a ball which keeps low from just short of a length requires immediate practical learning, the application of this very specific intelligence to the well-schooled routines and reflexes. With skill and luck, even if the bounce is now somewhat unpredictable, the batsman who has seen this happen, survived and somehow embodied the knowledge will be better prepared when it happens again, and will next time decide-in-action to come forward in defence rather than back.

There are a number of ways in which this might happen, and it will take the combined efforts of phenomenology and psychology to tease them apart. Some possibilities entrench the separation of the two memory systems, episodic memory and habit/skill memory. Perhaps the impact on the mindful body of the single ball which has kept low only consists in multiple temporary specific adjustments to the motor or kinaesthetic systems which drive skilled responses. It is not, however, clear how there could then sometimes be more enduring distinct episodic memories of *that* particular first ball. Or perhaps some distinct episodic trace or record in autobiographical memory is left, but it is wholly separate from whatever altered embodied systems underlie a subsequent improved response: but this again casts real expertise as the total bypass of the declarative realm. But it is also possible that there is not such direct competition between conceptual memory and explicit knowledge, on the one hand, and the enduring, fluid wisdom of the bodymind on the other: perhaps that first ball does leave at least a partial, temporary episodic trace, which then itself partly drives the altered response. This would make expertise in part the easy, fast mastery of the *links* between memory and action, between thinking and doing. [49] Again, this is not the implausible view that the batsman explicitly or consciously makes an inference by way of some production rule from the memory of the first ball to the appropriate action: rather, the activation of the episodic sensory-perceptual records is itself implicit or automatic.

Of course we just do not know *how* such distinct traces – whatever context-sensitive inner records might partly ground later personal memories of the incident – can get at the fast perception-for-action systems which are triggered just swiftly and exactly enough, we hope, for the second vicious shooter to be kept out. This is merely to say, again, that theorists know very little about how we can influence ourselves. It would be sensible to investigate the psychological aftermath of specific instances in which

batsmen surprise themselves, or in which there is some breakdown or change in the expected pattern of responses. The point of working with self-reports or 'thought sampling' techniques would be to treat the batsman's stories about how the shot was played not as authoritative guides to the sub-personal mechanisms involved, but as key further data which also arise in part from the same processes which led to the shot.

Imagine, for example, when a late adjustment successfully changes a back-foot defensive shot into a more aggressive square drive to the boundary. The batsman's mental life then, immediately afterwards, may include not just the pleasures of the shot but also various rushing superimposed partial impressions of what has happened in playing it, and of how responding to that slight field change on the previous ball helped, and of the bowler's growled comment at the end of the previous over, and so on. These are not likely to be full-scale narrative units in episodic memory, not at least until more fully shaped in the chat at the end of the over or the story at the end of the day's play. Rather, as the ball hits the rope and is returned to the bowler, and as preparation for the next ball begins, the mnemonic residue of that good shot – which was somehow selected from the particular response repertoire which had come to be alive and poised at the time, and then executed fast instead of the initially-prepared defensive or any other stroke – is perhaps a mix of barely-verbal confabulatory flickers and bodily after-images ghosting through the bodymind on unrealized trajectories of their own.

None of this need be at any high level of awareness at all: and top-down control and mental discipline applied over time will have led some batsmen more than others deliberately to suppress such bustling cognitive-affective-embodied sequences in favour of imposing more linear and quiescent personal-level thought patterns as buffers against the contingencies and opacities of the world at the wicket. Precisely when the world and the affordances it offers are not as neatly ready-to-hand as phenomenological philosophy can sometimes suggest, skill can require, for some people, substantial and deliberate simplifications of the task domain to tame the mind and turn dizzying fast problems into tractable pattern-matching. My point has been that such thought patterns too, whether they are thus controlled or more baroque, must function for top players among a range of means by which cognition – memory, thought, situational awareness, and explicit feeling – can (sometimes, partially, fallibly) affect the running off of sophisticated acquired bodily skills in complex contexts.

