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# **In the Synaptic Cleft:**

caught in the gap between neurotransmitter release and  
conscious experience in sport

DISSERTATION FROM THE NORWEGIAN SCHOOL OF SPORT SCIENCES • 2011

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**To Ella – a conscious neurobiological wonder**



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## **List of papers**

### **Paper I**

Birch, J. E. (2009). A Phenomenal Case for Sport. *Sport, Ethics and Philosophy*, 3(1), pp. 30-48.

### **Paper II**

Birch, J. E. (Forthcoming 2010). The Inner Game of sport: is everything in the brain?. *Sport, Ethics and Philosophy*, 4(3), pp. 275-294.

### **Paper III**

Birch, J. E. Skills and Knowledge: nothing but memory?. Decisioned October 7<sup>th</sup> 2010 to minor revision in *Sport, Ethics and Philosophy*, due December 6<sup>th</sup> 2010

### **Paper IV**

Birch, J. E. Intentional and Skillful Mirrors. Submitted to *Journal of the Philosophy of Sport* on October 17<sup>th</sup> 2010

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<sup>1</sup> NSSS = NIH (Norges idrettshøgskole)



contributed to general discussions of practice and theory of a natural science gone practical. I hope I declare often enough everything else I love about you. During these years Ellen and I have become parents to the most wonderful of daughters. During this project we have seen the conception, birth, first steps and sentences of Ella Sera Birch-Samuelsen. Hopefully you will not follow in your father footsteps if choosing an academic field, but I hope we can share some footsteps anyway. My dearest thanks go to my mother Anne-Lise Birch. I am not sure how common it is *not* to use professional editing services in language oriented studies like philosophy, but I am not sure they would've done any better. There are so many things I would like to thank you for, but other occasions seem more appropriate.

Last, but not least: huge thanks to my supervisor Professor Gunnar Breivik. When I started at NSSS in 1994, I had no philosophical interest what so ever. I started *Grunnfag* (undergraduate) to be able to take *Friluftsliv* (outdoor education) the year after. When *friluftsliv* did not run the following year I chose, for some reason, the *Idrett, Kultur, Samfunn* (sport, culture, society) course. I guess one reason must have been the lectures you held at *Grunnfag*. The IKS seminars made me want to study philosophy at the University of Oslo. After 5 years of philosophy, you several times encouraged me to apply for a Ph.D. grant. It finally paid off. During these four years Gunnar Breivik has been more than a regular supervisor. Your way of supervising is closer to an Aristotelian master-apprentice relationship, I guess. For me this relationship has been a perfect mix of liberty and constraint. One could of course think that travelling to Italy several times a year, or go climbing daytime on a Wednesday is not the way to do a Ph.D. thesis. Instead, I believe that these things have been *necessary* to get the job done, one way or the other. To understand, appreciate, and personify the same sort of attitude as you have done when we have gone about our *dannelsesreiser* - drinking wine on your terrace, skiing at Hallingskarvet or visiting the Nietzsche house in Sils Maria – takes a *true* philosopher. Without you there would be nothing.

Oslo, October 2010

Jens E. Birch

# PART I

## 1. 0. Introduction

- People who are constantly asking 'why' are like tourists, who stand in front of a building, reading Baedeker, & through reading about the history of the building's construction etc are prevented from seeing it.  
Wittgenstein (1998, p. 46)

When confronted with Wittgenstein's work, the usual response is one of, well let's just call it 'awe'. One reason can be the style and elegance. A more common reason is probably a complete lack of understanding. What the h..l does this guy *mean*? The above text is quite straight forward though. In the meeting with a significant work of art, or a tremendous building, we way too often read *about* the work in a guide book and forget to look at the picture or building itself. This thesis is not about Wittgenstein at all, but I believe we may learn something important from the quoted text. When we behold sport spectacles and prolific athletic skills, sport scientists quite often look to some kind of scientific explanation, and lose sight of the great performer/performance. One can say that it is the science's job to study small details, but the question remains if details make the wholeness foggy. What we are questioning then is if sport performance can be reduced to physical terms like force, angles, vectors and electro-chemical events. In the philosophy of sport we ask if skill, or knowing how, can be reduced to knowing that. That will be one of the main themes in the following inquiry. Another will be if consciousness and subjective experience can be reduced to neural events in the brain without losing something along the way. The proposal here is the same as Wittgenstein's: we do lose something. Perhaps the skill or the conscious experience itself.

### 1. 1. Summary: questions, purpose and structure of the thesis

There are many questions and issues surrounding this thesis and the articles within. Some might say there are too many. I believe they are all interrelated somehow, and the following discussions will hopefully make this interrelation clearer. I'd like to say that in his article *Visual Experience and Motor Action: Are the Bonds Too Tight?*, Andy Clark (2001) writes an almost perfect introduction to what this thesis is all about. Here, Clark uses contemporary empirical findings to criticize views which hold the assumption that conscious visual experience guides or informs motor action (p. 495). In other words; Clark argues that motor theories of mind are hostage to empirical fortune. Motor theories of mind have been popular

in the philosophy of sport. Philosophical and psychological works ranging from Dreyfus (1986), Gibson (1979), Merleau-Ponty (1962) and Polanyi (1962) have been welcomed and used to develop a philosophy of sport.<sup>2</sup> What if the supposition of seeing the body as primary to intentionality, action and cognition is wrong? Based on the neuroscientific findings of Milner and Goodale (1995), Clark argues that conscious visual experience and vision for action is dissociable to such a degree that intuitions about the body and perception being the seat of cognition should be given up. Instead of understanding consciousness and cognition through motor movements, we should look to memory is Clark's suggestion.<sup>3</sup>

The first article in this thesis starts with a review of which main issues in contemporary philosophy of mind are of interest to philosophy of sport. It is argued that the topic of consciousness is in need of both philosophical and scientific understanding and explanation. Clark's description of consciousness is close to the first article's description of psychological consciousness (see also 2. 5.), even though Clark writes about conscious *experience*.<sup>4</sup> The second article takes a look at what neuroscientists say about the body and consciousness. Do they downplay the role of body and motor action? The answer is dubious, but certainly not "no". The third article takes Clark and Prinz's suggestion at face value: what can the neuroscience of memory tell us about consciousness and motor action/skill? The article argues that a lot can be learned from memory research, but that there is more to consciousness and motor action than memory. The fourth article picks up where Clark left off. The discovery of mirror neurons can be seen as counter-evidence to Milner and Goodale (see Rizzolatti & Sinigaglia 2008, pp. 38-45), and Clark's position: vision, motor action and cognition cannot be dissociated. If they cannot, it will also be difficult to distinguish between the acquisition and possession of skill.<sup>5</sup> Interestingly, Clark seems to have changed or extended his mind about these issues (see Clark 2008). At a first glance then, this is what the whole thesis is about: how are we to understand consciousness? Does and should consciousness mean anything to sport science and philosophy of sport? What does neuroscience tell us about body,

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<sup>2</sup> See e.g. Breivik (2008), Eriksen (2010), Hopsicker (2009), Hyland (1990, ch 4), Kretchmar (2005, ch. 6), Loland (2007), Meier (1980; 1988), Mihalich (1982), Reid (2002, ch 2), Schrag (1979), Steel (1977) and Weiss (1969, ch. 3). Wertz's (1991) approach to the philosophy of sport is mostly analytic, but he draws on the phenomenological tradition when discussing Zen and tennis (ch. 5).

<sup>3</sup> That is also philosopher Jesse Prinz's (2000) suggestion.

<sup>4</sup> Clark writes about what conscious experience does (the causal role it plays), not how it feels (see 2. 5).

<sup>5</sup> This is an important distinction since it might be argued that neuroscience could be capable of capturing all the current states which make up a state of phenomenal consciousness or a skill. Edelman's theory of memory as a *re-membered present* (Edelman 1989; Edelman & Tononi 2000a) might also make the distinction fall apart since there could be no possession of brain activity of *this* particular sort without exactly *that* acquisition (see also article II & III). The possession we might say, loses its meaning without its acquisition.

brain and motor action in relation to a philosophical stance on consciousness in sport? The purpose of this thesis is first to say something about consciousness in sport from the perspective of analytic philosophy of mind. Second, to see what philosophy of mind can learn from neuroscience and what lessons neuroscience should learn from philosophy. Third, perspectives from philosophy of mind and neuroscience are used on philosophy of sport and sport science.

The thesis consists of two parts. The first part is this rather long introduction, which elaborates on theories and arguments surrounding the second part. The second part consists of four individual articles. The first part is supposed to enrobe the articles so they at a minimum give the appearance of being a whole on the issues just addressed.

## **1. 2. Abstracts of the 4 papers**

*Article I* tries to place the whole project inside the framework of analytic philosophy of mind. Key elements like *the explanatory gap*, *psychological-* and *phenomenal consciousness*, are introduced and related to knowledge in sport skills, sport science and philosophy of sport.

*Article II* looks at some neuroscientific work done on athletes and Gerald Edelman's *neurotheory of consciousness*. The article argues that a neurotheory of consciousness is needed if claims about the mind of an athlete are to be made from observing brain activation. The article further argues that Edelman's theory is a good start, but does not bridge the explanatory gap introduced in article I.

*Article III* continues with a philosophical review of the neuroscientific program to explain (motor) skills and consciousness. The article argues that sport science and philosophy of sport have a great deal to learn from the neuroscience of *memory*. The article also argues that the neuroscience of memory cannot give exhaustive explanations of neither (motor) skill nor consciousness.

*Article IV* aims to introduce research on *mirror neurons* to the philosophy of sport. Where the neuroscience of memory is quite internal, the neuroscience of mirror neurons is rather quite external. This research should perhaps receive a warm welcome from philosophers interested in (motor) intentionality, (motor) skills, (motor) knowledge, but also a whole range of other topics in the field of so-called body-mind relations.

## 2. 0. THEORY

- For I approach deep problems like cold baths: quickly into them and quickly out again. That one does not get to the depths that way, not deep enough down, is the superstition of those afraid of the water, the enemies of cold water; they speak without experience. The freezing cold makes one swift. (Nietzsche GS, 381)

### 2. 1. Why have I used *this* perspective and *that* theory?

I believe discussions on consciousness is perhaps the most enthralling philosophical inquiry today, and this is especially so due to the rocket ride of neuroscience during the last decades. The perspectives, concepts and thinkers used in this thesis are mostly from the analytic tradition of contemporary philosophy of mind. Since a lot of the argumentation is surrounded by so-called *phenomenal* consciousness and experience, one might think that phenomenology would be a more appropriate choice. There are several reasons why it is not: philosophy of sport (except ethics) in the Nordic countries has mainly departed from a phenomenological tradition (see Breivik 2010), so my idea is to bring something different to the table. The same goes for discussions in the philosophy of sport. Discussions on (natural) science in the philosophy of sport have not exceeded any tipping point, and neither have discussions on consciousness. There have been many analytic oriented discussions in the field (e.g. discussions on what a game, a sport is), but when discussions have turned to mind and body, it is the phenomenological tradition (especially Merleau-Ponty) that has been favoured.<sup>6</sup> I find the acceptance of phenomenology as *the* choice in the philosophy of sport rather disturbing.<sup>7</sup> (C)rudely put, one could say that some embodied theories have been taken for granted, which is usually not considered good sport in philosophy. One could also say that if it is possible to show the analytic tradition which has hardly been interested in sport and the body, exactly that sport and the body *is* interesting for understanding consciousness, that is just as fine an achievement as using what is already accepted as applicable. Although phenomenology has embraced embodiment, it is analytic philosophy of mind which has dominated when neurotheories of consciousness have been scrutinized by philosophers and vice versa.<sup>8</sup> When

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<sup>6</sup> Indeed, in his keynote lecture at the IAPS 2010 conference, Scott Kretchmar claimed Merleau-Ponty simply was “our” philosopher (see also Kretchmar 2007).

<sup>7</sup> A similar example is the un-nuanced acceptance of sport as having intrinsic value without falling into essentialism about the nature of sport. This is nicely pointed out by Culbertson (2008).

<sup>8</sup> Examples of analytic philosophical discussions on neuroscience are: Bickle (2003), Chalmers (2004), Smith & Jokic (2003) and Velman & Schneider (2007). Examples of neuroscientists turning to analytic philosophy of mind are: Changeux (2004), Edelman (1992, 2006), Kandel (2006) and Koch (2004). Rizzolatti and Sinigaglia (2008, p. 52, 77, 130) give their theory of action understanding and intentionality a more phenomenological (e.g. Gibson and Merleau-Ponty) treatment. Sinigaglia (2009) on the other hand, is more analytic. Thompson (2007) might be called a proponent for *neurophenomenology*, while Gallagher & Zahavi (2008) make an advance

turning to neuroscience and the mind, the choice of analytic philosophy is more than reasonable I would say.

It could be argued that this choice (using philosophy of mind/neuroscience on sport) makes the thesis not one of philosophy of sport at all; that the sporting part is quite contingent. That might be said. I take such a complaint rather light heartedly. Such a complaint must arise from a belief that there is such a thing as a philosophy of sport, *essentially* distinct from philosophy. I find it completely inconceivable what kind of *philosophy* that would be. The way I see it there is just philosophy, and philosophy of: philosophy of psychology, philosophy of mind, of perception, of evolution, of religion, of science, of sport. Graham McFee (1998) argues that there are no philosophical issues in sport other than ethical ones. I agree and disagree. I agree that there are no philosophical issues which are special to sport alone. So, if someone would charge me with the accusation that all the sport examples and descriptions could be substituted by other skills (like playing the piano) and therefore the use of sport is arbitrary, I confess: I am guilty as charged. Although I would not admit that psychological (say awareness) or phenomenal consciousness is the same when playing piano as when playing tennis, I agree that the difference is one of degree. But I do not see this to be a serious problem. I disagree that there is any ethics of sport which is essentially different to any other kind of ethics. There is medical ethics, there is ethics of business, ethics of law, of science, of sport. There might be special cases in sport which require ethical consideration, but they are also cases which differ in degree, not in essence. What kind of ethics would ethics of sport be if it were completely outside the concepts, tools and writings of philosophical ethics? If there was to be such a thing, it must be something *other* than ethics.

This thesis then, is wrapped in and brought forward by analytic philosophy of mind. This tradition is used as a tool of analysis on sport and neuroscience. I believe any kind of philosophy must be somewhat pragmatic and use little bits of different pieces and mix them up as we go. Here is *this* mix: these are some perspectives and certain cases. If you don't like it, fine. If you can come up with different and more justified perspectives, that is even better. It is my belief that both the analytic philosophy of mind and the neuroscience of choice can increase our knowledge, widen our discussions and put our intuitions and arguments to the test on questions of consciousness and science of sport. I am not sure we can hope for more in philosophy.

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towards a combination of phenomenological and analytical understandings of mind and body in cognitive (neuro)science.

The philosophical theories are chosen because they are among the leading in the field (and have not worn down the paths in the philosophy of sport). The same goes for the neuroscience. The writers are contemporary, state of the art, and have a philosophical message that concerns sport science and the philosophy of sport. In the following, I will first elaborate on the tradition which has led up to the analytic philosophy of choice. I will then go deeper into some of the material underpinning discussions in the articles. This is done in the following order: Nagel, Jackson, Chalmers, Levine, Kim and Papineau. Some of these thinkers are addressed directly in the articles, particularly in the first, but the ideas are evident throughout the whole thesis. I will then give a brief review of the neuroscientific search for consciousness in the last century before discussing more thoroughly the contributions of Changeux, Damasio, LeDoux, and Kandel. I aim here to relate both the philosophy and the neuroscience to ideas and theories in the four articles.

## PHILOSOPHY

### **2. 2. Can physicalism be non-reductive?**

Without venturing into a long debate on what physicalism is or amounts to, let us simply start by saying that *physicalism* is an ontological monism which holds that there is nothing over and beyond physical matter in the universe.<sup>9</sup> A *reductive physicalism* holds that every phenomenon, substance or state within the universe must be reducible to the basic statements of fundamental physical theory. When it comes to human psychology and mentality, the most common view of reduction is functional- or identity reduction to neurophysiology.<sup>10</sup> Lots of questions about the reducibility of consciousness surround this thesis: article I deals with the attempt to reduce consciousness by identity, article III deals with the attempt to reduce skill by identity. A *non-reductive physicalism* is an ontological monism holding that there are physical states or phenomena that are not reducible to some fundamental physical theory. The contemporary path, or background, leading up to the non-reductive physicalism I have

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<sup>9</sup> A good introductory to physicalism is delivered by Horgan (1995).

<sup>10</sup> I will not discuss different approaches to reduction. Nagel (1986, ch. 2), Chalmers (1996, ch. 2, ch. 3), Levine (2001, ch. 4) and Kim (2005, ch. 4) provide similar ideas to functional- and identity reduction (or by bridge laws). Article I takes a more thorough look at identity theory, a fine treatment of functionalism is provided by Levin (2004).

declared in the articles must be addressed.<sup>11</sup> This address attempts mainly to establish why there is something like a non-reductive physicalist position. If such a position is sound is a disturbing question. I will question the position via the work of Jaegwon Kim. Kim argues that non-reductive physicalism should be abandoned. What is the alternative? I argue it must be some form of identity theory, like Papineau's. This position is similar to John Perry's described in article I. If Papineau and Perry's positions are equally tough pills to swallow as the shortcomings of non-reductive physicalism are, where does that take us? I will not try to answer the latter question in a more sophisticated way than back to non-reductive physicalism. At least not until the end of the first part of this thesis.

The task of manoeuvring in philosophical waters is a challenging job. There have been several distinguished philosophers who declare both physicalism and the irreducibility of consciousness, perhaps most noteworthy is Davidson (2006). But I will keep it simple, not even moving outside a quite narrow scope. I now move swiftly to Nagel and what I take to be the start of the contemporary idea and concept of what would later be known as *phenomenal consciousness*.<sup>12</sup>

### **2. 3. Nagel and “what’s it like”**

In the opening sentence of his memorable article *What is it like to be a bat*, Thomas Nagel announces that it is *consciousness* that “makes the mind-body problem really intractable” (2006, p. 255). We can arguably say that Nagel with this sentence distinguish questions of *consciousness* as something different than questions of *mind*. We might also interpret Nagel to be saying that questions of mind-body relations are not all that insurmountable if they shy away from questions of consciousness. Already with Nagel then, do we see the line between hard and not so hard questions. Which ones are which? In the first footnote (p. 263) accompanying Nagel's critique of reductive approaches to the mind-body problem, Nagel claims Smart, Lewis, Armstrong, Putnam and Dennett have all missed out on the type of consciousness he is about to address, or got it all wrong.

Another interpretation of the first sentence, which I will discuss later, could easily be that *all* questions of mind-body are way too hard – because consciousness (the phenomenal

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<sup>11</sup> The non-reductive physicalism I have declared is an ontological monism, but an epistemological dualism saying that there are some things (consciousness and skill) that cannot be reduced to a fundamental physical theory.

<sup>12</sup> Nagel and Jackson's ideas are what constitutes both the hard problem of consciousness (2. 5.) and the explanatory gap (2. 6.). Preliminaries in article I do not give these ideas the treatment they deserve. Neither will this thesis, but I owe it to them to give a little more in-depth background. Some of Nagel and Jackson's ideas are evident throughout all the articles and this thesis.



one) cannot be separated from any of them. The traditions I will deal with more thoroughly below (2. 5. & 2. 6.), have gone for the first interpretation. In the hazy shade of winter light though, the latter seems even more intriguing, perhaps even more likely (see e.g. the second passage, p. 255). For the moment (and in the articles) though, I will stick with the usual interpretation, namely that the consciousness Nagel is talking about is the “what is it like to be” consciousness, which is dissociable from other questions concerning the mind-body problem.

Nagel argues that the “most important and characteristic feature of conscious mental phenomena” is *conscious experience* (p. 255). Nagel goes on to claim that conscious experience is widespread throughout the animal kingdom and so not limited to humans and language speakers. He argues that conscious experience may take different forms but that it means “basically, that there is something it is like to *be* that organism” (p. 255). Interestingly, Nagel then states that “an organism has conscious mental states if and only if there is something that it is like to *be* that organism – something it is like *for* the organism”. It seems to me that these are two different conditions for consciousness. The first sentence and the first half of the latter sentence seem to indicate a wide interpretation of conscious experience: if there is something it is like to be, that is a sufficient condition to have conscious mental states. This might be interpreted as saying that any organic life with some minimum of self awareness (this condition is left open, but given a wide definition in the presiding sentences) does not only have mental states but *conscious* mental states. The second half of the sentence though, seems to imply that this organism must also be aware that there is something it is like to be that organism. This is a much stronger condition, implying that some kind of awareness of consciously experiencing is needed in addition to simply *be* a creature *and* experience (which might otherwise be interpreted simply as responding to stimuli). The subtleties and richness of Nagel’s writings are not to be dwelt upon here, but I find it quite entertaining that the distinctions following in the wake of Nagel have not considered the option that phenomenal- and access/psychological consciousness and hence easy and hard problems go hand in hand. Anyway, Nagel gives a minimum requirement for consciousness: it is enough to be an organism for which there is something it is like to be that organism. Nagel *also* excludes lots of contenders for consciousness by this move: *only* such organisms may be said to have consciousness. We might say he puts the nail in the coffin for computers, robots and the coming zombies (see e.g. first paragraph p. 256).

Nagel calls the “what is it like” condition for consciousness the subjective character of experience, and this he claims is not reducible to functional or intentional states, precisely

because such states can be obtained by robots which do not experience. He does not deny that behaviour can be given a functional characterization, he denies that reductions leaving out the subjective character of mental phenomena are exhaustive (p. 256). Any reductive project of physicalism seems impossible because “every subjective phenomenon is essentially connected with a single point of view, and it seems inevitable that an objective, physical theory will abandon that point of view” (p. 256).<sup>13</sup>

Nagel brings in his infamous bat to illustrate his point. The bat is a mammal which has experiences (not argued for), but have a sensory apparatus (sonar) severely different from ours to make it hard to understand what it is like to be a bat.<sup>14</sup> Nagel’s descriptions are pressing the point: it is not a question of imagining flying, navigating and eating insects, which would be what it would be like for *me* to behave like a bat – it is a question of what it is like for a *bat* to be a bat (p. 257). This is a significant difference, because we could easily see that if neuroscience actually was capable of determining all the neural events in my brain so someone (correctly) could observe “Jens is now experiencing fear in an encounter with a terrible snake – we all know what *that* is like”, is different from *my* subjective experience of that particular encounter. I am terrified of snakes, and it would be quite astonishing if any neuroscientist would know exactly how I felt. The point is more pressing even than this, because a neuroscientist could reply that fear (if we keep it to that) is just a question of amygdala activity and say substance P release, so if we duplicate these states in my brain and put them in a scientist’s brain, the latter *would* know what it is like to be me (at least my fear) in a snake encounter. This misses the point because my subjective experience is constituted by certain snake encounters in forests, mountains and at my grandfather’s cottage which my conscious experience encapsulates. This is the point which Edelman sees sometimes (but not always) in article II. The same point is also addressed in how long-term memory must always participate in any working memory state in article III, and how acquired motor knowledge influences the mirror neuron system described in article IV. We might say it is another

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<sup>13</sup> It seems that this point is accepted by the neuroscientists described in this thesis. Puzzlement rises when it is so easily forgotten (see e.g. Edelman in article II).

<sup>14</sup> Interestingly, Rick Grush’s (1998) example of a sonic device which aids blind people to “see” and the expert (Toni) of using this instrument is quite similar to Jackson’s super scientist Mary being a Nagel bat. Grush does not refer to Nagel or Jackson, but maybe we actually could understand what it is like (for a human) to be a sonar-orienting creature? There is now an established device helping blind people see by sound (CASBlIP), and the executive director of World Access for the Blind, Daniel Kish, was born blind and taught himself to “see” using palate clicks when he was a small child. Kish is reportedly able to mountain bike, hike in the wilderness, and play ball games without traditional aids (<http://www.worldaccessfortheblind.org/>). The big question still remains: although Kish is functionally and intentionally similar to us “seers”, does he know what it is like to see like those not born blind? Nagel himself addresses just these questions (last paragraph p. 257).

problematization of the distinction between possession and acquisition. Bringing these lifestories into our actions and so forth is what being a creature is like.<sup>15</sup>

On the one hand, Nagel sees our common physiological structure as enough to understand what it would be like to be a creature (third paragraph p. 257 & first paragraph 259), but that knowing what it would be like to be *that* creature (or me) is something else entirely (fourth paragraph p. 257 & second paragraph p. 259). To do this one needs to occupy the particular view of the creature (footnote 8). Accepting that this is not an aim of objective science (like Edelman and Koch sometimes do) is not asking too much; and (neuro)science should not feel obliged to have such an aim either. The point Nagel pushes is that this subjective character is what consciousness is all about. If we take this subjective part away, we are not talking about consciousness anymore.<sup>16</sup> “After all, what would be left of what it was like to be a bat if one removed the viewpoint of the bat?” (pp. 259-260). Science on the other hand is occupied with transcending the subjective by reducing the dependence of a specific viewpoint. This is a fine strategy when describing or reducing things or phenomena external to us. But when it comes to consciousness and experience, the move away from one point of view and supposedly towards greater objectivity “does not take us nearer to the real nature of the phenomenon: it takes us farther away from it” (p. 260). According to Nagel, the irreducibility of consciousness does not entitle us to claim physicalism is false. What we lack is an understanding of how it can be completely true and so Nagel sees non-reductive physicalism as perfectly coherent. (p. 261). Although Nagel speculates in the possibility of a theory of how physical states and mental states refer to the same thing (e.g. a theory of language where mental terms and physical events converge, p. 261), he finally sticks with the idea of the nonsensical in asking for the objective nature of a subjective experience (p. 262).<sup>17</sup>

It is perhaps the idea of his “realism about the subjective domain” that drives Nagel to a slight spin-off on the impossibility of conceptual analysis of consciousness. Nagel concludes that reflection “on what it is like to be a bat seems to lead us.(...).to the conclusion that there

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<sup>15</sup> Although not related to consciousness, Hopsicker (2009) and Moe’s (2005) points about tacit knowledge and background are also along the same lines (see article IV).

<sup>16</sup> This is again a question if Nagel is talking about a particular form of consciousness (phenomenal consciousness). If he is, it seems legitimate to study the rest of the mind-body problem (psychological consciousness) without getting into the impossible task of taking each individual’s point of view. If he (or we) argues that you cannot take away (phenomenal) consciousness from the mind-body problem at all (because there would only remain body), then the explanatory gap is considerably wider than what is customarily acknowledged.

<sup>17</sup> Nagel formulates the idea of asking for the reality of an experience, in contrast to the appearance of an experiment. The argument is that the appearance *is* the reality, and hence it does not make sense to ask for the *real* experience – that which can be viewed by many, from a point of view available for many (or a view from nowhere).

are facts that do not consist in the truth of propositions expressible in a human language” (second paragraph p. 258). This is not Nagel’s spotlight for the evening, but he seems to deny the solution to the explanatory gap offered by Perry and Papineau, and criticized in article I. The problem of consciousness is not a *conceptual* problem, and the content (if we use the second and much stronger interpretation) of a conscious experience (Nagel never uses the word “qualia”) can be non-conceptual.<sup>18</sup> Qualia, what Levine (see 2.6.) calls the second component of the explanatory gap, is the major ingredient in Frank Jackson’s Mary-tale.

## 2. 4. Jackson, Mary and the knowledge argument

Before Frank Jackson gave center stage to the super-scientist Mary in 1986, we were introduced to another character named Fred in 1982.<sup>19</sup> In *Epiphenomenal Qualia* (Jackson, 2006) Jackson states that “there are certain features of the bodily sensations especially, but also of certain perceptual experiences which no amount of purely physical information includes” (p. 311). According to Jackson, “physical information” is the kind of, and the relations and functional roles of brain states. Jackson argues that neither identity theories, functionalism, nor neuroscience tell us anything about “the hurtfulness of pains, the itchiness of itches, pangs of jealousy, or about the characteristic experience of tasting a lemon” (p. 311). Jackson presents his case by what he calls “The Knowledge Argument for Qualia” (pp. 312-314). In this argument Fred has far better colour vision than anyone else: he sees two distinct colours where the rest of us see only one. No matter how we arrange what to us appear to be qualitatively identical red tomatoes, he can always distinguish them into “red1” and “red2”. The idea is not that these are shades of red, but that they are as different for Fred as pink and blue is to us. Now, a physiological investigation of Fred’s optical system reveals that he can distinguish two wavelengths in the red spectrum like we do with pink and blue. This should lead us to the conclusion that Fred can see at least one more colour than you and I.

If we would like to know what kind of experience Fred has, “no amount of physical information about Fred’s brain and optical system tells us” (p. 312). So, knowing all physical

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<sup>18</sup> Nagel’s final speculation on an objective phenomenological description seems rather far fetched. We may agree that there might be better suited concepts for the phenomenology of conscious experience than what we have today, but how could they be objective in the sense Nagel asks for? Nagel finally ends up in a position similar to Kim’s: *if* (and Nagel is not too optimistic) such an objective phenomenology could be obtained, there would still be something left out (pp. 262-263).

<sup>19</sup> As with Nagel, a whole thesis could be spent on the knowledge argument. I merely hope to give a fair treatment to the idea Jackson presents. The most influential papers on the issues are presented and in Ludlow, Nagasawa & Stoljar (2004).

information is not the same as knowing everything about Fred; hence physicalism leaves something out. Jackson then goes on to argue against a position like Perry's presented in article I: if we know every detail about the internal physiology of Fred so we could copy and implant them in any other person, then after the implant we would know what kind of experience Fred had. But if we knew everything about the physiology beforehand, and this is all the knowledge there is (which is Perry's argument), then we should also have known about Fred's experiences before the implant. But this is not the case. Jackson's argument with Fred is both intuitive and convincing. The knowledge argument is not necessarily more convincing when the Mary-case follows:

In *Epiphenomenal Qualia*, Mary is a brilliant scientist who knows all there is to the neurophysiology of vision, but has acquired this knowledge in black and white. When she leaves her colourless room and experiences colours for the first time; "Will she *learn* anything or not?" (p. 313). This seems to be another question than the question above. The question in Fred's story is: if he is the only one who has experienced a certain colour, but we know everything about Fred's physiology, do we know then what it is like to experience that colour? Answering this question with a "no" seems quite convincing. The question posed with the Fred example is rather similar to Nagel's, although the path is different. Nagel's argument is one of subjectivity, while Jackson's is one of qualia – *but*, what physicalism leaves out is what it is like to have an experience involving qualia. In the Mary case, Jackson formulates the question to a matter of learning something new. Perry's answer to this question is "no". The physical description is not changed, enhanced or even expanded, so she does not learn anything *new*. But what does Mary learn? For surely, Mary *is* (also according to Perry) seeing something for the first time. In article I, I have tried to show that Perry claims she only learns how to categorize or finding the relation between physical descriptions and a particular experience. But this is not a satisfactory answer, because we are missing the story of Fred. Jackson's knowledge argument is twofold: first, what is missing in the Fred example and then second; does Mary know all there is? The first part is not answered by Perry or other physicalists, but they do have a point in the second: Mary gains a new experience, arguably not knowledge.<sup>20</sup>

Jackson himself contrasts his knowledge argument with Nagel's "what is it like to be" argument. Jackson's argument is that there is a property of Fred's experience that is left out

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<sup>20</sup> The argument against Perry's position in article I is that either ruling out knowing how (what Mary learns) as knowledge at all, or that knowing how can be reduced to knowing that fails. Jackson's first statement of the knowledge argument (the Fred example) is mostly left untouched.

by physicalism, not that we have to take up a specific point of view to know what it is like to be Fred (p. 315). Jackson acknowledges that these two are connected, but he insists that his concern is the property of Fred's experience. The property is qualia and qualia are facts about experiences. Physical descriptions do not tell us about these facts. Jackson accuses Nagel for not *denying* physicalism, but what makes Jackson's argument work (if it does) must be that the qualia of Fred's subjective experience cannot be exhausted by a physical description because those are supposed to be objective. Jackson seems to argue that the knowledge argument works without the subjectivity part, because physical knowledge does not exhaust knowledge. But this seems to be so just because some knowledge is by necessity subjective. Nagel, as we have seen, does not claim that physicalism is false. But Jackson makes this conclusion. He happily argues that qualia are causally inefficacious and epiphenomenal (2006, pp. 315-316).<sup>21</sup> In article I, the figure Ronald is a combination of Fred and Mary. The Fred aspect concerns the possibility of reducing Ronald's experience of being a footballer to physical language; the Mary aspect concerns whether it is possible to reduce everything Ronald knows. I have argued here that these are not necessarily the same issues, although Jackson seems to believe so. I have also argued here that it is the Fred aspect that makes the Mary aspect problematic. We therefore move on to the follow up article *What Mary Didn't Know* (Jackson 2003).<sup>22</sup>

Again Jackson tells us of the tale of the super-scientist Mary, but I believe there are some differences in his second version of the knowledge argument: in her black and white room, with her b/w books and her b/w television set, Mary "learns everything there is to know about the physical world" (p. 458). According to Jackson, she will know all there is to know if physicalism is true. "For to suppose otherwise is to suppose that there is more to know than every physical fact, and that is what physicalism denies" (p. 458). We see that the story of Mary here is different, because the emphasize is on learning and knowing more than a physical *fact*. If Mary learns something new, it must be a non-physical fact, and then physicalism is incomplete. Jackson repeats his argument by stating that Mary does not know all there is, because when she is let out, she *learns what it is like* to see red (p. 458). Jackson illuminates the what it is like character, which he distinguished from his initial case with Fred

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<sup>21</sup> To a certain degree does Jackson's position resemble both Kim and Edelman: Jackson is a one-way epiphenomenalist, arguing that brain processes causes qualia, but qualia do not cause anything physical in return. He claims qualia are bi-products of natural selection (pp. 316-317). Although Edelman (or Kim) would never claim physicalism is false, they are closer in kinship than a first impression may reveal.

<sup>22</sup> The follow up is constructed as a reply to three objections by Paul Churchland to *Epiphenomenal Qualia*.

four years earlier (see footnote 2, p. 463). In his critique of Jackson, Perry undermines the power of the intuitive here, because Jackson has opened up for the possibility that Mary learns something. But what is it that she learns? Is it something different or new than her prior physical knowledge? Perry answers “no”: what she learns is a know-how; the knowing how to put her new experience in the correct catalogue of her physical knowledge. But there is no *new* knowledge of facts, no extension of her body of knowledge, so to speak. Perry claims Mary learns a new way to reflect upon the facts she already knew (2001, p. 159). I think we might agree with Perry on this one, as I have stated in article I. The question remains then if Mary’s know-how is knowledge. Jackson observes Perry’s argument, but denies that what Mary learns is to see that experience M is identical to physical description P. Jackson’s argument is simply this: Mary knows every physical fact, but she is caught by surprise when let out of her room. Ergo: she did not know all there was. The problem with this is of course that Jackson needs to show that Mary actually learns a new fact, which she doesn’t (Perry argues). She learns a know-how, but that is not a threat to physicalism, according to Perry. Jackson observes this objection too, so he claims that what is new to Mary is not an experience (*that* he says is no threat to physicalism), no, she gains “*knowledge about the experiences of others*” (p. 459). This is a dubious move on the part of Jackson.

In his first reply to Churchland, Jackson reformulates the knowledge argument: Mary knows everything physical about other people, but she does not know everything about other people. The knowledge argument is suddenly about learning something new about *other* people. Jackson also directly confronts Nemirow and Lewis’ solution (p. 461): that Mary’s prior physical knowledge is not changed and hence she learns knowledge how. Jackson goes along with this reply, but he insists that Mary learns something more, namely some factual knowledge (which is not physical) about the experiences of others (pp. 461-462). When Jackson states his argument like this, it can be reconciled within a physicalistic framework. I have taken the liberty of reconstructing the knowledge argument in article I. I think Jackson is on a tottering foundation when moving Mary into the territory of learning some new non-physical *fact*, and then extending this to knowledge of others. The original case of Fred gives better artillery to the knowledge argument, but the thrust comes from the barrier of the subjective. It is this interpretation I have used in article I, and have elaborated with the sport example of Ronald the footballer (article I).

There is stormy weather on every side of the knowledge argument. The philosophy of sport should take the problem of what we know when we know a game, to rephrase Steel (1977),

more seriously. Things are not as simple as stating that knowledge in sport = skill = knowing how. Let me give some illustrations: we might say that Tracy Austin has tennis know-how, although she may have lost her ability. This is to make a distinction between ability and knowing how. It might be easy then to say that the same distinction is there when an athlete chokes on the field: the skill is somehow lost, but the know-how remains. Norwegian ski-jumpers are perfect examples, suddenly not able to perform world-class ski-jumping. When the distinction between know-how and ability is allowed, we easily fall into the question of what this know-how consists of. Suddenly it seems that know-how is being able to *say* to oneself or another perfectly what is *supposed* to be done. If this is know-how, then we might grant a person who have *never* had an ability (like a coach) know-how too. Such know-how seems reducible to knowing that. If not, we must find what the know-how difference is between Tracy Austin and the perfect coach who have never played tennis. Suppose they both watch someone play, and correct her with identical descriptions: what is the difference in know-how? It seems we must fall back to know-how being ability,<sup>23</sup> or admit that knowing how is reducible to knowing that. Neither response seems seductive to a philosopher of sport because both leave us with a denial of skilful motor behaviour as knowledge proper. Perhaps we must even admit that one can have ability, but not know-how: a person might be able to perform a pole vault, but has no idea of how she does it. This line of reasoning seems to be at the bottom of Perry's work (see also Bennett & Hacker 2003, pp. 148-151). Such an interpretation says that knowing how is neither sufficient nor necessary for ability, and vice versa.

This has important consequences: if a distinction can be drawn between knowing how and ability, then knowing how can be reduced to knowing that. A philosopher (like Perry) would argue that Mary's knowledge is indeed reducible. This line of argument will probably answer the knowledge argument concerning knowing qualia of others. Or perhaps this way of reasoning is entirely wrong? If Goldman's (2006; see also article IV) theory of simulation has anything to it, we *must* have experienced the same state to understand *and* recognize it in others. That is also the message from Rizzolatti and the mirror neuron proponents (article IV): to understand others we must have personal knowledge and experience. That is to say that to

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<sup>23</sup> This move would also suggest that skill is the same as ability. I would like to state that clearly it is not: a baby has the ability to cry, but does not have crying skills (like a Hollywood actress). Skill then, is perhaps ability *and* some kind of knowledge of how and when to apply an ability in a flexible and adaptive manner (see article III for a discussion of what Agassi knows; he must also know certain propositional facts like the rules of tennis). Such knowledge might be reflective, but perhaps not conceptually. Discussions on ability, know-how and skill are not only unsettled in the philosophy of sport. Philosophy of sport should also contribute to these discussions in traditional philosophy of mind/epistemology: when philosophers like Perry describe Mary's new knowledge as relating concepts to experiences, that is surely not the same know-how as exhibited in sports.



know a third person state we must have first person experience. To recognize and understand, we must have experience; we must have done, or still be able to. The differences between Tracy Austin and our imaginary coach are several, even if they give the same report on how to do something. The same report simply reflects the same know-how of telling someone what is supposed to be done – *tennis know-how* is something else. The first is a matter of perceptual knowledge and coupling this with appropriate concepts (Perry’s solution to what Mary learns). What Austin has in addition is motor knowledge, enabling her to also know what it is like to play tennis. Our imaginary coach is similar to Perry’s idea of Mary, while Tracy Austin is similar to Fred. Austin knows something more than the coach, although *seemingly* their tennis know-how is similar. We are still left with the question if skill and know-how are identical, or if skill and ability are identical (see footnote 23). Perhaps the difference between Austin and our imaginary coach is simply that Austin has acquaintance with tennis? These debates will not be settled here, but they surely await more serious treatment in the philosophy of sport.