However, the kinds of thinking and remembering in question here, which do in the right circumstances reach down to influence the subtle mechanisms by which a stroke is manufactured, are (to repeat) themselves highly active and condensed. Explicit thought and memory too, according to Bartlett, 'have to be regarded as constituents of living, momentary settings belonging to the organism ... and not as individual events somehow strung together and stored within the organism'. In the case of the quick stroke made in tennis or cricket, it is obviously an illusion to think that 'I reproduce exactly a series of text-book movements', because 'demonstrably, I do not': but it is no less a mistake in the case of ordinary personal memory to imagine that I can

'reproduce exactly some isolated event which I want to remember', for 'again demonstrably I do not'. [50] Far from being driven into some new dualism by examining relations between personal memories and habit memories, then, we find that the former can in fact be better understood in light of the latter, as skilled performances themselves, compilations made on the fly from any available resources. And, although neither methods nor concepts are yet easy to identify, both thinking and doing, both personal remembering and embodied remembering, will be better served by theories which address their intricate interweaving in the exercise of both ordinary and extraordinary skilled activities. Thought then appears not as an inner realm behind or additional to practical bodily skill, a glorious or painful luxury of peacetime, but instead as itself an intrinsic and worldly aspect of our most flexible, real-time engagements with the shifting, tricksy physical and social environment. Good batting is the intimate integration of memory and the present, of history and context, of thought and habit, and as such exemplifies human embodied intelligence at its adaptable best.

Conclusion

The kind of concentration evident in high-quality batting performances, most cricketers think, is not conscious and deliberate attention. The 'certainty and self-belief and total absorption', which Ed Smith, for example, finds in 'the zone' is a 'complete indifference to external distractions, a reluctance to waste energy or words, a determination bordering on possession', not an intense self-monitoring: and such innings leave in memory not exact records of each decision and precisely-executed shot, but 'a kind of concentrated blankness'. [51] On this prevalent and plausible view, there can be a *subsidiary* role for explicit memory and conscious planning in the development and maintenance of expertise, but only in the calm of preparation or rethinking, or in the introspective absorption of off-season practice. Smith writes: 'think, practise, think, practise. Too much theory can ruin anyone's batting. But a little, in January, can help.' [52] In this essay I sought firstly to underline and ground what must be right in this downplaying of thought in favour of action and embodied habit, drawing out its implications for the relations between personal memory and skill memory, and identifying a number of areas for further research, such as the need to investigate whether (and in what circumstances) expert batsmen really exhibit the level of 'expertise-induced amnesia' which this view seems to suggest. But, secondly, I complicated this picture of the independence of habit from thought by suggesting that thinking itself can fruitfully be reconstrued, with the help of the dramatic and dynamic context of cricket batting, as online and active and embedded in the now. Instructional nudges, the remembered maxims of a favourite coach or admired mentor, engrained movement routines, well-practised mental-motor imagery, using accidental external cues as mental prompts, or the deliberate skewing of an allowable response repertoire in some non-standard game situation . . . : we have tentatively identified a whole host of ways in which we can influence ourselves at the crease. Smith, of course, like most

top players, is in other moods entirely aware of this: in attacking the 'ghetto-ization' of one-day batting by which a batsman must be *either* 'Big Hitter' or 'Mr Ones and Twos', Smith complains that this tendency to locate everyone in fixed categories 'takes away the need to think on your feet, to read the situation as it unfurls'. [53]

Genuinely *thinking* on your feet, I have suggested, lies at the heart of batting: both developing and enacting high levels of skill require us not to cut intellect and emotion off from our embodied, grooved performances, but to achieve and then access unusual *flexibility* in linking thought and action, knowledge and motion, conceptual memory and procedural memory. But because neither practitioners nor coaches nor scientists understand much yet about exactly *how* we can thus influence ourselves in real-time embodied performance, just identifying these phenomena opens up a range of intriguing and barely-studied problems about skilled activity which might interest not only sports psychologists but also performers, commentators, and even philosophers. [54]

Notes

[1] F. C. Bartlett, *Remembering*, 201f.

[2] I came across the line in Beilock, Wierenga, and Carr, 'Expertise, Attention, and Memory in Sensorimotor Skill Execution', 1236.

[3] Ranjitsinhji, *The Jubilee Book of Cricket*, 158.