For the moment, let us link this interesting matter to article III and IV. In article III it is argued that neuroscientists do not take a serious discussion on the above conceptual issues. Motor skills and know-how are said to be the same thing, and then they are identified as long-term procedural memory. Since Kandel has reduced long-term procedural memory to molecular biology, he has without further reflection reduced knowing how to knowing that. A more nuanced version would be to say that Kandel has reduced *motor memory* to knowing that, but he has not reduced skill. Why not? In the article I have tried to show that skill is not simply motor memory, because skill consists of *at least* episodic memory, sensory memory, working memory as well as motor memory (and of course an able body – the different memory systems can exist it seems with an injured/unable body). An interesting case for the philosophy of sport and memory research would be the case of Clive Wearing who is able to play the piano and conduct a choir even though he does not even remember (or know?) that he is able to. Such lesion studies might shed light on the relations between memory, knowledge, skills and ability.<sup>24</sup>

In article IV it is argued by Rizzolatti that *motor knowledge* is necessary for action understanding. Where does that leave us with the case of Tracy Austin and our imaginary coach? Rizzolatti’s argument should be interpreted as saying that the coach has impaired action understanding compared to Austin. Motor knowledge in this sense is some kind of

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<sup>24</sup> The simplest way of denying that procedural motor memory is identical to skill is of course to say that the molecular basis of the brain is intact in tennis player x, but x’s skill is not due to a terrible fencing accident.

motor memory which is acquired by present or former ability. According to Rizzolatti, Austin understands something that the coach does not; she has a first person grasp of what is going on (Rizzolatti & Sinigaglia 2008, p. 138). The same conclusion can be drawn from Edelman's (1987; 1992) neural Darwinism (see article II): without ability and exposure to certain stimuli in a certain world (of tennis), certain neural connections cannot occur (visualization is not enough). However we define knowing how, skill and ability, there *is* a knowledge difference between our imaginary coach, Tracy Austin and a still-able-to-perform athlete like Roger Federer. Both Austin and Federer know something the coach does not. If we take Rizzolatti's idea of the body and motor movements as cognitive at face value, then Federer must also know something Austin does not.

Summing up: Perry solves the knowledge argument *qua* knowledge argument by claiming Mary's knowledge is knowing how, which is reducible to knowing that. But the solution leaves the what it is like feeling untouched. It is by illuminating this point that sport contributes to the discussion: a coach may know how to do x, (or know-how of telling how x is done), but without having done x, the coach could not possibly know what x is like. I believe this is much clearer when it comes to sport skill than the usual obscure discussions of experiencing "the redness of red".<sup>25</sup> Phenomenal consciousness must be experienced in first person, and this necessitates ability or skill to breach the boundaries of subjectivity. *That* takes more than know-how in Perry's (and Bennett & Hacker's) sense.

## **2. 5. Chalmers: psychological consciousness vs. phenomenal consciousness, and the easy vs. the hard problem**

In his now famous book *The Conscious mind*, David Chalmers (1996) addresses the problem of how our subjective inner life arises from physical systems like brains.<sup>26</sup> Chalmers complains that *scientific* theories do not even touch upon questions like why we are

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<sup>25</sup> There is a fine line here between a skill on the one side and mere movement on the other. It might be argued that there is a skill of sitting-on-a-chair. If so, it might be said that this skill can be gained by nothing more than reading a manual. Alas, we might say that gaining such a skill is accomplished without ever having performed the sitting (because if somebody ordered me to do so I could do it easily). Following this line of argument leaves us with the idea that the difference between movements and skills is along a continuum so that in *principle* a more complex skill could also be learned simply by reading. I would not argue that there is an essential difference between movement and skill, but still hold onto the idea that knowing what it is like to actually sit on a chair is manifested first *after* the sitting. One could also say that skills are the performance itself, meaning skills are evident only in the moment. This means drawing another distinction between ability to do a skill (the potential) and the skill itself (the actual, or the realization of the skill).

<sup>26</sup> This part is not supposed to be a discussion of Chalmers' own theory, his panpsychism and his idea of a naturalistic dualism. The focus is on psychological vs. phenomenal consciousness, and the easy vs. the hard problem.

experiencers and why there is something it is like to be such an experiencer. Instead (natural) sciences ask questions like: “How does the brain process environmental stimulation? How does it integrate information? How do we produce reports on internal states?” (pp. xi-xii). Such questions are what Chalmers labels “the easy problem of consciousness”.<sup>27</sup> Chalmers argues that to ignore the (hard) problem of consciousness would be antiscientific; instead we must take consciousness seriously (pp. xii, xiv). To explain consciousness away, or to redefine it as something it is not (e.g. take away the subjectiveness of experience) will not work. I have tried throughout the articles and this thesis to show that this is often the strategy in cognitive science and neuroscience. Such approaches do not work however: if one gives up on, or try to deny the fundamental of the phenomenon at hand, we are really not looking at the phenomenon at all. We must start then, by admitting that there *is* a problem of consciousness. Chalmers believes consciousness is a natural phenomenon, so there is no reason to look outside the physical world to have a scientific theory of consciousness (p. xiii). Why then, does Chalmers argue that a “reductive explanation of consciousness is impossible” (p. xiv)? In other words: what is the hard problem of consciousness, and why is it so hard?

Chalmers follows in the footsteps of Nagel, claiming the most central aspect of consciousness is *experience*, or more to the point; *conscious experience* (p. 4).<sup>28</sup> We are all personally familiar with Chalmers’ characterizations: perceiving, acting and thinking do not go on in the dark.<sup>29</sup> There is something it is like to be you and I. There is an internal aspect of colours, smells, sounds, tastes and pains. This is “the subjective quality of experience” (p. 4). Chalmers, like Nagel, claims that “a mental state is conscious if there is something it is like to be in that mental state”.<sup>30</sup> And this is equivalent to saying “a mental state is conscious if it has a qualitative feel”, or qualia for short (p. 4). The hard problem is explaining qualia. We see here that Chalmers do not make a distinction between the subjective part and the qualia part of consciousness.

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<sup>27</sup> If scrutinized, we could say that the first two questions are mere questions about the brain and only the latter is a question about consciousness.

<sup>28</sup> To separate the point of interest from experience as in “he had lots of experience”.

<sup>29</sup> It is interesting to see that Chalmers makes exactly those distinctions between perceiving, thinking and executing Rizzolatti & Sinigaglia (2008) criticize (see article IV).

<sup>30</sup> This must amount to saying that there can be mental states that are non-conscious. This is what I have discussed as implicit or non-declarative, especially in article III. I think the problem with this distinction is that it renders it an open question if so-called phenomenal consciousness can actually be reduced to psychological consciousness because it seems we must be conscious *of* the qualitative character in experience. This is to ask for an access to, or psychological consciousness of, phenomenal consciousness.

Chalmers echoes the knowledge argument when he says that even if we knew every fact of physics and dynamics information processing in a system, there wouldn't be any reason to grant consciousness to such a system.<sup>31</sup> It follows that there are two explanations connected to conscious experience that stand out. First, it is explaining why conscious experience exists and how it arises in a physical system. The neurotheories discussed below and in article II deal with these questions.<sup>32</sup> The arguments for answering the former part are rather convincing - answers to the latter part are perhaps not if they cannot answer the second question: why do conscious experiences have a specific character, why do they feel like this, and not like that? To get a better grip of the discussion at hand, Chalmers makes a list of different conscious experiences, each with their own character (pp. 6-11). The list includes *visual experience* (deeply connected to mirror neurons, article IV and also Koch's main target), *auditory experiences* (imagine the difference in a physical description between air pressure and sound waves, and how your favourite song makes you feel), *tactile experiences* (why does water feel like that, and wind in my hair like this?)<sup>33</sup>, *olfactory experiences* (we all know how difficult it is to describe smells, like in wine, yet we are amazingly good at distinguishing differences), *taste experiences*, *experiences of temperature*, *pain*, itches, tickles, proprioception and other *bodily sensations*, *mental imagery* (where's the literature on consciousness in studies of mental motor imagery? It surely feels like something to imagine movements)<sup>34</sup>, *conscious thought* (explicit thoughts and attitudes like desire often have a phenomenal feel to them, especially in memory. If Edelman (1989, 2000a) and Changeux (2004) are right in their theories of memory as a re-firing of an original neural event, that says

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<sup>31</sup> This is what an identity theory denies: a system with those and those properties and events have consciousness, knowing about those properties and events are just what one needs to know about having consciousness. Chalmers says initially (p. xvii) that his work is not dealing with identity theories. As I have stated in article I, this amounts to saying that his zombie arguments are directed against other reductive physicalisms, like functionalism (see also Chalmers 1996, pp. 14-15). Chalmers claims phenomenal concepts deal with first person-aspects, while psychological concepts deal with third-person aspects (p. 16). It is unclear whether Chalmers agrees with Papineau about phenomenal concepts being more coarse-grained than psychological or physical concepts (see 2. 8.).

<sup>32</sup> In short: Edelman argues consciousness has evolutionary benefits: a flexible system which is more adaptive can handle novel and a lot more situations than could non-conscious automata. In sport science, this is to say that it is better in the long run (or at the highest level) to have conscious and adaptive athletes, than non-conscious athletes acting automatically. The reason is that our biological system could not have automated behavioural responses to *any* situation possible. Qualia are there to secure different feels associated with different stimuli so we can distinguish between them and make appropriate responses. Changeux, Damasio and Koch's theories are along the same lines.

<sup>33</sup> An interesting story: I was trying to learn butterfly in the swimming pool at NSSS with huge monofins. The feeling (and sound!) of water rushing past my ears was fantastic due to the increase in speed. I told one of my classmates about this great feeling, and he simply answered "now you know how swimming feels to me". He was competing in the 1996 Olympics.

<sup>34</sup> Thomas Alsgaard tells the story of how 8 time Olympic champion Bjørn Dæhlie was an expert at making imagery become so vivid he would throw himself to the ground when celebrating an imagined victory (Møller Solheim 2010, p. 34).

something of why memories have some of the same qualitative character as the original experience. See article II & III), *emotions* (why does happiness feel like that and anger like that? Emotions are what Damasio (2. 13.) and LeDoux (2. 15.) have specialized in) and *sense of self*. Edelman, Changeux and Damasio all argue that sense of self is primary to other types of consciousness, there must be someone consciousness is for (and which makes the conscious experience subjective and maybe ultimately non-reducible to neuroscience...). Chalmers' interest in the sense of self is what it is like to have a sense of self, which is something else (and difficult to pin down).

Chalmers then goes on to divide consciousness into two different classes: *psychological-* and *phenomenal* consciousness. Psychological consciousness is a mental state which plays a causal role in the production of behaviour and is what Chalmers claims cognitive science is interested in (p. 11).<sup>35</sup> When consciousness is looked upon from such a view, it does not matter whether there's a conscious quality of the mental state. The psychological concept of mind is characterized by what it *does*. The phenomenal concept of mind on the other hand is characterized by the way it *feels*. Phenomenal consciousness is, as we have already discussed, conscious experience: "a mental state as a consciously experienced mental state" (p. 11; see also article I).<sup>36</sup>

How are the types of conscious experience listed above to be classified into psychological and phenomenal consciousness? This is obviously quite difficult. Take emotions (or feelings) as an example. Emotions clearly have a large phenomenal aspect; we are in fact talking about what it is like to experience something, or what experiencing sometimes feels like. But we can easily see that when LeDoux (2002) writes about the neurophysiology in the amygdala causing the emotion fear, which again causes one to act in a certain way, he is talking about

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<sup>35</sup> One of the arguments in this thesis is that phenomenal consciousness *also* plays a causal role in the production of behaviour: that an experience *x* feels like *y*, has an impact on my behaviour *z*. If the experience *x* felt like *y*\*, my behaviour might have been *z*\*. Contrary to his distinctions, Chalmers also leaves room for this view, arguing that psychological and phenomenal properties tend to co-occur (p. 17).

<sup>36</sup> It is difficult to understand in Chalmers' work how we could experience a mental state *as* conscious if we do not have psychological access to it. Chalmers writes about mental states of psychological consciousness as not necessarily conscious to us, e.g. implicit mental states that have impact on behaviour (like priming) (p. 11). It is confusing to argue that states of psychological consciousness need not reach a subject's awareness, while states of phenomenal consciousness must. That is to say that all phenomenal states are psychological, but not all psychological states are phenomenal. My argument has been that there are many factors in experiences that contribute to the way an experience is like, but we are often not aware of those factors. Chalmers' distinction makes it sound like a state playing a causal role is by definition a state of psychological consciousness, while all states which we are consciously aware of are phenomenal state. If so, then phenomenal consciousness is by definition an epiphenomenon. I agree that all states we are aware of are also phenomenal states, but not that *only* states we are aware of are phenomenal. Factors we are not aware of certainly make experiences feel like this or that. Chalmers opens up for this idea, but leaves the answer open (p. 12).

what the emotion fear *does*. He is not talking about what fear is like for someone. Also, when Damasio (1994) discusses how feelings and emotions contribute to decision making; he is discussing how these states influence (and perhaps benefit) our behaviour. Chalmers' example is the standard case of pain: pain surely has a phenomenal component: pain feels like *that* (although pain from cutting ones knee with a knife has a different qualia than pain from a scrape, even if they would lead to the same loss of blood). But it also has a psychological component: pain plays a causal role in behaviour: pain leads to certain muscle responses, like a withdrawal reaction (p. 17). It is hard to argue for which of the two is more essential to pain *qua* pain, but we could have one without the other: we could make a device which would withdraw its limbs in every instance a human experiencing the qualia of pain would, but without having such qualia. On the other hand, we can tolerate the qualia of pain without the typical causal role of withdrawal. Sports is an excellent example: lots of sport is about enduring pain, be they of mechanic impact like American football or endurance sports like the *Tour de France*. Some athletes even seem to enjoy pain.<sup>37</sup>

Chalmers finds propositional attitudes to be the most complex case of consciousness (pp. 19-22). Propositional attitudes reflect intentionality, they are *about* something. Such mental states are composed by an attitude (usually a verb like “desires”, “hopes”, “wants”, “fears”) towards a proposition (a sentence with a truth condition like “water is transparent”, “drinking wine is not healthy”). Propositional attitudes are relations to *that*-clauses where the attitude may change to the same proposition: Jens fears drinking wine is not healthy – Jens knows drinking wine is not healthy – Jens hopes drinking wine is not healthy. Propositional attitudes are regarded as psychological because they play roles in our behaviour, but Chalmers points out that they also have a phenomenal aspect (p. 20): it is something it is like *wanting* to tackle a person terribly hard, which has a different qualitative feel than *fearing* to tackle a person terribly hard. Chalmers also insists that “although no *particular* phenomenal quality is required to have a particular belief, a being must at least be *capable* of conscious experience to believe anything at all” (p. 20).<sup>38</sup> It seems that in Chalmers' analysis of how intertwined

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<sup>37</sup> Pain in athletes seems to be an excellent target for neuroscience, since dealing with pain is crucial to many sports. What phenomenal character athletes experience and what neural events they have must surely be interesting both to psychology and philosophy.

<sup>38</sup> This seems a little counter intuitive because if that is correct, a robot lacking phenomenal consciousness cannot have propositional attitudes. But if a robot has algorithmic/conditional rules and is goal-directed, we would think these will play the same causal role as propositional attitudes. Chalmers must mean then that a robot might have a goal-directedness related to a given rule (a proposition), but this is not an *attitude* since it lacks phenomenal character. If this is what Chalmers means, he seems to include a phenomenal aspect in attitudes like desire as necessary. A consequence is that a robot does not have an attitude if it only has goal-directedness (see Chalmers p. 21). This leaves it open if intentionality must also by necessity have a phenomenal character, and

phenomenal- and psychological consciousness are, there isn't much left in the department of the easy problem. Actually it seems that the only thing left in psychological consciousness is mental events that play causal roles, but have no phenomenal character (no qualia, no what it is like feeling), and never rises to our awareness.<sup>39</sup> But that seems not to be what Chalmers has in mind. According to him there are lots of things left for the *easy problem of consciousness* (pp. 24-31).

What makes up psychological consciousness is what is best suited for scientific studies and what Chalmers considers the easy problem of consciousness. Chalmers exemplifies with learning and memory. Learning and memory have functional properties; they play causal roles in our behaviour. So a question like "how could a physical system be the sort of thing that could *learn*, or that could *remember*?" does not pose a seriously difficult question (p. 24).<sup>40</sup> The other varieties of psychological consciousness Chalmers describes are:

- *Awakeness*: the opposite of being asleep. We surely have experiences while sleeping, like dreams, so awakeness is not the same as phenomenal consciousness. What Chalmers have in mind must be that we can (by EEG) tell if a person is sleeping (and in what sleep state) or awake scientifically, because awakeness surely has a qualitative character. It is something it is like being awake, distinct from what it is like being in a dream state. This is a good thing, since most of the time we know that dreams are not real. Chalmers claims that awakeness can be analyzed functionally, "in terms of an ability to process information about the world and deal with it in a rational fashion" (p. 26).

- *Introspection*: the process we use to become aware of the content in our mental states. We can analyze introspection functionally, according to Chalmers, "in terms of one's rational processes being sensitive to information about one's internal states in the right sort of way" (p. 26). As such it is at least partly functional, although lying on Freud's couch in a

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that goal-directedness is not intentionality. If so, a robot is not intentional either. This is an interesting discussion related to Rizzolatti & Sinigaglia's (2008) idea of intention/goal-directedness presented in article IV.

<sup>39</sup> Chalmers has described conscious experience as phenomenal consciousness, and we are *aware* conscious experience. It seems hard to say what we could be consciously aware of that has absolutely no phenomenal character, because he has also argued that even beliefs have phenomenal character (pp. 20-21). What is left might be what I have described as implicit memory (like priming) in article III. I have argued that these also have phenomenal character.

<sup>40</sup> It is this sort of reasoning that I find difficult to swallow. If memory is to be part of the easy problem it must mean that memories lack phenomenal character, but that seems completely contra-intuitive. What I have argued in article III is that (some) memories seem to play causal role *because* they have a phenomenal character.

psychoanalytic session while introspecting my most secret thoughts probably has a phenomenal aspect.

- *Reportability* is our ability to report the contents of mental states. Introspection is thus presupposed. It also presupposes language, which introspection does not. Reportability is central in all aspects of declarative or explicit memory as discussed in article III. If reportability is to be analyzed as psychological consciousness it seems we are talking about the content of the report (the proposition), not how it feels to report, or the feeling of how it was to be in the state reported.

- *Self-consciousness* is the awareness of our existence distinct from others, and our ability to reflect or think about ourselves. The former part seems apparent across many species, while the latter does not. Chalmers must have some sort of representational capability like Damasio's (1994, ch. 8) somatic marker in mind when he speculates on how self-consciousness is to be analyzed as psychological consciousness (p. 27). Proprioception might also be considered part of self-consciousness, and a fundamental part of sport skills. If proprioception is some kind of self-consciousness, then clearly sport would be an interesting research field for it. Anyway, Chalmers is not talking about what it feels like to be aware of one's own existence (perhaps as some sort of more or less constant hum), if there is such a thing, nor is he talking about the great feeling it is to have superb proprioception during a sport performance.

- *Attention* is a cognitive resource we use to focus on something specific. As I have discussed in article III, we might be conscious of many things without paying attention to it, but those things we pay attention to are most certainly conscious to us. Attention is interesting because there seems to be neural mechanisms which can be associated with it, but there is a complete lack of relating attention to phenomenal consciousness (also in Chalmers). There is certainly a qualitative difference between paying great attention to a thing (as to be completely lost in time and place, or being in a state of flow), and to pay as little attention as you need to the same thing. The neuroscientific work discussed in article II lacks this discussion. It might just be the case that top-level golfers have less neural activity because they are actually less attentive than novices. If an expert group and a novice group are to perform the same task it sounds rather obvious that the experts need to pay less attention to the task at hand, and hence have less neural activity. Concluding that the experts' neural activity is more focused and limited is thus wrong. A hypothetical approach would be to start by giving both groups tasks that demanded the same degree of attention (meaning identical neural activity) but of different difficulty and then see what happened. Do they experience the



same qualitative state of attention? Is it possible then, to be more attentive, but have less neural activity (which might be the goal in sport, since then you have a surplus of energy resources in the brain), or is it as simple as this: the more skilled an athlete is at something, the less attention (s)he has to pay to a given task? Attention seems to be the most interesting part of consciousness to (neuro)science of sport. But as I have discussed in article II, III and here, without including the phenomenal part of it, it is a question of what is being measured.

- *Voluntary control* is when an act is not only performed deliberately but when an action is caused by a prior thought. This is an interesting subject, discussed both in article III and IV. Chalmers idea of a prior thought seems to be some sort of declarative command like “now I am going to move my leg” occurring before the movement of the leg. Again sport seems to be an interesting field of research because athletes must be said to have fantastic voluntary control (what they do is not a coincidence) of their actions *without* prior declarative thoughts.

- *Knowledge*, which is what article I deals with. We usually say that we are conscious of what we know, and that what we know is what we are conscious of. Chalmers leaves knowledge for an even more rainy day it seems, simply notifying that knowledge is “as central to the everyday usage of” consciousness “as anything else” (p. 27). Before moving onto a more lengthy discussion on awareness, he also acknowledges that there are phenomenal states associated with all the varieties above. What that does to, and where it leaves the easy problem of consciousness is not very promising for science it seems.

- *Awareness*

After arguing that all the above varieties of consciousness have both a psychological and a phenomenal property (or vice versa, see p. 28), Chalmers goes on to argue that there is a psychological property of experience itself. In other words, there is a psychological property in phenomenal consciousness as such (p. 28). Initially, Chalmers presents awareness as that state where we have access to some information, and can use it to control behaviour.<sup>41</sup> We see here how much greater the distinction between *access-* and phenomenal consciousness is in Block’s usage (1995; see also Chalmers 1996, p. 29). Chalmers has already argued that phenomenal consciousness is mental events that are consciously experienced, and now he states that generally “wherever there is phenomenal consciousness, there seems to be awareness” (p. 28). Now if awareness is a necessary condition for phenomenal consciousness,

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<sup>41</sup> Does Chalmers mean that awareness is some stimuli monitor *and* voluntary control? The latter condition is puzzling; you can certainly be aware of something without wanting, needing and even restrain from acting upon it.

and awareness can be studied and reduced, then perhaps phenomenal consciousness isn't that hard a problem after all. If awareness is a sufficient condition for phenomenal consciousness as well, everything should be in order. Chalmers claims that awareness, like the above list, understood at a functional level poses few insurmountable problems. But there seems to be a distinction here between '*consciously* aware' and just 'aware' that Chalmers does not use, though I believe he should: when we are consciously aware of say a change of stimuli in a task, we can easily report what the content of our awareness is.<sup>42</sup> But there seems to be quite many things even language users are aware of and yet not capable of reporting. Tasks in cognitive psychology are full of examples: we are bombarded with stimuli so when asked, we have no clue of the cue we supposedly have been exposed to. When pressed to perform answers we do rather well – ergo; we must have been aware of those cues, but not consciously (in Chalmers sense: having access to the appropriate information) aware. The philosophical case of blindsight is an (obscure) example, but lots of tasks of attention and implicit memory work in just this fashion; for example studies of what is known as subliminal perception (see e.g. Schmidt 1990). Article III includes some perspectives on this issue but let me exemplify here.

Let's say you are given a task of attention. You're supposed to focus your (visual) attention on a red cross in the middle of a computer screen. When it changes to yellow you must push a button as fast as you can. The yellow stimulus lasts for only some milliseconds, so you must keep your attention on the cross at all times. Simultaneously there are pictures of different faces flashing over the screen. The task lasts for way too many minutes and you feel like there has been hundreds of faces flashed before you, and you really hate that red and yellow cross. You were consciously aware of those pictures appearing, but you have no idea of what the faces looked like since your eyes were fixed on the cross. When finished you are asked if you are consciously aware of any of the faces, say where they all women, men, Asians, Africans, blue-eyed, short hair etc. You have no idea. Then you are told to sit down and look at some pictures of faces and as quickly as possible you're supposed to hit a button if you have seen the picture before (some were in the attention task, some were not). After a while you realize that you have no idea and your answers feel like guessing. When you receive the result of your "guessing", the performance is *way* above random.

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<sup>42</sup> Chalmers says awareness is necessary for reportability, but not the other way around. But for Chalmers this seems to be a language deficit (p. 28). For Chalmers, all the above varieties of psychological consciousness seem to be subsumed by awareness (p. 29).

Such tasks show that you are aware of what you are attentive to, but awareness is wider than attention. Such tasks also show that awareness is wider than *conscious* awareness, which seems to be what Chalmers means when he is discussing awareness. The point I am arguing for in article III is that awareness, which is not conscious in Chalmers' sense, also has a causal impact. Chalmers might render this as psychological consciousness playing just a causal role, but my argument is that awareness which we cannot report is causal efficacious *because* it makes a difference to the phenomenal character of experience (the attention task would not have felt exactly the same had not those irritating faces flashed all over the screen). This does not mean that my usage of Chalmers' concepts of phenomenal and psychological consciousness misses the point, it means that even those varieties of consciousness Chalmers categorizes as psychological also have phenomenal aspects which cannot be overlooked or explained away.

Chalmers, like Block, claims that we *can* study consciousness scientifically, at least on a functional level.<sup>43</sup> Or rather; he claims we can at least study the psychological aspects of consciousness, or a conscious experience, even if we do not study consciousness as such and hence cannot construct an exhaustive reductive scientific theory of consciousness (ch. 3). What I have done here is problematizing if psychological- and phenomenal consciousness always coexist, and if so they are perhaps not separable at all. If they are separable, like Block claims, and Chalmers opens up a "perhaps" for (p. 31); we have an easy and a hard problem of consciousness. This is the attitude I have taken in the articles. If they are not separable and the distinction is a convenient construction; that leaves us with questioning if there are *any* easy problems of consciousness. Both attitudes leave us with a significant explanatory gap. It is just a question of how much of the gap can be bridged.

## **2. 6. Levine and the explanatory gap**

The notion of *the explanatory gap* is central to the whole thesis. In article I, the explanatory gap is used to spotlight the problems we easily encounter when consciousness is put into a reductive philosophical program. In article II, the explanatory gap confronts the neurotheory of Gerald Edelman. In article III, the explanatory gap is seen in efforts of describing consciousness as (a) memory system(s). In the wake of article IV, we might speculate if the discovery of mirror neurons is actually capable of bridging the gap. Although not always

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<sup>43</sup> Block's idea of explanation is by identity reduction (see Block & Stalnaker 1999).

declared, the explanatory gap is present and lurking wherever the thesis turns. A fitting start is therefore to describe more thoroughly than article I does what the explanatory gap is.

The expression “the explanatory gap” stems from Joseph Levine. He highlights three aspects of our mental life, which have all been parts of the mind-body problem (Levine 2001, pp. 3-4): rationality, intentionality and consciousness.<sup>44</sup> Levine argues that unlike lifeless objects, humans (let us forget about other animals for the moment) set goals, and deliberately behave to achieve them. When we behave thus, we are rational – at least we do not merely cope alongside the mindless and causal laws of nature. To behave rational in this way, we must be able to conceive of a plan and different actions to achieve this plan: closely linked to our rationality is our intentionality. Levine’s description of rationality and intentionality is similar to Rizzolatti & Sinigaglia’s (2008) as presented in article IV. What we will focus on in this thesis is the idea that our mental life involves conscious experience. There is something it is like for me to act rationally and have certain intentions. Rationality, intentionality and consciousness becomes a mind-body problem when we ask what physical (the body) features make these mental (the mind) features come about. I believe most of us have intuitions that these mental phenomena are both causes and effects of physical phenomena. This opens up the idea that mental phenomena must in fact be physical. If they were not, how else could they interact with a material body? In other words: even in an electro-chemical brain there are certain knobs and wheels to be switched and turned to make things happen. In the causal closure of the physical domain, only a physical event can have a physical cause.<sup>45</sup> When naturalizing the mind in this way, explanations of rationality, intentionality and consciousness are not exactly self-evident: we are left with a gap between explanations of the physical events on the one side, and our experiences on the other.<sup>46</sup> We might say that rationality and intentionality comprises what Chalmers (see 2. 5.) calls the easy problem, and that consciousness makes up the hard problem. Computational or formal processes might explain rationality, and

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<sup>44</sup> Levine might be interpreted thus: mind = rationality + intentionality + consciousness. Rationality and intentionality are features of what Chalmers calls “psychological consciousness”, consciousness is the same as “phenomenal consciousness”.

<sup>45</sup> The discussion on Kim (2. 7.) provides follow ups on this issue.

<sup>46</sup> Levine’s (1983, p 358) own description of the explanatory gap: “...(T)here is more to our concept of pain than its causal role, there is how it feels; and what is left unexplained by the discovery of C-fibre firing (the standard philosophical candidate for the neural basis of pain, despite its total empirical implausibility) is why pain should feel the way it does! For there seems to be nothing about C-fibre firing that makes it naturally “fit” the phenomenal properties of pain, any more than it would fit some other phenomenal properties. Unlike its functional role, the identification of the qualitative side of pain with C-fibre firing (or some property of C-fibre firing) leaves the connection between it and what we identify it with completely mysterious. One might say it makes the way pain feels into merely a brute fact.”

representationalism (see the section on Damasio, 2. 13, 2. 14.) gives us a sound account of intentionality. What is it about consciousness then that is so terribly hard?

Levine argues that the problem of consciousness consists mainly of two things: subjectivity and qualia (2001, pp. 6-7). The *subjectivity* of conscious experience becomes a problem when someone tries to describe how an experience is like *for me*. Experiencing has a certain point of view, and the problem of subjectivity arises when someone else tries to take *my* point of view. This is described in article I, but also in article III. In article I, the problem of taking a third person view of a first person experience is investigated. It is argued that a first person view is always a spatiotemporal relation which can only be occupied by the experiencing person. In article III it is argued that in this spatiotemporal relation the experiencer always carries a bag of earlier experiences (e.g. long-term memory) which influences what it is like to be in such a spatiotemporal relation, experiencing this or that. So even if you actually could occupy the same space and time as me, you would also need to have had exactly the same life story as I have had to know what it is like for me to be in that position at that particular time. And even if someone could do this, that someone could not make this knowledge objective for the scientific community. One could say, like Mary coming out of her room, “so that was what it was like, now *I* know” but that would be it. This problem of transforming first person experience (the subjective) to third person observations/descriptions (the objective) is appreciated by Edelman in article II as a limitation of science. The problem is also connected to article IV when Rizzolatti (2008, p. 138) argues that mechanisms of mirror neurons actually give us a grasp of the first person experience of the other. If we have the necessary motor knowledge (long-term procedural memory/similar experiences), more or less congruent neural activity arises in the performer and the observer. This is not to say that the observer experiences the same as the performer, it is to say that the observant understands something of what it is like for the performer.<sup>47</sup> We see here perhaps why mirror neuron activity is congruent, not identical: if we make use of Edelman and Changeux’s description of how synaptic connectivity is pruned (see article II), it *couldn’t* be identical. For that to be the case two persons must have been in the same spatiotemporal relation and experienced exactly the same things at all times.

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<sup>47</sup> Nagel argues that we do indeed understand and can communicate with each other due to common physiology or genetics. Might we speculate that he would have pointed to the mirror neuron system as our common ground today?

This leads us to the second problem, the problem of *qualia*. While the problem of subjectivity is often related to Thomas Nagel, the problem of qualia is related to Frank Jackson's knowledge argument. As we have seen, the problem of qualia refers to the qualitative character of an experience. Qualia is the *what* in "what it is like", subjectivity is the problem of what that what is like *for me*. Levine (2001, p. 7) argues that qualia becomes problematic for a naturalistic explanation because of the subjectivity problem.<sup>48</sup> The colour of a tomato being red is not specifically troubling before trying to understand and describe what that redness is like *for me*. We might say that representationalism (see Damasio 2. 14.) gives a sound explanation of qualia *qua* qualia, but falters when it comes to explain the subjective qualitative features of an experience. It is the same problem that encounters Changeux (see 2. 12. & article II): the neuronal states of experiencing the qualia of red might be similar enough across individuals to point to the brain and say "that's red". But that is not the same as being able to say "this guy is experiencing red just like *this*", which is what makes the hard problem of phenomenal consciousness really hard. The end result is that there is an explanatory gap between the phenomenal consciousness of a person experiencing and an objective scientific account of consciousness.

If you accept that there is nothing else in the universe than physical matter, there ought to be an explanation of how the mind (rationality, intentionality, phenomenal consciousness) is realized from something physical. It is not enough to reveal some causal mechanisms behind a conscious experience, in the brain say, because this will not make the conscious event more intelligible. We want to know more than "where" and "when", we want to know "why" and when it comes to phenomenal consciousness we want to know "why is it like that".

I try to show in article II that Edelman (and Changeux) argues that consciousness and qualia are there for us to discriminate between perceptions and inputs, and select appropriate responses. We are given an answer to *why* we have qualia. Without being able to experience qualia as such and such, we would not be able to adapt behaviour to the situations and environment. We would be more like a stimuli-response machine. We might say that Edelman argues that consciousness has evolved to override automatic responses and create a flexible creature that learns. This is an extremely important explanation, because it says that to describe the highest level of expertise as automation must be wrong. This is underpinning all the articles. But such an explanation does not answer the question of why it feels like that. We

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<sup>48</sup> The neuroscientist Christof Koch (see article III) also believes that it is subjectivity and not qualia that makes up the *really* hard problem (2004, p. 244, 310).

are given an explanation of the causal potency of qualia in general, but not if there is any causality to why the experience of seeing 10 000 spectators feels such and such. If I was to claim that seeing that many spectators watching you feels good because then you perform better you are not getting the point. I feel good when drinking a bottle of Barolo, but it does not feel the same way as seeing my daughter – although I want to do more of both. And seeing 10 000 spectators watching might feel good to Michael Jordan, but personally I would run to the locker room. We might then, get a perfectly sound explanation of why I ran to the lockers, but we lack an explanation of why feeling fear and then shame feels like *that* for *me*. This is reflected in Jackson’s knowledge argument: Mary learns something new when she experiences red for the first time, because the underlying physical processes she knows all about do not explain or instantiate what it is like to have such processes. There is an explanatory gap between qualia in an experience and the physical (neural or other) causing (if it does) the what is it like feeling of having such an experience.

Levine argues (like I have done in article I) that if we accept that Mary learns something, there exists an explanatory gap (2001, p. 77). Levine agrees with Papineau (see 2. 8.) that pure identities are not in need of further explanation. If there was a pure identity between a brain state and a phenomenal state we would just have to accept this fact and not ask for more. But Levine argues that the identity between brain states (or neuronal events) is at best “gappy”. Gappy identities are identities which requests explanation; qualia are such gappy identities. Levine agrees with Papineau that phenomenal concepts are thick (vague) while physical descriptions are thin. But unlike Papineau, Levine does not believe this makes the explanatory gap go away. That would at least take a very good account of why phenomenal concepts are so special, and we have no such thing as a good account (Levine, 2001, pp. 81-86). Levine’s explanatory gap survives identity claims because even if two descriptions (a physical and a phenomenal) indeed did refer to the same thing, the “causal or nomic relations seem ill-suited to explain the sort of cognitive relation we have to qualitative character” (Levine, 2001, p. 92). Even if we knew all the neural events necessary and sufficient for causing an experience like *that*, we would still not know what *that* would be like.

This thesis argues that there is an explanatory gap in (sport) sciences due to the existence of consciousness (article I). Then the thesis investigates to what degree neuroscience in general (article II), and the neuroscience of memory (article III) and mirror neurons (article IV) in particular can do to bridge the explanatory gap. This is first and foremost an epistemological encounter. It is questioning if science can know all there is, even

when it comes to the human mind. The thesis is not thought to be a metaphysical project because the outline is that there is nothing above or beyond physical matter. I will not discuss substance dualism. This leads us to the question whether such a position (non-reductive physicalism) is at all sustainable.<sup>49</sup> Jaegwon Kim argues that if you accept that there is nothing but physical matter, everything is in principle reducible. A metaphysical stance gives epistemological bearings.

## 2. 7. Kim: non-reductive is nonsense

Jaegwon Kim has argued that non-reductive physicalism is an unattainable position to hold.<sup>50</sup> In *The myth of Nonreductive Materialism* (1989), *Mind in a Physical World* (1998) and *Physicalism, or something near enough* (2005), Kim argues that if you accept physicalism, one must also accept reduction. That is, if you metaphysically believe or argue from a position that holds that there is nothing except physical matter in the universe, you must also believe that everything is in principle reducible to the physical. If we know everything metaphysical then, we must also (in principle) know everything epistemologically: you cannot hold an ontological physicalism and be an epistemological dualist. Kim argues that if you stick with an epistemological dualism, you are led to some sort of substance dualism or epiphenomenalism. Kim's work is important because if he is right, Levine's idea of the explanatory gap collapses and many of the ideas in this thesis about the irreducibility of skill and consciousness with it. What are Kim's arguments and is the artillery so heavy that a non-reductive physicalist should never see daylight again?<sup>51</sup>

To make it a rather short story, we can say there are four main types of causation affecting our lives. First, it is common to say that a physical event can make a physical change. Imagine an ice hockey player tripping you on the ice so you fall. That would be a change from a standing to a lying position without anything mental involved: a physical event causes a change from physical state P (standing) to another physical state P\* (lying). We have  $P \rightarrow P^*$ . Second, we believe that a physical event can change your mind. Imagine that you lay your hand on a red hot iron, a physical event (P). If you are not too stupid, you will have second thoughts, a

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<sup>49</sup> Non-reductive physicalism says that there is nothing but physical matter, but some human features (e.g. the mental, mind or here; phenomenal consciousness) are not reducible to the physical. Non-reductive physicalists come in a whole range of varieties: e.g. token-token identity (Davidson 2006), property dualism (Searle 1997), dual aspect (Nagel) and neo-mysticism (McGinn 2003). Levine's position is arguably similar to Davidson's.

<sup>50</sup> More specifically, Kim goes after Davidson's non-reductive identity theory, but Kim also claims that any non-reductive physicalism must accept some version of the supervenience idea Davidson holds (Kim 2005, ch. 2).

<sup>51</sup> I will not discuss substance dualism or epiphenomenalism in detail in this thesis.



mental state (M\*), about gripping red hot irons again. This incident would be an example of a physical event (P) causing a change from mental state M (it is okay to grip red hot irons) to mental state M\* (it is not okay to grip red hot irons); we have  $P \rightarrow M^*$ . This relationship is also the case when people claim physical activity can increase a person's mental health. Third, it is normal to think that a mental event, let's say a belief, can make a change in the physical world. If I believe that Barack Obama should be the president of the United States (M), I might actually walk to a room and do some physical movements (P\*) which ensure he's getting my vote. This is a case where a mental event (M) causes a change from P (standing still) to physical state P\* (walking and putting an envelope in a box); we have  $M \rightarrow P^*$ . It is also the story of a psychosomatic explanation: a psychological event causes a physical state. For example when the thought of your intolerable husband makes you so uptight that your shoulder muscles are constantly contracted and you end up with some tendonitis. Finally, a mental event (M) can change a mental state (M\*). If I believe that snow is white and some paint is green, I can, if I'm logical at all, understand that green paint will change the colour of snow. I don't even have to try it in the real world. This is a case of  $M \rightarrow M^*$ .

Kim argues there are three main ways to think about these four types of causation in philosophy:<sup>52</sup>

1) *Substance dualism*: the view that there are two substances in the world, a physical and a mental. The question is how one of them can make a change in the other. That is, how can something non-physical, non-material, something without spatial (maybe even temporal) location, push on something, move something, cause something, make something happen in the physical domain? That was the question Descartes could never answer, and neither have someone else. It seems totally contradictory. Also, one of the first principles of natural science is that physics is causally and explanatory self-sufficient. It is not necessary to go outside the physical domain to explain a physical event.<sup>53</sup> This means that mental events (M) could not cause physical states (P) if (M) are without physical properties. And vice versa. If you do believe that physical exercise can have positive effects on the mental health of a person, you have a serious problem as a substance dualist in explaining how. Psychosomatic illness might occur under such an ontology, but it would resemble telekinesis: a mental event (M) in me

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<sup>52</sup> I will not discuss idealism since physical events simply do not occur at all in that "ism".

<sup>53</sup> Also known as the causal closure principle: if a physical event has a cause at time t, then it has a physical cause at t: the physical world is a causally closed domain (Kim 2005, p, 15).

might alter the physical state (P) in you, but how that is the case seems completely unexplainable. The psychosomatic case of how my psychological state, if it is non-physical, can have an impact on my physical state would be unaccountable for in any scientific program based on substance dualism. Of course, that does not exclude that it simply cannot happen, but then all our beliefs and theories about how physics, chemistry, physiology and biology work must probably be abandoned. That might not be the first thing you want to consider abandoning if you are some kind of physician or sport scientist.