[4] In addition to the works in dynamical cognitive science which I cite throughout the essay, it is worth registering some accessible background literature for readers whose instincts are generally antagonistic to the whole enterprise as swamped in scientistic individualism. The animating spirits of this project include a range of related frameworks in which thinking and memory are wholeheartedly seen as bodily, worldly and social phenomena. They include sensorimotor contingency theory (Hurley, *Consciousness in Action*; Noë, *Action in Perception*); and philosophical developments of 'active externalism' (Haugeland, 'Mind Embodied and Embedded'; Rowlands, *The Body in Mind: Understanding Cognitive Processes*; Wilson, *Boundaries of the Mind: the Individual in the Fragile Sciences*). Just one example of the potential theoretical utility of cricket batting as a case study is that it forces attention to the often dramatic centrality of individual differences in the ways cognition and action are intertwined.

[5] Poulton, 'On Prediction in Skilled Movements'. Success in open skills lies in the effectiveness of the motor pattern in producing an outcome: in 'closed skills', where the environment is more static, by contrast, the precision of a motor pattern as an end in itself is constitutive of the skill. Cricket batting can be taxonomised on these and other dimensions against other sports skills and against other embodied activities: depending on our interests, it might be as informative to compare batting with (for example) yoga or dance as with tennis, soccer, golf or basketball. For related multidisciplinary work on modern dance see Grove, Stevens and McKechnie (eds), *Thinking in Four Dimensions*; and for a directly parallel study of memorization in classical musical performance see Chaffin, Imreh and Crawford, *Practicing Perfection*.

[6] Whiting, *Acquiring Ball Skill: A Psychological Interpretation*; Glazier, Davids and Bartlett, 'Grip Force Dynamics in Cricket Batting'.

[7] Bartlett, *Remembering: A Study in Experimental and Social Psychology*, 201f.

[8] The phrase is from the poem 'At Lords' by Francis Thompson (1859–1907). Nostalgia so naturally arises in cricketing contexts partly, perhaps, because of specific features of its history and social role in some of its countries, but my remarks below suggest that its intrinsic features may also mark and highlight the peculiar way in which human beings are embedded in time.

One cricket writer commenting on Thompson's poem says that 'we are, all of us, no different from the poet. We all prefer the ghostly batsman playing to the bowling of a ghost. For that is cricket.' (Wright, 'Francis Thompson in all of us'.)

[9] Here and throughout I use the traditional term 'batsman', which is more common in women's cricket too than 'batter'. There is even less research or writing about my topics in relation to women's cricket, but the framework sketched here should allow attention to gender differences as well as other relevant differences. There are suggestive ways in to such an extension of my mixed phenomenological and cognitive scientific approach to motor habits and sporting activity in Young's 'Throwing Like a Girl: A Phenomenology of Feminine Body Comportment, Motility, and Spatiality', although her analysis of the feminine lived body as inhabiting a world 'populated with opacities and resistances' looks from my perspective more like an accurate portrayal of bodily experience in open skills in general than a specifically feminine plight. See on this Preston, 'Merleau-Ponty and Feminine Embodied Existence'.

[10] Nothing crucial here hangs on treating these embodied capacities and skills as a form of memory at all, as long as the dimensions on which they differ from personal/autobiographical memory are kept in mind. A discussion of the divergent terminology across the disciplines in this area must wait for another occasion: I trust that the core phenomena in question, in which embodied skills which have been acquired in the past are retained and employed in the present, are intuitively clear. For more on the varieties of memory see my entry 'Memory' in the *Stanford Encyclopedia of Philosophy.*

[11] Sheets-Johnstone, 'Kinesthetic Memory', 71. Sheets-Johnstone's *The Primacy of Movement* includes relevant and highly original constructive work on 'thinking in movement' (chapter 12, also chapter 3), but also exemplifies a pessimism about the relevance of the cognitive sciences, in suggesting their incompatibility with phenomenology, which I don't share. For a more integrative approach to related topics see Gallagher, *How the Body Shapes the Mind*, especially chapter 6.

[12] Tulving, 'Episodic Memory: from Mind to Brain'.

[13] Campbell, 'The Structure of Time in Autobiographical Memory'.

[14] Hoerl, 'Memory, Amnesia, and the Past', 240–7.