2) *Epiphenomenalism*: the view that mental and physical events are running in parallel, without causing changes in each other. This would be a view where I might hold certain mental beliefs, but they could not – in principle – make a difference in the physical world or in the body. In this picture, we can only have  $P \rightarrow P^*$  and  $M \rightarrow M^*$ , but not  $P \rightarrow M$  or  $M \rightarrow P$ . This view claims that both mental and physical events are real and well, but the consequence is rather absurd since I could not possibly make my arm move by thinking about it, it just happens. If you want physical exercise to make an impact on mental illness, it certainly isn't the view you should hold. It also means that there can be no such thing as psychosomatic phenomena, nor voluntarily control as described in 2. 5.

3) What we are left with is *physicalism*. Let's still keep to our simple statement that physicalism amounts to the view that there are no things, substances or phenomena except physical ones. This means that all mental events, processes or states in some way must be physical. It does not necessarily mean that mental or psychological events do not exist, but they are somehow physical events. If this is the case, we can have mental/physical causation. But what does it mean? It means something like this:

A mental event is supervenient on, plays a (functional) causal role, or is simply identical to a physical event.<sup>54</sup> So, if

$M \rightarrow P^*$ , then M must have a physical substrate (P), a neural correlate of, or just be physical matter:

$M \rightarrow P^*$

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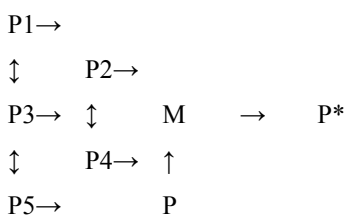
<sup>54</sup> For a discussion on supervenience, see Chalmers (1996, ch. 2) and Kim (2005, ch. 1-2). Kim loosely formulates supervenience as “the claim that what happens in our mental life is wholly dependent on, and determined by, what happens with our bodily processes” (2005, p. 14). Kim claims that the supervenience thesis amounts to a belief that “the psychological character of a creature may supervene on and yet remain distinct and autonomous from its physical nature” (2005, p. 15).

↑

P

But, if that is the case, then it is P that causes P\*! And since we do not need two causes (M and P) to get to P\* (which would be a case of what Kim calls overdetermination, 2005, pp. 46-52), we will only need  $P \rightarrow P^*$ . Actually there is no mental causation at all, because if M does not supervene, has a physical correlate, or is identical to P, we are back into substance dualism, where causation is one big problem. We can think about it like this: a mental event (M) must have/be a necessary physical event in the brain, say some neurons firing. If not, the mental event (M) will not occur. My feeling of fear (the mental event M) will not occur if some physical event (P), say the release of substance P in the amygdala, does not occur. Then the new physical state (P\*), running, will not occur either. The explanation we need for (P\*) cannot be found without (P), and (P) is all the explanation we need.

$M \rightarrow P^*$  is an example of a psychosomatic phenomenon: some psychological event (M) alters the physical state (P\*) of a person. But to do this, the psychological event must be physical; alas there is no such thing as psychosomatics. Why do we turn to such concepts then? The reason must be that we cannot find the physical cause for P\*, so we turn to a complex set of causes – social or psychological causes, causes that are difficult to pinpoint. This is perhaps the reason for the position known as *non-reductive physicalism*. What Kim argues is that if you accept a physicalist stance of what there is (in the world), the mental *must* be physical. So instead of being a simple case like  $P \rightarrow P^*$ , we have something more complex like this:



This is probably the case for all psychological or mental events: there are several things going on in our brain, in our history, in the external world and so on. The arrangement and numbers of the P's here is just an illustrative diagram, but as we shall see, it is how leading neuroscientists explain how the brain can make us cognitively conscious: neural events are going on at different places, in loops, reentry and in groups. Add the outside social world to this picture and no wonder physicians cannot find the sole reason behind your aches. But that is not to say that the reasons are not physical.

Let us use another example: how we believe physical exercise have an impact on mental health. In this story we have  $P \rightarrow M^*$ : physical event(s) changes the mental state of a person from  $M$  (depressed) to  $M^*$  (less depressed). Doing some running or playing basketball ( $P$ ) can make a depressed person feel better ( $M^*$ ). Like in the picture above, we probably do not have a simple  $P$  to get to  $M^*$ . There are  $P$ 's for bouncing the ball, moving your legs, your arms, increased heart rate, the release of inhibitory or excitatory neurotransmitters and so on. In the case of depression, medication is focused on selective serotonin reuptake inhibitors.<sup>55</sup> So, the regulation of serotonin is what the physical activity must alter. That is not to say that neurotransmission simply is depression, or is the cause of it (the cause is probably many things, and often outside your own body), but without a certain neurotransmitter regulation you will not get better – it is a necessary condition. As above, the mental disorder is not *non-physical*, it is just extremely complex and difficult to account for in medical terms, normally dealing with bodily phenomena alone. That, of course, also means that physical activity doesn't cause any mental change at all. What physical activity probably does cause is, for example in depressed persons, inhibition of serotonin reuptake.<sup>56</sup> And it seems to do so just as well as Prozac or Seroxat, which are also serotonin reuptake inhibitors. Kim's main argument is that what we *call* a mental state, by necessity is a physical state of some kind or type, and hence must at least in principle be reducible. If indeed we want mental causation and save consciousness from the realm of the immaterial, we must accept full reduction. Hence, a non-reductive physicalism is an unbearable position. Kim's arguments are indeed powerful. But there are escape routes. I will outline some of the most relevant to this thesis.

Kim's work should give any non-reductionist some waking hours. What remains puzzling is the position Kim ends up with. Kim's argument boils down to the idea that if we want mental causation, we must accept reductionism, even if we do not like it. We cannot have our cake and eat it too. Kim concludes that type-type identity leaves too many objections unsolved to close the explanatory gap (Kim, 2005, ch. 5). What we are left with is what Kim calls conditional physical reductionism (2005, pp. 150-161). This is a kind of functionalism that ensures causal efficacy for intentional and rational states, but leaves qualia non-reducible (2005, pp. 169-170). This is as strong a physicalism we can hope for according to Kim. Conditional physicalism is not completely global, but certainly more than local (which is Davidson's alternative).

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<sup>55</sup> See e.g. <http://www.nature.com/npp/journal/v30/n6/full/1300666a.html>

<sup>56</sup> See e.g. Salmon (2001).

What is striking with Kim's suggestion is that leaving qualia (or just a little bit of qualia, see e.g. 2005, p. 173) non-reducible, also leaves them epiphenomenal.<sup>57</sup> This fact is accepted by Kim himself (2005, p.174). But that should not seem acceptable at all. Why go through all the trouble arguing for years about the hopelessness of a non-reductive stance of physicalism when you actually end up with exactly that position?<sup>58</sup> Kim's conditional reductionism is a mirror view of Chalmers' easy and hard problem: intentional and rational states (psychological consciousness) are (more) easily reducible, qualia and subjectivity (phenomenal consciousness) are so bloody hard. Kim's problem stems from his unwillingness to accept type-identity theories. When Kim argues that functional reduction is the only option open to a healthy physicalism (2005, pp. 164-165), he has left himself in troubled waters. The reason is that Kim cannot find any functional properties of qualia. Perceptive states have causal tasks, but how/what they feel like for me do not, Kim argues (2005, pp. 169-170). This position is rather similar to Edelman's position in article II. It also resembles the way Penelope Rowlett describes sensory memory in article III. In article II, I use Kim on Edelman, arguing that such a position leaves a gap of epiphenomenalism to fall into. In article III, I argue that Rowlett describes what sensory memory does (psychological consciousness), not how it feels (phenomenal consciousness). Now I turn Kim on Kim. In his attack on non-reductive physicalism it seems that Kim has to make a difficult choice: become a non-reductive physicalist himself, or opt for type-type identity. If he chooses the former, he is in the same boat I have declared myself to be in. Let's take a look at an alternative.

## 2. 8. Pap's Gap

I have tried to show above that Kim's position is a questionable kind of physicalism. If keeping some aspects of phenomenal consciousness irreducible, it seems he on the one side opens his arms to property dualism (which is what he always has opposed) and on the other some kind of epiphenomenalism concerning phenomenal consciousness, which he denies emphatically. Epiphenomenalism concerning qualia seems to stem from a functionalistic fundament. It is a question then, if Kim should rather embrace an antecedent physicalism akin to John Perry's identity theory, which article I revolves around. I will not repeat my criticisms of Perry here. But it seems that if Kim wants to criticize non-reductive approaches *and* not end up with epiphenomenalism concerning qualia, then an identity theory might be a better

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<sup>57</sup> See also Koch (2004, p. 237).

<sup>58</sup> Kim compares his position to both Chalmers and Levine when it comes to phenomenal consciousness (2005, p. 162).

alternative than functionalism after all. Could a conceptual dualism (rather than property dualism) close to David Papineau's account of antecedent physicalism in *Thinking about Consciousness* (2002) be that alternative?

Antecedent physicalism conserves some important ideas of the mind that Kim argues for: mental states have both causal potency and phenomenal aspects. The latter idea is what leads Kim into his fling with epiphenomenalism. The former is his main argument against non-reductive physicalism. I believe it should also exclude Kim's move towards epiphenomenalism concerning phenomenal consciousness and rather push towards antecedent physicalism.

Antecedent physicalism is rather pragmatic. It holds that we should antecedently accept it if we do not have very good reasons not to (Perry 2001, pp. 27-28). To accept it then, it must be shown that problems relating to the explanatory gap are not such good reasons. To Papineau the explanatory gap is a question of reduction and explanation. He resembles Kim in this respect. When we try to reduce phenomenal experiences to physiological events we lose something and thereby we conclude that the reduction is false. Being an identity theorist, Papineau believes this is because we have trouble accepting scientific proof of identity between events in the brain and phenomenal consciousness. When we come to accept this identity, there is no more mystery to this identity than there is between water=h<sub>2</sub>O, or Tully=Cicero. Then the explanatory gap is gone. Like Perry, Papineau rests his case on how language works. The explanatory gap is seemingly there because language double instantiates; language creates an illusion of distinctness. This is because phenomenal and physical concepts refer differently. The physical concepts refer by causal roles, by what they do. C-fibre firing refers by the causal role of some neuronal activity. Phenomenal concepts, on the other hand, refer directly – like proper names. We think about painfulness when we think about pain, not what causes it. That is why we don't think about why a pain feels just like that. We accept it like we accept that Tully just is Cicero, we do not have to explain this identity. But when we think about c-fibre activation, we think of it as something that causes and/or accompanies pain – and this leads us to think there to be two things. In cases like this, we must simply accept that there is only one thing. It is not meaningful to question *brute* identities - like water is h<sub>2</sub>O. So in questions of consciousness we must accept, like we do in other scientific enterprises, that pain and c-fibre activity is the same thing. In some way Papineau's position is a modification of Kim's critique of non-reductive physicalism. They both argue that token-token identity theory is too weak to be a healthy kind of physicalism.

But they also accept that reductions concerning phenomenal consciousness are indeed difficult. Papineau gives Kim a lifebuoy: accept the problem of reduction, but claim that everything is *in principle* reducible because anything mental is identical to something physical (for every type of mental state M, there is a type of physical state P, such that M=P).

That the explanatory gap is closed if a strong identity theory of the mind is true cannot be questioned. It is the strength of such a position compared to functionalism. Papineau still believes that a science of qualia is impossible. This is because phenomenal concepts are vague (Papineau 2002, ch. 7). The phenomenal concepts are coarse-grained and so they may refer to different events in the brain, the reference is uncertain, but they always refer to events in the brain. Papineau's conclusions are puzzling: First, it might very well be that physical and phenomenal concepts refer differently. But this does not make it true that there is mind-brain identity. This is to beg the question. If one accepts identity theory, we might agree with Papineau that the intuition of distinctness creates an illusion of an explanatory gap. But brain-mind identity must first be established. Just because there is identity between molecular combinations and folk-concepts elsewhere ( $H_2O=water$ ), that does not grant us a conclusive reason to accept an identity theory of brain-mind. Second, how can the link between phenomenality and brain be vague if there is identity? If there is true identity, then this phenomenal feeling must be exactly this brain event. This cannot be a vague relation. That the concepts are vague does not make the *relation* itself vague, because there is, according to Papineau, only one thing - there really isn't any relation at all - there is identity. It is the thought of a relation he wants to get rid of, our double instantiating intuition. But if there is only one thing and we know the neural part of the story, it must be possible to have a science of qualia. If we cannot, like Papineau argues, then there is still an explanatory gap.<sup>59</sup> To hold an identity theory that denies such a science would be a Davidsonian position, which claims it is impossible to find laws between token instances of M and P (Davidson 2006). Such a position is what Kim has always rejected. Davidson's "anomalous monism" *wants* to maintain an explanatory gap, Papineau does not. Kim's position seems to be something in between - almost between a rock and a hard place. Papineau's statement that we must not wonder how "squishy gray matter... give rise to pains, and colour experience" (Papineau 2002, p. 160) seems in the end to be supported only by fear of collapsing into substance dualism. I am not sure if Kim's collapse into epiphenomenalism is any better.

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<sup>59</sup> That would be an epistemological dualism.

Let us recapitulate before moving on from theoretical philosophy to neuroscience. In this part I have established a so-called non-reductive physicalism on the shoulders of Nagel and Jackson. The non-reductive physicalism I have been proposing is one that holds that there is nothing but physical matter in the universe, but that some things are not reducible to microstructures of physical matter. Via the discussion on Chalmers I have identified such a thing to be phenomenal consciousness. If there is such a thing as phenomenal consciousness, and it is irreducible, that leaves us with an explanatory gap. The explanatory gap says that even if one could freeze the entire state of the brain and point to the sum saying "that's what it is like", we are still left clueless to what it was like to be in exactly that state. Throughout the articles I claim that there is phenomenal consciousness in sport, that phenomenal consciousness has impact both on performance and the experience of sport, and hence should not go unnoticed by sport scientists. I have also tried to question if a non-reductive physicalism is a legitimate position to hold. Jaegwon Kim argues it is not. The problem for Kim is that he seems more than reluctant to support any kind of identity theory (Kim, ch. 5). But admitting the shortcomings of functional reductions concerning phenomenal consciousness, perhaps he should. The narrow epiphenomenalism he winds up with seems more inconsistent and further away from the idea of a sound physicalism. Kim's version of physicalism seems near, but not near enough. I have argued that non-reductive physicalism has some shortcomings when it comes to mental causation. If the alternative is a type-type identity theory, the problem of consciousness looks just as troubling. Perry and Papineau's antecedent physicalism is underpinned by an identity theory which is not yet empirically established. I have tried to sketch out some ways of answering Kim which hopefully allows a platform for an ontological physicalism and an epistemological dualism. In the articles and in the following I will hint at a non-reductive physicalism which is a form of externalism: consciousness, skills and mental states are not only extended to the body, but also to the subject's experiences in the external physical world. Maybe "experientialism" covers the meaning better (see 5. 6.). Such a position is perhaps a step towards leaving the idea of supervenience as a token-token identity between mental states and brain states. If states of consciousness do not solely supervene on internal physical states, but instead are to be seen as a cluster of neural, bodily and external states then lawlike reductions like those Kim are looking for must probably be given up. The neurotheory of mirror neurons (article IV) might also point us in this direction, since according to this theory what makes us able to understand



motor intentions are the other person, our bodily position in the situation and our own motor knowledge acquired through years of practice.

Although not the topic here, Kim's interpretation on causality is perhaps not the most appropriate either. Following Woodward (2003), John Campbell (2007, 2008) argues that in biological psychology and psychiatry the interpretation of causality is one of interventionism. Within such a framework, a non-reductive physicalism *is* possible because we can have mental causation without psychological mechanisms or laws. Or put in the interventionist framework: there can be psychological control variables without physical control variables. According to Campbell, even within a physicalist framework there can be  $M \rightarrow M^*$  and  $M \rightarrow P$ , without  $M$  supervening on anything physical.<sup>60</sup> Neuroscience does interventions, but they can hardly call upon universal laws. If Campbell is right then, even the science that tries to reduce mental states to neural/physical states holds the position Kim urges the non-reductive physicalist to leave behind. Let us now move into the domain of empirical neuroscience to see what kind of philosophical theory of consciousness is supported and denied. As we shall see, it is not obvious that it is a type-type identity theory.

## NEUROSCIENCE

### **2. 9. Here and back again: from molecules to brains, from fMRI to reductive neurotheories**

I have used material, theories, empirical data and views from several neuroscientists in the articles comprised in this thesis. It is not arbitrary which writers I have used. First and foremost they must have contributed to the *philosophical* field of consciousness, not just about neurons and the brain. Secondly, they should be state-of-the-art. Thirdly, they should be rather new and contemporary. In the article *The inner game of sport: is everything in the brain?*, I have analyzed Gerald Edelman's views rather extensively so I will not repeat myself here. The same goes for Rizzolatti and his contribution on mirror neurons, which is more or

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<sup>60</sup> A short version of Campbell's argument goes something like this: suppose we have a frictionless billiard table with lots of balls on it. Given a certain cue shot, the balls roll for months. The table and the balls form a physical and a deterministic system: the force and direction of the initial cue shot determines the movements of each ball. If at a particular time all the balls are gathered together in the top-right corner and a person asks: why are all the balls here rather than there, it will not give an explanation to point to the initial cue shot. Campbell argues that there is no reason all the balls are in that place rather than in another since there is no control variable for the outcome. The outcome is accidental even though the system is entirely physical and deterministic. The same goes for humans as a complex system. When causation is understood as intervention, there is no control variable for beliefs, and hence no physical cause for a psychological state.

less the sole topic of article IV. In all articles I have also, more sporadically, used views from Jean Pierre Changeux, Antonio Damasio, Joseph LeDoux and Eric Kandel. In this section (2. 12. – 2. 16.) I will embroider their views, hopefully giving better, or at least more, perspective on neuroscientific theories of consciousness. As I have done in the articles, I will also complement with applying the philosophical discussions above to central issues.

These scientists and thinkers all share some common ground, namely evolutionary biology.<sup>61</sup> They all start with the assumption that the human brain has developed in a certain manner, and this is why they highlight the idea that all questions concerning consciousness can be given neurobiological answers. It is a healthy start then, to give a brief account of how neurobiology describes how our brain and ultimately consciousness evolved (2. 10.), and then look at how the empirical search for consciousness has led to our neuroscientific theories (2. 11.). The methods used and the line of thinking deployed by such sciences reveal something about the idea that questions of consciousness can be studied, explained and reduced in the same fashion as questions of life can be answered by studying, explaining and reduce DNA.

## **2. 10. Birth of the cool – and focused<sup>62</sup>**

Let us take a short journey then through the universe of chemicals and molecules leading up to neurons and brains.<sup>63</sup> In order not to get entangled into a discussion on how cells emerged on planet earth, I will start with *proto-cells*. A proto-cell has a *membrane* which defines what is internal and external to the proto-cell. One difference between the inside and outside of the membrane is a potential difference, a voltage. The difference changes due to exchanges in ions like potassium, chloride, calcium and sodium. This exchange (which is needed for stability and survival) demands energy, like sugar. If a proto-cell becomes too large for stability, it will split in two. It has *reproduced*. This reproduction starts with the four letters A, C, G and T, which constitutes the alphabet of DNA.<sup>64</sup> To be a daughter cell, the same pattern of proteins must be present. When a mechanism of such a faithful replication has evolved, natural selection comes to work. Those cells more efficient at capturing and using energy, and reproducing faithfully will survive and spread. Those less efficient will die and be consumed by others. To be more efficient, cells with different specialisms emerge to form organisms.

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<sup>61</sup> See e.g. Changeux (2004, ch. 5-6), Damasio (1999, ch. 2), Edelman and Tononi (2000b, p. 139), Kandel (pp. xii-xiii), Koch (2004, ch. 1) and LeDoux (pp. 33-36).

<sup>62</sup> This part is based on the excellent chapter “The Past Is the Key to the Present” by Steven Rose (2005).

<sup>63</sup> The journey is not supposed to be scientifically detailed or exact, just a coarse story of where neurotheories of consciousness come from.

<sup>64</sup> Adenosine, Cytosine, Guanine and Thymidine are the molecules comprising life (defined as DNA).

With multicellularity, behaviour becomes a property of the organism and the individual cells are subordinated. To ensure that the organism has a life conserving interior, one needs a mechanism ensuring stability. And if the interior is not stable, one needs different actions to be prescribed. When behaviour turns complex the demand for specialized cells increases. We get sense receptors, muscle cells and finally nerve cells which must be co-ordinated. This can be done by electrical or chemical signals.<sup>65</sup> The information from the external environment is communicated to the nerve cell by its dendrites (the input). This leads to inhibition or excitation of an action potential (the output) in an axon. The junction where nerve cells meet is the synapse, where the different famous neurotransmitters are released between the transmitting and the receiving nerve cells. When concentration of such nerve cells starts locating at a certain place, we are also at the start of a brain (or the neural tube), not just a nervous system. Specialisation continues in the brain: the neural tube divides into the fore- (cerebrum), mid- and hindbrain (cerebellum) with a division in labour. With evolution leading up to the increasing role of the forebrain's thalamic regions for control and co-ordination, many "old" connections and pathways still exist. This is why studying brains of less complex animals can teach us something about humans.<sup>66</sup>

The mammalian brain's advantage over a simple nervous system is better co-ordination of stimuli and responses. What is even more advantageous is the ability to adapt. This is secured by the mechanism of synaptic plasticity, which we will investigate later (2. 15. & 2. 16.), and especially in article III. The most notable change in the mammalian brain though is the expansion of the layered neo-cortex. This expansion combined with synaptic plasticity enables the brain to have different action responses to the same input stimuli – we get top-down processes. When a brain has developed to such a degree that different responses can be (at least apparently) chosen, we have seen the dawn of a creature with some cognitive skills that can adapt its behaviour to situations without habitation. Such skills, and ultimately consciousness is seen as a tool for survival.<sup>67</sup> Neurobiology teaches philosophy something interesting: the human brain is the ultimate survival tool. The brain has evolved to understand and respond to external stimuli via and with the body. Without a particular body situated in a particular environment, the human brain would perhaps never have existed. The moving body then, is the evolutionary fundament for the human brain and consciousness, not language. This leads us to the idea that if mechanisms for survival like muscle responses to electrical

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<sup>65</sup> One can see the pattern clearly: communication between neurons is the continuation of the difference in membrane potential in the proto-cell.

<sup>66</sup> See e.g. Changeux (2004, p. 108) and Koch (2004, p. 14).

<sup>67</sup> See e.g. Koch (2004, p. 17).

stimulation can be studied by science, why should consciousness be any different? In Changeux's words (2004, p. 73): "Most neuroscientists regard consciousness as a property or function of the brain, comparable to breathing or digestion, that in principle should be explicable in terms of the activity of neurons and synapses and their regulation by chemical signals."

## **2. 11. A very brief history of nearly everything about neuroscience and the empirical search for consciousness<sup>68</sup>**

As far as I see it, there are some clear stages in the quest for consciousness (as Koch calls it): the theory of evolution, techniques and methods to study the brain and behaviour and cognition, and a theory binding the first two to consciousness in a philosophical sense. This thesis is fundamentally about the latter element, but since I have given a (very) brief sketch of the evolutionary framework, I consider it reasonable to do the same with the second element. The second element is surely connected to how psychology met (neuro)physiology and (neuro)biology to make neuroscience go cognitive. The history and development of psychology and neuroscience is way beyond the scope of this thesis, but a brief overview comes in handy. The idea of a theory of consciousness rising from *neuroscience* (and not philosophy) is connected to parallel movements in experimental psychology, anatomical and functional cartography of the brain and developments in neurophysiology from the middle of the 19<sup>th</sup> century. When we reach the turn of the millennium, the technologies to combine methods and interests of cognitive psychology with neuroscientific measurements finally exist. The empirical search for and naturalizing of consciousness is ready to be fulfilled.

When Luigi Galvani (1737-1798) detected electricity in frog legs and was able to move the legs with static electricity we might say that the link between experimental science and animal behaviour was established. Galvani's discoveries showed that nerves conduct electrical signals to and from the brain and that the brain itself can generate electricity. Franz Joseph Gall (1758-1828) started the cartography of the brain, declaring that the brain was organized into parts with different functions, even for so-called mental- or personality traits like generosity. The empirical search for consciousness was clearly on the move. Paul Broca (1824-1880) and Carl Wernicke (1848-1905) provided lesion studies to Gall's idea on the relation between specific parts of the brain and specific functions. Their discovery of the

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<sup>68</sup> This part is based on Bear, Paradiso & Connors (2007, ch. 1), Frith & Rees (2007) and Gazzaniga, Ivry & Mangun (2002, ch. 1).

cerebrum's importance for the production and understanding of language was a giant leap towards clinical *neuropsychology*. When Korbinian Brodmann (1868-1918) later established the basis for comparative cytoarchitectonics of the mammalian cortex by describing 52 distinct areas in the brain, the now independent discipline of psychology could dust the belief that mental phenomena were not appropriate for experimental study off its shoulders. The early so-called psychophysicists were concerned with finding measures for determining how objective, physical properties could give rise to subjective, psychological properties – what we call mental states. People like Gustav Fechner (1801-1887) studied the minimum intensity required for an observer to become aware of stimuli. In other words, they were studying thresholds for conscious experience. The psychophysicists wanted to find laws to determine the physical basis for consciousness. Combining this strategy with measurements of reaction time and introspection (reporting a perception), early structuralists like Wilhelm Wundt (1832-1920) analyzed conscious experience by its constituent sensations, images and feelings. At the same time, German physiologist Hermann von Helmholtz (1821-1894) studied the neural basis of perception and measured the speed of travel of nerve impulses. Helmholtz proposed that there were different kinds of nerves for different types of perception, but also different processes within modalities. Helmholtz understood that our experience of perception is immediate, but that processes in the brain occurred before conscious (and reportable) perception; hence there were unconscious processes in conscious experience. At the turn of the century, Santiago Ramón y Cajal (1852-1934) established the neuron as the basic functional unit of the brain (the neuron doctrine) and identified the neuron's transmission of electrical information in a single direction. The neuron doctrine is still fundamental to understanding neurophysiology. Together with Camillo Golgi, he was awarded the Nobel Prize in 1906. If Cajal is not the godfather of neuroscience, he is certainly its *consigliere*.

The interest in consciousness came to a brute stop with the behavioral turn, but in the 1950s and 60s behaviourism was triumphed by cognitive psychology. A key development was viewing information processing theory as a mathematical account of cognition. If the brain could be viewed as a communication device which process and transmits information, then it is suitable for experiments and measures. In such a theory the neuron is not just the basic unit of the nervous system, but the basic information processing unit. This view is seen in Gazzaniga, Ivry & Mangun (2002). Cognitive psychology's research on selective attention (Broadbent, 1958), short-term memory (Atkinson and Shiffrin, 1968) and mental imagery (Richardson, 1969) was certainly empirical psychology on what we have earlier coined

psychological consciousness. We might say that the approach by the early cognitivists was what Owen Flanagan (1992, pp. 4-5) calls a piecemeal approach: we can deal with big questions of consciousness by working our way up from the bottom on smaller problems. This approach is evident today in the works of Kandel, Koch and LeDoux. Before we go on to see where these historical preliminaries have led us, let me quickly describe some of the most common devices for measuring brain/neural activity in cognition.<sup>69</sup>

- *EEG* (electroencephalography) records overall brain activity in different behavioural states (like sleep vs. wakefulness) by measuring large populations of active neurons associated with those states. EEG measures *global* activity by placing electrodes on the scalp, so the recordings are of limited use to cognitive psychologists and sport scientists. Relating EEG signals to particular tasks is done by extracting an evoked response. The evoked response creates an event-related potential (ERP) and is a slight variation of in the EEG signals. With this method one can for example measure the time from a stimulus is presented, to the event-related potential.

- *fMRI* (functional magnetic resonance imaging) uses the magnetic properties of hemoglobin to measure the ratio of oxygenated to deoxygenated hemoglobin. This ratio is called the blood oxygenation dependent effect, or simply BOLD. When performing a task, fMRI measures increased activity in brain areas. This is done by first finding activity in the regions of interest during a resting task (imagining sitting on a beach), and then subtract this activity from the cognitive task (doing arithmetic). The temporal and spatial resolution of fMRI is increasing rapidly, and has surpassed the similar technique of PET (positron emission tomography) by far. The problem with fMRI as a recording device for sport science is the necessity of keeping the head still.

- *Single-cell recordings* record activity of single neurons when animals perform cognitive/motor tasks. A thin electrode is inserted into the brain and electrical changes can be measured. This technique is used to establish if experimental manipulations produce a consistent change in the response rate of the neuron. The method can determine if neurons in a brain area are involved in coding a visual stimulus' colour, shape, movement etc. When doing motor and cognitive tasks, neurons do not work in isolation. Edelman's idea of a neural "dynamic core" (Edelman & Tononi 2000b) presents the problem of recording neural activity in groups. In the only single-cell recording of mirror neurons in humans, almost 1100 neurons

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<sup>69</sup> For a more thorough treatment of the methods of cognitive neuroscience, see e.g. Gazzaniga, Ivry & Mangun (2002, ch. 4).

were measured (Mukamel, Ekstrom, Kaplan, Iacoboni & Fried 2010). Single-cell recordings are usually performed on animals sitting still, but technological advances allow some recordings on moving animals.

- *TMS* (transcranial magnetic stimulation) offers a “simulated” lesion to a brain area of interest. By generating a powerful magnetic field, neural functioning is disrupted and the “lesion” sheds light on normal functioning. TMS was developed for clinical purposes, initially thought to stimulate damaged tissue. It is now possible to detect neural pathways for movement and cognition, and perhaps in the future see if these pathways are different in experts and novices. For the moment, TMS is of rather limited use, but it does (or could) provide causal claims like those Hickok (2009) feels are missing in the mirror neuron theory (see article IV). Philosopher Dan Lloyd (2004) speculates on how a futuristic TMS device can be of use to consciousness studies.

Armed with these techniques, and probably many more and far better just around the corner, neuroscience can go cognitive. We see that cognitive neuroscience emerges from different levels of analysis; be they molecular, cellular or behavioral. I believe it’s fair to say that neuroscience of *consciousness* is a special field within cognitive neuroscience. It is a truly interdisciplinary field, combining experimental, cognitive and biological psychology with (molecular) neurobiology, -anatomy and -physiology. Sometimes a little dash of philosophy is thrown into the stew as well. I do not think it is unreasonable to claim that the glue holding everything in order is evolutionary biology. In the neurobiological story, the evolutionary history of mammals and brains leads to the micro cosmos of evolution in the human individual. I have written about Edelman’s “Neural Darwinism” and theory of consciousness in article II, so I will instead supplement with reviewing other central neurotheories of consciousness, starting with Changeux.

## **2. 12. Changeux**

The Frenchman Jean-Pierre Changeux is perhaps the most famous neurobiologist in Europe. Changeux has collaborated with Edelman (Edelman & Changeux 2001) and shares several of his views. Changeux’s *Neuronal Man – The Biology of Mind* (1997), has become a classic. It is a tremendous work which covers the history of neuroscience, how the brain works, the theory of evolution – and, above all, the claim that *homo sapiens* is first and foremost a neuronal creature. As we shall see later, such a statement is made even clearer, or narrower, by

LeDoux (2. 15.). That is, what we take to be specifically human activities – mental images, language, thoughts, emotions – are basically neuronal activities: “Consciousness, then, corresponds to a regulation of the overall activity of cortical neurons and, more generally, of the entire brain” (1997, p. 151). Consciousness is, according to Changeux, a regulatory system, and to examine consciousness is to examine “its different states and identify the mechanisms that guide the change from one state to another” (1997, p. 145). For Changeux, consciousness is approximately “attention”, attention dealing with mental objects and computations using these objects. Baddeley’s (2009) account of working memory as described in article III is close to Changeux’s description of consciousness. We see here the tendency to move directly from one aspect of psychological consciousness (attention) to a *complete* theory of consciousness. From lesion studies, scientists have shown how attention is closely related to neurotransmitter regulation in the brainstem, especially dopamine. Dopamine is a *necessary* condition for attention (consciousness, according to Changeux).<sup>70</sup> Together with sensory neurons, interneurons and motor neurons - a confrontation is possible between the outside world and one’s inner world. Changeux describes the regulatory system as an evaluative mechanism for the surveillance of linking mental objects. The brain and the central nervous system then, are also *sufficient* conditions: “From the interplay of these linked regulatory systems, consciousness is born” (1997, p. 158). These linked regulatory systems are neuronal groups in the reticular formation, “piloting” information to cortical areas and receiving information about what is being performed through reentries in loops. To explain consciousness is to explain these regulatory systems, which is done by explaining how neurons and mechanisms between neurons work. This view is very close to Edelman and Tononi’s (2000b), although McGovern & Baars (2007, p. 190-200) describe Edelman as more of a dynamic neuro-*connectionist* and Changeux closer to what Thompson (2007, p. 10-13) calls embodied dynamicism.<sup>71</sup> Changeux’s view opens for an eliminative materialism: “it is sufficient to say that consciousness *is* the functioning of this regulatory system. Man no longer has a need for the “Spirit”; it is enough for him to be Neuronal Man” (1997 p. 169). So be it; consciousness can be reduced to functional activity in the brain. And this activity is a neuronal activity. I hope the relation to both identity theory and functionalism is pretty obvious.

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<sup>70</sup> Christof Koch claims (2004, p. 87) that his (and Crick’s) theory of consciousness is rather close to Changeux’s (2004, p. 311), since they both are looking for the smallest necessary component for NCC. If you go for a broader distributed brain activity theory, like Edelman, it will be difficult to pin down qualia across individuals.  
<sup>71</sup> Changeux calls his view “the neuronal workspace hypothesis” (c.f. Baars’ Global Workspace Theory, Baars 1997), which he argues is distinct from the too simple 40 Hz hypothesis of Crick and Koch, and not as abstract as Edelman and Tononi’s (Changeux 2004, p. 88).



In *The Physiology of Truth* (2004), Changeux makes even more daring claims concerning consciousness. In this later work he puts more emphasis on subjectivity and qualia, the so-called hard problem of consciousness (2004, pp. xii-xiii). Changeux believes that the key to understanding subjective experience is to understand the organization of the brain (2004, p. 9). Unlike Papineau (see 2. 8.), Changeux claims that qualia are not necessarily inaccessible to scientific investigation. Even though experiencing qualia is different to different persons, it is “reasonable to expect that these shared qualia may be correlated with physical brain states” (2004, p. 74). This is because Changeux believes that a person’s experience of, let’s say, red, is constant and this implies constant neuronal states. If so, that would perhaps supply empirical evidence for an identity theory like Papineau and Perry’s. If such constant neural states can be found, then the subject’s oral information can be correlated with the subject’s brain states. I am not sure how far such an approach takes us on resolving the problem of subjectivity. It seems that Changeux believes that questions of subjective experience can be answered if the underlying neural states in qualia experiences can be identified. When this is done, there isn’t more to be said about subjective experience: neural correlate P *is* the subjective dimension of consciousness M.<sup>72</sup> This certainly sounds like a strong form of identity theory, and is in stark contrast to Changeux’s own views about not falling into “simplistic reductionism” (2004, p. 88). It is also a somewhat strange position to hold when we compare the idea of type identity between brain states and (oral reports of) qualia, with the individual differences the epigenesis- and plasticity theory Changeux advances (2004, pp. 185-187). The problem of the subjective character of consciousness gets turned upside down: it is suddenly a question of finding a corresponding or correlating neural event in a person, not why a certain experience is experienced *like that*. The subjective dimension is replaced by a quest of which parts of the brain contribute to our apprehension of a self (an “I”), and how these are bound together to a unity (Changeux 2004, pp. 75, 86-87). We would like to know all this of course, but it is not the same as answering the hard question of phenomenal consciousness.<sup>73</sup>

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<sup>72</sup> Changeux (like Edelman, see article II) is not entirely consistent on these matters: on the one hand he seems to say that the organization of many neural states give rise to, or play certain causal roles to a certain conscious state (a kind of functionalism), but on the other he also seems to (like Koch 2004, p. 87) be most interested in finding the smallest or final component in such a state. When the latter is found, we have also found the conscious state (a kind of identity theory), leaving interest in all the other neural states and the organization of them behind.

<sup>73</sup> On this point, Changeux resembles Baars’ description of consciousness as a theatre (1997, prologue).

When Changeux starts to talk about the qualitative subjective state of an experience (pp. 73-74), he moves to the what's it like feeling of looking into oneself (what Chalmers have called the phenomenal property of introspection, see 2. 5.). *This* state then ends up solely with necessary conditions for memory. According to Changeux, an essential aspect of consciousness is to "explicitly refer to personal subjective experience" (Changeux 2004, p. 101), and if this ability to report is impaired it makes a science of subjective conscious states difficult. In the article *Knowledge and Skills: nothing but memory*, I have tried to show that memory is *not* a necessary condition for consciousness, and certainly not sufficient (that is what anti-AI arguments have thought us). Koch argues that sensory memory is perhaps necessary for conscious visual experience, but that is not exhaustive of consciousness as a whole. Changeux's description of memory is not sensory memory, but a necessary faculty to report on mental content. Some kind of memory is probably necessary for this, like many other faculties of the brain. But memory and phenomenal consciousness is not identical as I have tried to show in *Knowledge and Skills*, and certainly not to Changeux's description of memory. When Changeux starts on the hard problem of consciousness he ends up with analyzing neural events for retrieving memories *of*, or access *to* phenomenal consciousness. This is what we have called psychological consciousness; Changeux calls it secondary consciousness (2004, pp. 76-85) – similar to the higher order theory I will ascribe to Damasio (2. 14.). Phenomenal consciousness is anyhow left out of the scientific picture once again.

An interesting point to philosophers of mind is Changeux's denial of the multiple realization argument of functionalism: he argues that the human brain (and ultimately consciousness) could not be made up of anything else than biological matter like cells and neurons. *Only* this kind of matter can accomplish mentality, intentionality and will. Changeux's claim is of course an identity claim. It is a mirror view of philosophers Perry (2001, ch. 4) and Papineau (2002, ch. 3) who claim that with different matter, mental events either could not occur, or be different. Changeux does in fact stress the *organizational* importance of how the brain is built (which could be interpreted as a functionalistic statement); but only a certain kind of organization will do, so even the organizational component is an identity claim.<sup>74</sup> Although reluctant to embrace "silly reduction", Changeux's thoughts are closest to what we would call a type identity theory. This is also reflected in his stance on subjectivity: it can be reduced to events in the brain. And finally, it is a reduction to a neuronal and molecular level. At the end of the day, it is in the neurons that

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<sup>74</sup> Changeux opens for individual variation though. Individual variation is due to environmental adaption – what Edelman calls Neural Darwinism.

the answer to consciousness lies. The organization of the brain is anyway coded for in the DNA, which again is already accounted for reductively. Changeux's theory is at bottom a fully fledged identity theory. The problem then, is that Changeux's own neuroscience is in empirical controversy with the claims he makes. If each individual's brain differs due to environmental inputs (as Changeux also admits) then the same type of mental event M (let us for the sake of the argument allow M's across individuals to be identical) should be instantiated from different types of physical/neural events.<sup>75</sup> But if so, we have token-identity, which is a non-reductive physicalism. Changeux wants full reduction, so it is not a position he wants to hold. In a philosophical effort Changeux calls to John Searle's neurobiological theory of consciousness (2004, p. 210, ch. 3). That is a dubious move because Searle holds an emergence theory of consciousness which is a property dualism claiming consciousness to be irreducible even if it emerges from neurobiological events and matter. That consciousness somehow (mysteriously) emerges from the underlying neural substrates does not seem like the position Changeux should adopt, because it is the emergence itself that is non-reducible. But the emergence is exactly what Changeux wants to explain – and he does it by identity analogies: this and that mental event simply is this and that neural event.

Interesting to philosophy of sport, Changeux follows Edelman in rejecting the cognitivist computer analogy of mind. I have underpinned this rejection in article IV. There I have related it to a discussion in the philosophy of sport brought forward by Vegard F. Moe (2005). Unfortunately, the empirical rejection of information processing theories does not close the explanatory gap. While Edelman acknowledges the gap, he denies that the subjective dimension of consciousness is a (neuro)scientific matter.<sup>76</sup> Science deals with the objective and measurable, not the personal and subjective. If Edelman accepts all this, he should also accept that the subjective is such a fundamental dimension of consciousness, perhaps the dimension philosophy has been most occupied with since Nagel. Changeux on the other hand claims that neuroscience can deal with the problem of subjectivity. He claims we already have the technology and tools; it is just a matter of time before tuning them to the mission.<sup>77</sup>

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<sup>75</sup> It seems that the possibility of identical physical/neural events across individuals is precluded, even for identical twins. In the light of neurobiology we might question if such a case is even conceivable, because it would take identical twins to have occupied the same tempo-spatial relation – we would then have only one individual. Again, the distinction between acquisition and possession is undermined.