[15] In *Boyhood: a Memoir*, J.M. Coetzee describes the young protagonist's first match innings, batting against 'these other boys, whose names he does not know', who 'are of one mind only: to cut short his pleasure'. The batsman 'must concentrate, but there is something irritating he cannot put out of his mind: Zeno's paradox'. In trying not to think about it he is further agitated, as the ball tumbles towards him. 'Is this what he is choosing when he chooses to play cricket: to be tested again and again and again, until he fails, by a ball that comes at him impersonally, indifferently, without mercy, seeking the chink in his defence, and faster than he expects, too fast for him to clear the confusion in his mind, compose his thoughts, decide properly what to do? And in the midst of this thinking, in the midst of this muddle, the ball arrives.' (53) Thinking, here, is a destructive luxury, for 'cricket is not a game. It is the truth of life.' (54) Some remarks of Coetzee's about skill learning in sport influenced the ideas sketched in section 3 below: Coetzee, 'Fictional Beings'.

[16] Ken Barrington (as told to Phil Pilley), *Playing it Straight*, 97f. Barrington continues: 'The only real tonic is a good knock … In my time I have been given lots of advice on how to get out of a bad patch – have a swing, play golf, get drunk – but I've normally stuck to two methods: first, a study of technique, and, second, superstition.'

[17] Armstrong, *The Art of Cricket*, 47f.

[18] Gordon, 'Reflections on Providing Sport Psychology Services in Professional Cricket', 20.

[19] 'I don't want to sound too Freudian about the art of batting but a lot of it really is in the mind … Too many batsmen at all levels of the game allow their minds to be cluttered up with theories and forget that batting is basically very simple.' (Graham Gooch with Patrick Murphy,

Batting, 25.) Even Ed Smith, who acknowledges the positive roles of thinking more than many top batsmen, notes the dangers of remembering either good times or bad times: 'when the past is up, the future is down ... and it is forward, of course, that the sportsman should be looking' (Smith, *On and Off the Field*, 136); see also Smith's remarks on the uses of 'a selective memory' in 'blanking out failure' (21).

[20] Connerton, *How Societies Remember*, 102: the whole third chapter of Connerton's study, 'Bodily Practices', 72–104, is valuable reading on these topics.

[21] Dreyfus, 'Refocusing the Question: can there be Skilful Coping without Propositional Representations or Brain Representations?' 417. See also Dreyfus, *What Computers Still Can't Do*; 'The Current Relevance of Merleau-Ponty's Phenomenology of Embodiment'; 'Intelligence without Representation: the Relevance of Phenomenology to Scientific Explanation'; 'Overcoming the Myth of the Mental'. Vegard Fusche Moe has offered a tentative evaluation of Dreyfus's phenomenology as it might apply to sport: see Moe, 'A Philosophical Critique of Classical Cognitivism in Sport: from Information Processing to Bodily Background Knowledge'.

[22] Dreyfus and Dreyfus, *Mind Over Machine*, 30.

[23] Dreyfus gives the dynamical framework a specific anti-representational spin, which is beyond the scope of this essay: for a brief telling commentary see Andy Clark, 'Skills, Spills, and the Nature of Mindful Action'; and for a much more detailed development of a phenomenological version of dynamical cognitive science see Wheeler, *Reconstructing the Cognitive World: the Next Step*.

[24] Indeed there is a straightforward connection in the figure of the Nobel laureate Herb Simon, who both developed the Physical Symbol Systems hypothesis for classical cognitivism and collaborated closely with Anders Ericsson, arguably the leading researcher in the psychological study of expertise and sport. As usual with such connections, though, the lines of influence and theoretical proximity can be misleadingly simplified: Ericsson has recently sought to distance his 'deliberate practice' framework from classical cognitivist information-processing psychology, attributing systematic misunderstandings of his work to the fact that dynamicist critics wrongly assimilate it to Simon's approach (Ericsson, 'How the Expert Performance Approach Differs From Traditional Approaches to Expertise in Sport'). My brief sketch of the deliberate practice framework should be read with this *caveat* in mind.

[25] Ericsson and Kintsch, 'Long-term Working Memory'.

[26] Fully explicit coded motor routines, for example, once automated and stored, might simply be called up without conscious control or awareness: Antony, 'How to Play the Flute', 399. There are of course distinct issues here about explicit rules and distinct representations: one could, for example, accept the latter without the former. In *Ignorance of Language*, Michael Devitt offers a wonderfully clear analysis of possible positions on these questions: see especially chapters 3 and 11 on rules and the psychology of skills.