<sup>76</sup> Edelman seems to deny that any description, however perfect, could give rise to an experience. The subjectiveness of conscious experience blocks such an enterprise (Edelman & Tononi 2000b, pp. 139–40). If Edelman is right about the asymmetry between description and experience, he has also denied a solution to the knowledge argument by claiming that *complete* knowledge actually could give rise to an experience.

<sup>77</sup> See Changeux (2004, pp. 2, 73, 76, 105, 108).

When Changeux declares we must abandon “spirit” and embrace “neuronal man” by establishing type-type identity, he has in the same breath also embraced “silly reductionism” and abandoned his humanistic and holistic thoughts. Unfortunately, he has also washed away the hope of explaining the subjective character of experience, and like Edelman instead provided us with an impeccable answer to why we have consciousness in evolutionary terms: consciousness gives better possibilities of responses to stimuli (2004. pp. 36-38). Philosophically that is not a great leap forward to phenomenal consciousness. A good start to such a leap should be looking for feelings.

## **2. 13. Looking to Damasio**

Arguably, Antonio Damasio is the most influential neuroscientist on the planet. In *Descartes' Error* (1994), Damasio's project is to undermine our faith in rational decision-making without feelings. In *The Feeling of What Happens* (1999), Damasio makes an even stronger connection between feelings, emotions and consciousness. His latest and most elaborate work, *Looking for Spinoza* (2003), deals with the question of what feelings and consciousness really are. It might thus seem that Damasio is first and foremost concerned with feelings *per se*, but that is only half the story. His main concern is definitely body-mind relations. Damasio's approach to a theory of consciousness is that to understand consciousness, we must understand feelings. Or, putting it more crudely, consciousness is constituted by the neurophysiology of feelings. Is Damasio then, the neuroscientist who delivers when we come to talk about subjective experience and the what's it like character of consciousness?

As described in 2. 10., Damasio starts with the idea that throughout evolution, all creatures with a central nervous system have some kind of homeostasis – the regulative and life preserving mechanisms. To secure an effective homeostasis, a continuously updated picture of the creature's status is needed. Most of such a status update is done automatically and unconsciously (as in non-declarative). In evolutionary terms, it is done in the older, lower-laying regions of the brain: the thalamus, hypothalamus and epithalamus, not reaching the neo-cortex associated with language and declarative thought. This evaluation of body status with some response, Damasio labels (widely) *emotions*. *Feelings*, on the other hand, are the knowledge of these emotions (2003, p. 92). The life preserving benefit is that feelings can overrun otherwise automatic responses. That is, we get a more flexible and adaptable creature with choice. Human beings, of course, are the most distinguished candidate for this

description. The evolution of more cognitive feelings is due to the evolution of (neural events in the) neo-cortex. Damasio's account is in opposition with Milton's (2007) on this point, as I have stated in the article *The Inner Game of Sport*. Damasio claims that the brain forms a map (or maps rather) of what goes on in the body; this is the internal relation of brain-body. He calls this the somatic marker hypothesis (1994, ch. 8). An emotion is understood as a significant difference in such a map, so that some sort of response is necessary to preserve life in a fitting way. A feeling is the knowledge (meaning not *nonconscious*, but not necessarily involving language – some kind of awareness seems sufficient) of such a change, and the choice of how to deal with it. Consciousness then, is the feeling of what happens – it is the conscious experience of a change in (a) body state(s) that arises to neo-cortex (although the specific location in the brain is not important).

Damasio does not claim that this feeling of what happens goes on in a theatre of mind, like Changeux. When Baars talks about a global workspace it simply means that brain activity is distributed widely across the brain, and as such cannot be pinpointed exactly. To Damasio, the emotions are changes of states in the entire body which are being communicated back and forth to different areas of the brain. Damasio emphasizes the relationship between brain *and* body significantly more than Changeux and Baars. Without body, there would be no emotions. But when we talk about feelings, the conscious knowledge, we talk about states in neo-cortex. The point is that some complexity of the brain is necessary to produce the feeling of an emotion. This, in humans, happens in the neo-cortex, modern neuro imaging tells us (see 2003, pp. 109-111).

Damasio's neurobiological theory of consciousness add up to this: the brain continuously maps the body's states as they change depending on internal and external causes. Changes in these maps start responses and actions. If a creature has a feeling of these changes and can act accordingly, it has consciousness. On this level, Damasio's theory is similar to Nagel's description of what is necessary and sufficient for determining if a creature has consciousness although Nagel does not share Damasio's interest in responses and actions. According to Damasio, acting accordingly necessitates an autobiographical memory and self. Consciousness' sufficient conditions are the ability to feel body changes, self-awareness (some 'it/I' must feel) and memory (2003, pp. 126, 177-178, 184, 215, 270). Memory, maps (somatic markers) and awareness of them are describable in neuronal language. On *this* level, consciousness is only a complex and effective life preserving mechanism for novel and changing environment (2003, pp. 207-208). On this account, memory and self-awareness have

an evolutionary benefit: they are necessary components of a flexible and adaptive response-regulative system. Damasio's theory of feelings – the conscious knowledge of changes – ends up with being a mechanism which contributes to homeostasis. A rather long step from the subjective experience of feeling what an experience is like. What we have got is an account of *one* such experience: the feeling of hunger ends up with securing more than an automatic response to eating. I can choose what to eat, according to my preferences. Such mechanisms are analyzable by neurophysiology. And as such, consciousness is also analyzable by neurophysiology.

Damasio's contribution is that to understand choices and rationality, we must understand what feelings are and their role in our conscious life. We must appreciate this entanglement of feelings and rationality. It is certainly a step away from a mechanistic understanding of a "pure" rationality. But our intuitions are that consciousness – understood as the feeling of what it is like to be me – is a whole lot more than choices of responses to life-regulation. To a certain degree evolutionary biologists would probably describe all feelings as life-preserving and reproductive. Maybe they are even right after all, even concerning feelings of love, happiness, sorrow and greed. But when we want an account of phenomenal consciousness, we are not looking for what these feelings *do*, we are looking for how they *feel*. Damasio provides a theory of why we have knowledge of feelings, but it is a theory of getting conscious access to feelings. It is a theory of psychological consciousness, not phenomenal consciousness.

Except for the neurobiological part, what kind of philosophical theory is Damasio's? In *Looking for Spinoza*, Damasio himself compares his theory to Spinoza's. This thesis has no intention of going into details about Spinoza's philosophy. But I am afraid that Damasio is attracted to Spinoza's elegance of writing and aesthetic aspects more than his philosophy of mind. When Damasio describes his and Spinoza's theories both as dual aspect theories, I am not sure how far we should stretch the comparison. Spinoza's dual aspect theory claims that the mental and the physical are distinct modes of a single substance - God. I am not certain Spinoza's direction is one Damasio wants to move towards. When Damasio writes about the dual aspects of his and Spinoza's theories, the similarities are more due to the use of concepts, rather than content.

Damasio notes that the language of feelings is entirely different from the language of neurophysiology: they are two aspects of the same state. This resembles the conceptual dualism of Papineau (and Perry) which is one of the subjects in the article *A Phenomenal*

*Case for Sport.* If Damasio wants to be a dual aspect theorist, a move towards what is standardly attributed to Nagel is more attractive than Spinoza. Nagel's dual aspect theory is usually considered an emergence theory, where the emergence of phenomenal consciousness is more or less unexplainable. This is not Damasio's view. He gives consciousness – the feeling of what happens – a causal role. The causal role of consciousness is so formidable in Damasio's theory that it looks more like a kind of functionalism than an identity theory. My suggestion is that it is a representational theory of the mind. If so, it encounters the objections put against functionalism in general, and representationalism in particular: when describing consciousness as some feeling with content, Damasio (and representationalism) does not deal with the subjective character of conscious experience, only with what Chalmers calls psychological consciousness, like awareness and intentionality (see 2. 5.).

## **2. 14. Representationalism and Damasio**

There are several types of representational theories of mind: the higher order (HO) account of Tye (1995), the higher-order thought (HOT) theory of Rosenthal (2005), or the inner sense view of Lycan (1997) to name a few. I will not present a deep analysis of any of them in this thesis. Instead of going into detail on one, I will take a brief look at some general features that hopefully are useful in order to see that Damasio places himself somewhere in this philosophical tradition.<sup>78</sup> I will then give a short discussion of the problems that face representational theories in general and Damasio's theory.

Representational theories are, to put it crudely, versions of functionalism. Functionalism defines mental states by their causal relations to each other and to inputs from the external world and behavioural outputs. It is thus the relations themselves that are important, not the intrinsic qualities of the matter which instantiate the relations. The important relations in a representational theory are the ones that make up our mental representations. This kind of theory makes an important distinction between the properties of the represented object and the properties of a representation of that object. Not to make this distinction is referred to as the phenomenological fallacy. It has been argued that if you don't want to make the phenomenological fallacy, any HO account must turn itself into an HOT account (see Güzeldere 1997). The distinction emphasizes that qualia of subjective experiences are not

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<sup>78</sup> Koch also puts himself (and Crick) in this tradition (2004, ch. 18), although I must admit that the idea of a nonconscious homunculus (which Damasio definitely criticizes), and thoughts as nonconscious are at best puzzling.

properties of the object of the experience, but are properties of the representation of this experience. That is, qualia are nothing but a certain kind of representation. In this way, representational theories claim they are not vulnerable to ordinary qualia-critique mounted against relational/functional theories. The different types of representationalism can in general be categorized as Higher-Order (HO), or Higher-Order Thought (HOT) accounts. Lycan's inner sense view, which we will describe below, falls into the HO category. Both HO and HOT theories claim that consciousness is the higher-order representation of some lower-level mental state. If the representation is perception-like it is a HO account, if the representation is cognitive/thought-like it is HOT. I hope the link to Damasio's somatic marker and feelings as knowledge of emotion is quite clear (2003, pp. 87, 194). The resemblance of Lycan's inner sense (HO) account and Damasio's theory of the somatic marker is particularly strong. Damasio even writes about neural pathways having the same appearance as the object of a perception: brain imaging of people watching pictures of say a cross have activity in the brain which can be interpreted as a cross. Such ideas would probably be met with open arms from a perception-like HO account. But what else is similar in Lycan's and Damasio's theories?

William Lycan's inner sense theory is a representational theory that views consciousness as internal monitoring. According to this view, consciousness is "the functioning of internal attention mechanisms directed upon lower-order psychological states and events" (Lycan 1997, p. 755). I hope the link to Damasio's somatic marker hypothesis is quite clear: homeostasis is *monitoring*, and the somatic marker moves along a *map* which is a representation of the body's inner states. Further, Lycan claims that there are no qualia, "what's it like" or subjectivity that would not be exhausted by the representational properties of the mind. Once representation is fully understood, then we would know all there is to consciousness.

Both Lycan and Damasio operate with two levels of monitoring. In Damasio's case it is first the somatic marker which constantly maps the body. This is equivalent to the internal monitor of Lycan. If something extraordinary is detected by the somatic marker, it causes some emotion. In other words, an emotion is a lower-order representation, what Lycan calls a first-, or lower order psychological state. As we saw earlier, Damasio claims that an emotion becomes a feeling (and feelings are combined with a self) when the feeling is about the emotion. In other words, the emotion is a lower-order representation; a feeling is a higher-order *thought*. For Lycan, the internal monitor is a higher-order representation of a lower-order state. That resembles Damasio's theory of the somatic marker. But Damasio claims that



this is not enough to make an emotion *conscious*, in other words: make it a feeling. Damasio gives an answer to the question of how mere representation of physical states can be enough to make those states themselves *conscious*. For this we need a thought connected to it (2003, p. 86). For Damasio, feelings are these higher-order thoughts. Damasio's theory is a HOT-theory, with a representationalism like Lycan's inner sense theory at the core. Although I have argued above that Changeux and Edelman lean more towards an identity theory, they also resemble HO(T) when they describe consciousness as a life-governing, value-marker or discriminatory device. I would argue then that Damasio's theory is a combination of Lycan's inner sense view and a HOT-theory. If it is sound to claim that an inner sense view like Lycan's resembles the core of Damasio's theory, what objections would meet such a view?

Güzeldere argues that any HO account must turn into a HOT account, or fall into what he calls the "fallacy of the representational divide" (1997 p. 789). HO accounts get problems with confusing the properties of what is represented and properties of that which represents what is represented; the introspective monitor causing awareness.<sup>79</sup> This can only be solved by abandoning the perceptual hallmark of HO, to the more conceptual oriented HOT. It is not certain that Damasio's theory which highlights the somatic marker should make such a conversion light-heartedly.

If Damasio turns HOT, he will face other objections. First, he will have a problem facing animals and infants without language but supposedly with phenomenal consciousness. The argument says that the T in HOT isn't necessary for phenomenal consciousness. One can of course argue that only creatures which can think conceptually can have phenomenal consciousness, but that does not fit Damasio's theory based on evolutionary biology. Another problem is explaining the distinctive properties of phenomenal consciousness. We can easily conceive of creatures with the right sort of representation but without phenomenal consciousness. Representations do not deliver a sufficient explanation for phenomenal consciousness. Damasio's neuroscientific theory should definitely deliver explanations, but probably shy away from requirements of conceptual thoughts.

In any HO(T) theory it is implicit that it is a metalevel mental state which is responsible for the consciousness of the lower-level states. Consciousness is a second-order

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<sup>79</sup> Lycan's view has met the objection of malfunctioning (see e.g. Levine 2001, pp. 104-111): this objection is a version of the 'impossibility of being wrong about our own subjective states' argument. An internal monitor might report a pain when there isn't any pain and vice versa. This seems contra-intuitive. The objection(s) no doubt fires also at Damasio's theory.

state that represents the lower level, perceptually (HO) or cognitively (HOT). In Damasio's case it is the feeling that somehow makes the emotion conscious. In his theory we are not only left with the problem of explaining how we get from a lower-level state to a second-order *conscious* state because Damasio actually operates with *three* levels: 1) the physiological, 2) the emotional (the somatic marker/monitor) 3) the feeling of what happens/consciousness. Can we explain how we get from 1) to 3) by an appeal to the complexity in neo-cortex? Complexity does not answer our questions of why an experience feels like that. Damasio reaches outside of the brain to explain *why* we have consciousness (or feelings); he delivers a kind of externalism, including body and responses to the external world. But even if he stresses the importance of feelings, he does not provide us with a light in the tunnel on the dark and hard problem of consciousness. If we are still lacking a good theory of phenomenal consciousness, maybe we haven't gone deep enough on the inside? For a truly reductive turn on consciousness, let us look at Joseph LeDoux's synaptic story.<sup>80</sup>

## 2. 15. LeDoux on self, memory and consciousness

LeDoux's work must be seen in conjunction with Eric Kandel's. Kandel's work on the molecular basis for changes in the synaptic structures of the marine snail *aplysia* allowed a reductive stance on learning. The mechanism of synaptic growth is described in article III. The idea is that if a creature has a long-term memory muscle response to certain impulses, then the creature has learned. Learning is a cognitive capacity and the harvest of Kandel's work is that we can understand learning and other cognitive capacities at a molecular level also in humans. This is because all creatures share the same fundamental level of DNA, according to evolutionary (neuro)biology (see e.g. Kandel 2006, pp. xii-xiii; 234-236). What LeDoux has done is using Kandel's idea and work to study synaptic growth in amygdala. Amygdala is (probably among many things) a regulator of emotions, especially fear. Amygdala is part of the limbic system and is to be found in "lower-level" creatures as well as humans. The causal role of (or identity with) amygdala in fear can be seen since blocking e.g. the neuropeptide substance P (in amygdala) will disrupt fearful emotions (see Zhao, 2009). If we have a tool then, for reducing questions of emotions to questions of neurotransmitter release and uptake in the amygdala, there might be similar tools for investigating all faculties

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<sup>80</sup> On the one hand, it might be hard to take LeDoux's "you are your synapses"-view seriously, on the other hand it is a very honest view (not as ambivalent as Edelman or Changeux's). It seems to claim "look, if we truly believe that neuroscience can answer all riddles of consciousness, then we must be prepared to go all the way with reduction". LeDoux goes for a "ruthless reductive account" (see Bickle 2003), which deserves a more serious treatment than simply saying it is ridiculous.

of human consciousness (see e.g. Kandel, 2006, pp. 376-388). If we can understand (mental) *feelings* this way, surely we must be able to understand everything this way.

LeDoux's work is worth investigating further here because his work revolves on fear conditioning in the amygdala. In more precise words: certain stimuli of fear cause synaptic growth in the amygdala, which is then seen as a kind of long-term *memory* – we *learn* responses to fear. Studying synapses are thus seen as the ideal tool for studying memory, learning and ultimately consciousness. This reductive strategy (also shared by Kandel, see 2006, pp. 161, 201-204) is perfectly stated by LeDoux in the opening (see article III) and the final conclusive sentence of his book *Synaptic Self*:<sup>81</sup> “You are your synapses. They are who you are” (LeDoux 2002, p. 324). Seemingly absurd statements like this must arrive from lesion studies (e.g. the case of Phineas Gage described by Damasio, 1994, ch. 1, ch. 4) and/or blocking of neurotransmitter release/uptake causing severe behavioural changes.<sup>82</sup> We know for certain that turning some of those knobs and wheels in the brain will change you entirely (LeDoux 2002, pp.304-307; 323-324). The same idea seems to motivate the philosophical brain in the vat argument. So we should not dismiss ideas about consciousness and self from reductive neuroscientists that easily, although we quite obviously are more than synapses.<sup>83</sup> What is to be learned from such a reductive strategy then?

First of all it is that these scientists work with operational definitions which *can* be tested by empirical methods (the same goes for Kandel, see 2. 16.). When doing neuroscience that is of course just fine, the problem occurs when the same neuroscientists want to deal with the big *philosophical* questions of consciousness, self and morality. This is appreciated by LeDoux (2002, pp. 17-18). LeDoux starts with the assumption that what we mean with consciousness are those mental states that are available to us (what we have called consciously aware of something). When seen in evolutionary terms, this is to point to the neo-cortex (see LeDoux 2002, p. 11). The problem with this attitude is that we are left with a brain-in-the-vat attitude: we can study consciousness by studying certain parts of the brain alone, forgetting that these

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<sup>81</sup> The opening sentence is: The bottom-line point of this book is “You are your synapses” (LeDoux 2002, p. ix).

<sup>82</sup> Kandel's description of blocking the regulatory protein CREB in the nuclei of a sensory neuron serves the point: it completely prevents long-term synaptic change (2006, pp. 263-266). The same point seems to be the fundament of John Bickle's “ruthless reduction” (2003).

<sup>83</sup> If I claim that losing my hair changes my personality (I believe that have happened to some people), it would be rather strange to conclude that “I am my hair”. What it *should* mean is “I am also my hair”. As I have stated in article III, if we took out all the synapses that LeDoux believes are necessary for him to exist as him and had them over for dinner, it would not be much of a dinner experience for neither of us. It is important for philosophy (of science) to point out then, that synapses are perhaps necessary, but certainly not sufficient for a self (or consciousness). What *is* sufficient seems to remain metaphysical speculation (although LeDoux sees it differently: “What else could it be?” (2002, p. 2; see also the accompanying footnote...)).

parts are an integrated part of a body acting in a world. LeDoux himself sees this problem (2002, pp. 23-24), but limits the search and study of consciousness to the brain, although the *whole* brain. The reason is that so-called unconscious processes, those that do not reach our conscious awareness (e.g. reportable states), have causal impact on exactly those consciously aware states. LeDoux criticizes traditional cognitive science to have excluded this part when studying the mind. We can see this critique in conjunction with Moe and Hopsicker's views presented in article IV. They argue for the importance of "the background" and "the tacit dimension" respectively. LeDoux's point is that to understand consciousness, we must study both the explicit (what we have conscious access to) and the implicit (what is non-declarative, but have causal impact on the explicit) (2002, pp. 26-31). The collaboration of the explicit and implicit is present also in article III, in the discussion of how long-term memory (both explicit and implicit) works in accordance with working memory. Highlighting the implicit part of what LeDoux calls the mind is an important lesson to learn for both philosophy and sport science (e.g. sport psychology). For neuroscience it means specifically to study brain activity of deeper laying systems like the amygdala.