[27] For this summary picture of the deliberate practice framework see the critique in Abernethy, Farrow, and Berry, 'Constraints and Issues in the Development of a General Theory of Expert Perceptual-Motor Performance'. One danger here, then, is that this framework equates the procedural with the rigid or inflexible: yet sophisticated skill memory, as I have noted, is regulated improvisation rather than reflex or conditioning. We need a way of allowing for some top-down sculpting of embodied routines which acknowledges that they are already intrinsically active and flexible.

[28] 'Like many cricketers, or for that matter great actors or mathematicians, Warne cannot explain his gift or even articulate it in an interesting manner. It is as if he is a conduit for it' (Nowra, *Warne's World*, 20).

[29] 'Sir Isaac Newton laid the foundation for modern skiing with several basic laws of motion. Violations of these laws are the cause of problems. Anyone attempting to thoroughly understand skiing should know these laws and the terms used in their proper, intended

meaning' (Howe, *Skiing Mechanics*, 9) as quoted in Loland, 'The Mechanics and Meaning of Alpine Skiing: Methodological and Epistemological Notes on the Study of Sport Technique', 58.

[30] Dreyfus, 'Overcoming the Myth of the Mental', 9.

[31] For this general picture in the philosophy of cognitive science see Clark, *Being There: Putting Brain, Body, and World Together Again*; and for sport see Williams, Davids and Williams, *Visual Perception and Action in Sport*, a highly instructive book structured around the contrast between indirect/cognitivist and ecological/dynamical perspectives.

[32] Abernethy, 'Mechanisms of Skill in Cricket Batting'. Roughly, deliveries from a medium-fast bowler, operating at 60 mph (international fast bowlers are at 85–95 mph), travel from hand to bat in only about 650 milliseconds, which on standard assumptions about reaction time and movement time 'necessitates the completion of shot selection with the ball less than a third of the way down the pitch' (6).

[33] Land and McLeod, 'From Eye Movements to Actions: how Batsmen hit the Ball'. The best of the batsmen studied by Land and McLeod also employed a more variable range of visual strategies, with different saccade timing and magnitudes for different ball trajectories: when facing overpitched deliveries in particular, the expert used more smooth gaze movements or 'pursuit tracking' instead of the sharp downward saccade, a strategy which differentiated his responses clearly from those of a moderate player as well a novice.

[34] Stretch, Bartlett, and Davids, 'A Review of Batting in Men's Cricket', 933–6.

[35] Glazier *et al.*, 'Uncovering the Secrets of the Don'.

[36] 'It is as if experts *cannot* pay enough attention to remember as well as novices, at least when performing under routine conditions so close to what they have practiced in the past.' (Beilock, Wierenga, and Carr, 'Memory and Expertise: What do Experienced Athletes Remember?' 310; Beilock and Carr, 'On the Fragility of Skilled Performance: What Governs Choking under Pressure?'). Beilock and her colleagues are clear that such expertise-induced amnesia will be apparent only or primarily in contexts which do not require heavy online involvement of working memory to keep up with unusual or complex environments: in the alternative picture of batting sketched in section 3 below I suggest that *some* kinds of attention, working memory, and top-down influence may sometimes be required.

[37] Much of the richer semantic memory can, however, be shared by experienced but non-playing critics or spectators, whose form of expertise is interactional rather than participatory. See Collins, 'Interactional Expertise as a Third Kind of Knowledge'.

[38] Historical, cultural and technological changes obviously influence cricketers' psychological preparation and habits, a topic for another occasion. Contrasting the modern cricketer's access to exhaustive footage of all opposition players, Richie Benaud told Michael Slater on Channel 4's Ashes coverage on 12 August 2005, that in his playing days 'I had a mental filing cabinet on every batsman: that was all you had'. Presumably there are still substantial individual differences across elite players in the extent and nature of reliance on technological assistance.

[39] On bowling see Bawden and Maynard, 'Towards an Understanding of the Personal Experience of the "Yips" in Cricketers'.

[40] Beilock *et al.*, 'When Paying Attention becomes Counterproductive'.

[41] Merleau-Ponty, *Phenomenology of Perception*, 238.

[42] Spinosa, Flores and Dreyfus, *Disclosing New Worlds: Entrepreneurship, Democratic Action, and the Cultivation of Solidarity*, 87. For a critical response to this aspect of Dreyfus's approach, see Selinger and Crease, 'Dreyfus on Expertise: the Limits of Phenomenological Analysis.'

[43] Sudnow, *Ways of the Hand: A Rewritten Account*. The introduction to this edition is by Hubert Dreyfus, who notes the shifts to fluid ease in movement as the pianist acquires expertise but does not notice these key residual strategic roles for symbolic surrogates in guiding habits of action. Compare also the use of a shared body of 'identifiable phrases of invention' by a group of contemporary dancers over time: the choreographer's deliberate recourse to explicit memory

or to specific video reminders of particular movements and sequences at first simply disrupts the open-ended 'habitual, flowing awareness' being developed by the company, but as the dance work takes form a set of shared labels or condensed shorthand symbols, such as 'D's wrist; K's sitting bones; sore sides' become 'democratically available' for resequencing and reshaping together. See Stevens et al., 'Choreographic Cognition: the Time-course and Phenomenology of Creating a Dance', quoting from Nicole Steven's *Red Rain* rehearsal log-book.

[44] I borrow this way of developing these themes from Andy Clark's recent work: 'Beyond the Flesh: some Lessons from a Mole Cricket'; 'Word, Niche, and Super-Niche: how Language makes Minds Matter More'.

[45] Clark, 'Material Symbols', 294.

[46] Larratt, 'Pre-Ball Routines: a Guide to Successful Batting', 4.

[47] Sheets-Johnstone, 'Kinesthetic Memory', 75, 84.

[48] Slogrove, Potgieter, and Foxcroft, 'Thought Sampling of Cricketers during Batting', 105.

[49] Compare Allard and Starkes, 'Motor-skill Expertise in Sports, Dance, and Other Domains'.

[50] Bartlett, *Remembering,* 201f.

[51] Smith, *On and Off the Field,* 56, 90–1, 254. Compare Smith, *Playing Hard Ball*, 24: genuine 'concentration' in sport means 'the absence of irrelevant thought', not 'attention'.

[52] Smith, *On and Off the Field*, 7. Compare Smith's description (17) of taking a deliberate cue from explicit observation of Michael Vaughan's cover drive, and using a net session to transfer this observation of Vaughan's more compact back-lift and early wrist-cock from his personal memory into embodied action.

[53] Smith, *On and Off the Field*, 117. Compare also Smith's use of external cues, however eccentric (55): his 'positive mental side' or 'good voice' latches on to 'whatever stimuli it can find as added incentives' while batting.

[54] My warmest thanks to Jeremy McKenna for his editorial support and patience. Some ideas in this essay were first tried out in talks in 2004 and 2005: at a forum 'Is there thought without language (in art)?' at the University of Western Sydney Parramatta campus; as part of a workshop on memory and embodied cognition at Macquarie University; and in a seminar at the Macarthur Auditory Research Centre at the University of Western Sydney Bankstown campus. I am grateful to Anthony Uhlmann and Kate Stevens for organizing the first and last of these events, and to the audiences on all three occasions for many helpful comments. Thanks in particular for specific points and for encouragement of various kinds to Peter Arnade, Tim Bayne, Samir Chopra, Andy Clark, Betsy Colwill, J.M. Coetzee, Michael Devitt, Bob Egerton, James Ley, Adrian Mackenzie, Vegard Fusche Moe, Andrew Murphie, Nigel Nettheim, Monte Pemberton, Agnes Petocz, Robert Sinnerbrink, Kate Stevens, Max Stuelcken, Will Sutton, Pepa Toribio and Anna Wierzbicka. I have discussed many of these issues in an enjoyable extended correspondence with Ed Cooke about the phenomenology of batting, and the essay has been directly influenced by a number of his ideas: in particular, the notion of an 'allowable response repertoire' is Ed's, as is the dream of studying the simultaneous bustle of many competing partial solutions to the problem of which shot to play. It has been a long-term pleasure to talk about these issues with Doris McIlwain over many years, and this is just my latest attempt to understand her various projects for applying intelligence to the reflexes.

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