LeDoux differs from Changeux and Edelman in that it is not the organization of the brain we need to understand, but the microscopic structure and functions of the cells and synapses that constitute the neural systems (LeDoux 2002, p. 36). Changeux, as we have seen, calls such an approach "simple reduction". For LeDoux it is the key to understand each person's defining qualities. We might interpret this as moving from not only trying to solve the easy problem of consciousness, but also the hard one if we say conscious experiencing is a defining quality of a person. The key to unlock the hard problem is synaptic plasticity. In neuroscience, learning is defined as synaptic plasticity (LeDoux 2002, p. 9). The idea then must be that since we learn by encountering the world, and this makes us who we are by nurturing the nature of DNA, we can understand who we are by understanding synaptic plasticity. I have outlined the molecular basis of synaptic plasticity in the section on Kandel in article III. Kandel's model is on procedural or motor long-term memory. LeDoux's contribution is to use the same approach on creatures (rodents/mice) with amygdala strikingly similar to humans'. LeDoux then wants to show that long-term memories of emotional responses (like fear) can be changed by synaptic plasticity in the amygdala, *and* that these changes influences so-called higher cognitive states in working memory. This is important. When we have a tool for investigating working memory, we have a tool for investigating consciousness (LeDoux 2002, ch. 7-8). LeDoux exemplifies this by taking the method of studying learned fear responses to

describing the neural basis of human love (2002, pp. 230-234). If *love* isn't a specifically human conscious emotion – perhaps even a state of phenomenal consciousness – then arguably none is. LeDoux sums it all up by describing love as the opposite of fear, by opening up to a person instead of running away. The feeling of love, according to LeDoux, is a “net result in working memory” (2002, p. 234). So, even in the face of the what it's like feeling of love, LeDoux falls into an explanation of stimuli-response that is at best a turn at psychological consciousness (emotional responses in amygdala becoming accessible/explicit through working memory). I must admit that I feel a bit disappointed by such perspectives. It is perhaps due to my philosophical spectacles. LeDoux does not really confront his views with contemporary philosophy of mind, and that might be why I feel reluctant.<sup>84</sup> Eric Kandel looks to some extent to McGinn, Dennett, Nagel and Searle (2006, ch. 28). Let's finish this part on neuroscience with a brief look at Kandel's turn on the “new science of the mind” as he calls it (2006, p. 11), and how he sees neuroscience befitted to arm wrestle with consciousness.

## 2. 16. Turning out with Kandel

For a scientific and a third person view of consciousness, one needs operational definitions. Kandel claims perceptual awareness and selective attention are good contenders (2006, p. 376). At least those are among what neuroscience of memory uses, as I have tried to show in article III. The question is if perceptual awareness and selective attention can make headway to understanding subjectivity and qualia, and thus close the explanatory gap. Kandel addresses these problems. Kandel understands most clearly that the problem of subjective experience is not that an individual *de facto* perceives some object, but that the problem is to understand how and why an experience is like that to the individual. Finding a neural correlate for a single conscious percept is certainly significant scientific advance, but not the same. Kandel accepts that such grand aims are not neuroscience's (2006, pp. 379-382). He resembles Edelman as described in article II when throwing in the towel on the subjectiveness of qualia. But just like Edelman, he is suddenly overenthusiastic on behalf of neuroscience's possibility of coming to grips with the hard problem of consciousness. He cites the idea of Crick and

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<sup>84</sup> It is rather symptomatic that the neuroscience turning to philosophy seems to believe that most philosophers accept Cartesian dualism and that their quest is to enlighten us. This is seen in LeDoux (2005, ch. 1-2), Edelman (1992, ch. 1, 15), Koch (2004, p. 238) and to some degree Damasio (1994). Damasio seems to hold that Descartes' (and philosophy's) biggest error is the strict distinction between reason and emotion, but he also notoriously attacks a metaphysical substance dualism (pp. 249-250). One could argue that LeDoux and Damasio's point of highlighting the contribution of emotions to rationality is the same as saying that there cannot be psychological consciousness without phenomenal consciousness; that also this distinction is false. I will return to this in the closing part before the articles.

Koch who argue that once we have solved all the easy problems we will also be capable to handle the hard problem.<sup>85</sup> Whether this is a simple set of neural correlates like Crick and Koch believes (Crick 1994; Koch, 2004, p. 101) or widely distributed neural processes in the cortex and thalamus (what Edelman believes according to Kandel, see 2006, p. 383), will not matter significantly.<sup>86</sup> If a strategy like that of visual attention (which is Crick and Koch's) can be combined with Kandel and LeDoux's approach to how (implicit) emotions arise from events in the amygdala, we seem to have all the tools necessary (Kandel 2006, pp. 383-388).

LeDoux and Kandel's work could and should be as confluent when coming to grips with consciousness. As I have stated above, Kandel's work on *aplysia* inspired LeDoux to study learned fear responses in rodents and mice, and this work again inspired Kandel to turn to more complex behaviour (Kandel 2006, p. 186). What lacks is perhaps what Kandel himself notices when discussing the philosophy of Thomas Nagel (2006, pp. 381-382): a change in methodology, a revolution in biology and a complete transformation of scientific thought. One will certainly look for the latter when one can appreciate the philosophical subtleties of consciousness on one page, and suddenly jump from laboratory work on marine snails to subjective experiences of human love on the next.

On one side philosophers must appreciate the work of revealing mechanisms in the brain like Changeux, Edelman, Damasio, Rizzolatti, LeDoux and Kandel have done. Neuroscientific research should influence philosophical discussions on mind/consciousness, knowledge and skill. There are at least two interesting lines of thought from amygdala to the philosophy of mind:

First, Damasio and LeDoux serve us empirical evidence that feelings and emotions guides behaviour. Feelings *should* guide behaviour because without feelings a decision could never be taken (Damasio 1994, ch. 3): it simply would not matter to us what we were doing since there must be some emotion establishing value to the individual. Damasio and LeDoux's stress of the significance of emotions is important also to the philosophy of sport. It

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<sup>85</sup> Koch is not completely consistent in hoping to solve the hard problem. He claims both that the subjectivity part of the hard problem is insurmountable (2004, pp. 242-244, 247, 310), *and* that the ultimate aim is to "explain all aspects of the first-person perspective of consciousness" (p. 314). This is possible it seems, if the technology gets better during the next years (p. 314).

<sup>86</sup> A key element of Edelman's theory of reentry and the dynamic core is that neural activity compounding the dynamic core is not a place but a process. A consequence is that what is necessary and/or sufficient for a conscious experience varies both across situations and individuals. Edelman argues that the search for fundamental properties in neurons (or synapses) is a shot in the dark. If so, solving the hard problem of consciousness seems improbable from a neuroscientific stance *and* to establish type-type identity in such a theory (see Edelman and Tononi 2000b, pp. 146-148).

serves as an empirical foundation for anti-intellectualism, which is to say that also the non-declarative, so-called non-rational is such an enormous part of both consciousness and life.<sup>87</sup>

Second, Kandel follows up on LeDoux's work on amygdala and fear, using face recognition to detect different brain systems involved in explicit and implicit fear (2006, pp. 386-388). This kind of work is what Goldman uses to argue for his simulation theory of mind presented in article IV. Neuroscientific findings could and should have impact on philosophical ideas. Christof Koch participated in some of the most remarkable empirical research on humans *in vivo*: single-cell recordings on epileptic patients doing perceptual and cognitive tasks of recognizing celebrities and famous places (Quiroga 2005). The single-cell recordings show different neuronal activity for different celebrities, for example the same neurons were activated for Halle Berry when seen on the red carpet, as "Catwoman" and even just by observing the letters of her name. Different neurons were activated for Jennifer Aniston, leaving the researchers to argue there were "Berry-cells" and "Aniston-cells", also known as "grandmother cells". This initial and appealing idea was later dismissed by Quiroga himself, arguing that millions of neurons were necessary to know and recognize an individual and that in some cases the same neurons were activated for several things, e.g. Jennifer Aniston *and* Lisa Kudrow (Quiroga 2008). Interestingly, neurons were activated by the pictures only if the observer already knew the celebrity/place. We might compare this to how memory influences on-line performances as I have discussed in article III, and how the mirror neuron theory argues that motor knowledge is necessary for action recognition (see article IV). Quiroga's work illustrates the difficulty in finding neurons to hold across individuals when searching for qualia. We might say that Changeux's belief in this possibility would be supported if there were such grandmother cells (see 2. 12. & article II). The problem is of course the individual's pruning and life story, as recognized by Edelman. Philosophically it might be argued that Quiroga's research supports a token-token identity theory of consciousness, but not type-type identity. If so, the reductive program of neuroscience makes full reduction of consciousness seem difficult.

On the other side, I believe Christof Koch states the scientific and philosophical, to some degree vanishing, hope of reducing consciousness neatly: "It would be convenient from a methodological and practical point of view if the NCC neurons shared a unique set of traits"

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<sup>87</sup> There's no *pure* reason, and there's no pure rationality either. There isn't perhaps rationality at all without emotion. That seems to be Damasio's conclusion from lesion studies (1994, ch. 3-4). Sport then, is in no need of an armchair so-called rational reason, an emotional reason is as good a justification as any. The implicit workings of amygdala support a non-declarative justification like the old Nike ad: *just do it*.

(2004, p. 102).<sup>88</sup> If Edelman and those supporting global neural distribution are right about neural correlates of consciousness *not* sharing unique traits - or even worse; Noë, Thompson and Rizzolatti's idea of an extended mind – it would be *an inconvenient truth*. We must remind ourselves, philosophers, neuroscientists and hopefully the public that there are certainly more to each and every one of us than brain, neurons and synapses. It seems that even bold scientists like LeDoux understand that this is so: “we’re (not) simply victims of our brains” (2002, p. 323). Alas, “we”, or “I” am not identical to “brain”.

#### **4. 0. Why should neuroscience and philosophy of mind be interesting to the philosophy of sport?**

We might say there are two ways of looking at the subject in sport science: 1) the athlete is like a non-conscious robot, or 2) the athlete is conscious. In this thesis I have taken the second option.<sup>89</sup> I have also tried to argue that consciousness is significant and central to both sporting skills and sporting experiences. Questions of knowledge and consciousness have thus been intertwined in this thesis. This has a long tradition in the philosophy of sport. As I said in the introductory lines, the phenomenological tradition has been used to describe how the body and motor movements are intentional, and thus conscious without a prior declared thought (which is the analytic idea of intentionality). Vegard F. Moe (2005, 2007) has for example discussed how logical analysis of propositional attitudes leaves skilful motor behaviour unexplained. According to Moe, skilful motor behaviour is certainly intentional, but the intentionality does not rise from propositional attitudes. Drawing on Merleau-Ponty he tries to combine phenomenology and the analytic philosophy of Searle to get a better grasp of intentionality in skilful motor behaviour. We might say that Moe argues that it is the lack of propositional content in skilful motor behaviour's intentionality that makes a propositional analysis difficult. If intentionality has something to do with the mind, and skills with knowledge, we see the entanglement of consciousness and knowledge in Moe's contribution.

The idea that there is knowledge in skills, but that this knowledge is not necessarily declarative (knowing that) is also apparent in the works of Steel (1977) and Wertz (1978). The works of Polanyi has also been used to describe how non-declarative knowledge underpins skills in sport, and how knowledge can be focal or tacit due to different modes of

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<sup>88</sup> NCC = neural correlate(s) of consciousness

<sup>89</sup> Breivik (2007) does the same in his critique of Dreyfus. Dreyfus (1986) argues that expert skill is not automation, but nevertheless mindless, or nonconscious.



awareness (see e.g. Hopsicker 2009).<sup>90</sup> If knowledge is tacit (non-declarative) or focal (which might be declarative) then, seems to be a question of how consciousness works. Similarly, works in the philosophy of sport have used Dreyfus' idea of expertise as absorbed coping to show that the highest skill-level is not automation (see e.g. Eriksen 2010). We might say that Dreyfus' skill model argues that to become an (sport) expert (have greater knowledge), one must rid oneself of declarative rules and let the body's motor intentionality take over (Dreyfus 1986). This might be interpreted as saying that what separates the novice and the expert is a difference in consciousness. My own work is a contribution to related areas in the philosophy of sport, but I do not mean to say that consciousness and epistemology is by necessity interrelated. I have hoped to bring neuroscience to the discussion of knowledge, skill and consciousness in sport. Steel argues that knowledge in sport is not essentially different from knowledge in the laboratory say (the "feel-theory" of Wertz would probably do the same). This is the same conclusion that neuroscience brings to the table: at a molecular and neuronal level, skills and motor knowledge are essentially the same as any other kind of knowledge.

The whole rationale behind this thesis is that if we want to study athletes and skills, we cannot be eliminative physicalists and simply ignore consciousness. This has long been the tradition in sport science, including sport psychology: if an athlete's skill is determined to be automatic, we are rid of consciousness because automata do not think – they are unconscious. Skills are said to be non-declarative (because a declarative command before the action, or to pay conscious (declarative) attention to your limbs while performing will disrupt the performance), and then considered to be unconscious and automatic responses. Skills may be non-declarative, sure. In this thesis I have been asking if skills can still be considered thinking, or: if you can think without words.<sup>91</sup> Neuroscience asks the same question (although perhaps implicitly) when showing how synapses, pathways and neural networks are pruned and extended in relation to environmental stimuli – it is a non-declarative adaption to the environment and situation. This is also to ask if the mind is extended (see e.g. Clark 2008) beyond the brain. The mirror neuron theory itself might be interpreted as stating there is both something like thinking without words: we understand actions implicitly – *and* extended thinking: through observation of others we understand ourselves and vice versa. So to understand ourselves, we stretch out beyond our brain by observing others acting in the world,

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<sup>90</sup> Polanyi himself seemingly argues that what constitute the skill of riding a bicycle *is* reducible to knowing that (1966).

<sup>91</sup> Philosopher José Bermúdez (2003) contributes in this area.

and this observation/understanding is underpinned by our own motor knowledge which is acquired by interaction with the external world. Paradoxically, neuroscience in general seems to hold that what we call the mind is not restricted to brain/neurons (contrary to LeDoux's position). Neuroscientific studies are limited to brain/neurons of course, but the implication of this neuroscientific study seems to be that mind, consciousness and skill are extended to both body and world. In effect they are not simply neural phenomena, and not reducible to such. Evan Thompson makes a beautiful and seductive argument for this position (2007, pp. 240-242).<sup>92</sup>

Thompson argues that the old brain in a vat thought experiment is not carefully constructed. He says that for a brain in a vat to experience, what the vat consists of must be reconsidered. The vat must keep the brain alive; it must duplicate external stimulation and compensate for all endogenous activity. To do these things, the vat needs something like an immune system, which requires bloodlike energy (which somehow must be transported in and out, filled with oxygen), it must have something similar to the sensorimotor system, which again needs inputs from a world. The vat must be something like a surrogate body, and this body needs to have stimuli from a surrogate world. The brain alone is not a sufficient requirement for consciousness.<sup>93</sup>

Thompson's "brain in a *body*" example is supported by how Edelman and Changeux describe neuronal growth, connectivity and pruning. These are some of the themes in article II. Unfortunately, the implications following from how neurons and brains actually work is seldom appreciated. When LeDoux has done some of the most famous research on how synaptic growth in amygdala occurs due to stimuli and response training (a causal mechanism including bodily reaction to external stimuli) and still advances the idea that you are in fact nothing over or beyond your synapses, something has gone severely wrong. One thing is the simple fact that the synaptic growth would not have happened without a body receiving some stimuli. The stimulus which is supposed to be "fear" comes from environmental conditions. It is rather astonishing that "fear" stimuli like an electrical charge, pictures of snakes, devastated bodies or terrible screams are then identified by neurotransmitter release (substance P, say) in amygdala causing synaptic growth. On such an account "fear" *is* the synapses, and then

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<sup>92</sup> Damasio (1994, ch. 10) argues along the same lines as Thompson.

<sup>93</sup> One might argue that the brain in the vat example is conceivable, if not nomologically possible in our world. So the brain in the vat argument works fine to state metaphysical possibilities. That is of course correct, but Thompson's argument is reasonable if used against neuroscientific approaches to consciousness and philosophical theories based upon neuroscience.

scientists like LeDoux seem to be type-type identity theorists. The leap is apparently rather short from this line of thinking to actually believing that “You are your synapses” (p. ix)<sup>94</sup> or “skills are synaptic plasticity”. For LeDoux, synaptic growth is associated with long-term memory (see article III). But neuroscience describes synaptic growth only as a necessary condition for memory, not as a sufficient condition (see Edelman, article II). One could of course argue that I have not made a distinction between acquiring and possessing, saying that to acquire a skill or memory one needs a body, but to possess it (in neuronal terms) we need only a brain, and so we can make identifications and reductions. That is to misunderstand what neuroscience teaches us. A neuronal structure (like those we have for long-term memory, and which are those LeDoux has worked with in learned fear response) reconstructs a particular memory by a re-firing in neural structures which would not have been there without a certain acquisition. The re-firing, what Edelman (1989) calls the remembered present, is re-acquiring the original possession. Such a re-firing must have new stimuli (similar to the original), which again needs a world and a perceiving (and perhaps acting) body.

Although this thesis is not in itself about thinking without words, it wants to deny the seemingly popular idea that athletes do not think. Analytic philosophy has done lots of work on non-conceptual content/experience which might be interesting to further discussions in the philosophy of sport.<sup>95</sup> Philosophers of mind often (too often?) collapse into philosophy of language when discussing consciousness, which might make it difficult to discuss topics like “consciousness” and “thinking” to be non-conceptual. Frank Jackson’s superscientist Mary serves the point. Mary’s experience of redness is reconstructed as a question of propositional truth, which requires some conceptual analysis. There are huge investigations into the area of colour perception and language worth looking into also for philosophers. Franklin (2005) argues that infants without colour-concepts can distinguish colours none the less. Goldstein, Davidoff and Roberson (2009) argue infants have *some* colour concepts. Franklin is supported by several studies (e.g. Wright 2006): when people who lack some colour concepts (they may have the concept blue, but not green – bleen) are presented with the colours green and blue and asked what colours they see, they respond “only one colour, blue”. But do they

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<sup>94</sup> The belief is analogue to the belief in the brain in a vat example. The belief in the latter must arise from the knowledge that we can change conscious states through brain lesions, electrical stimulation to the brain or chemical drugs altering (mostly) neurotransmitter release or uptake. Still, we must not forget that this is external stimuli (a world), which still needs a vat (a body) that keeps the brain up and running.

<sup>95</sup> See e.g. Crane (1992), and especially Grush (1998) on the skill involved in spatial content.

experience the two as the same? No. They experience two different things, but report it to be the same colour. But they do not experience the two colours as identical, even though they use the same colour concept to refer to both. Both infants and grown-ups have non-conceptual categorization skills and experiences. This links us to the question if knowing how is reducible to knowing that, and if there is some knowledge after all in knowing how or skills. Empirical neuroscience supports a “no” to the former question and a “yes” to the latter.

The tendency to resolve questions of (phenomenal) consciousness by philosophy of language might be the main reason why phenomenology has been preferred in the philosophy of sport. But the lean towards philosophy of language in questions of consciousness does not mean that analytic philosophy has nothing to offer philosophers of sport. What I have tried to contribute to the philosophy of sport here is exactly that both neuroscience and analytic philosophy of mind *do* have something to offer. I have tried to show that analytic philosophy of mind can help neuroscience and sport science on the quest for consciousness in highlighting what we mean when talking about consciousness, what we are looking for, what some problems are, and hopefully some conceptual clarification. I have also tried to show that neuroscience contributes to discussions in the philosophy of mind by expanding knowledge on how the brain works and thus negating or supporting ideas and theories. It has been my hope that the philosophy of mind and the neuroscientific discussions presented here and in the articles can do the same thing for philosophy of sport when it comes to issues as skills, consciousness and knowledge preferably.

#### **4. 0. The articles**

In this section I will provide some further discussion to both assumptions and sub-questions taken up in the articles. I will also try to show the connectedness of the assumptions and questions in the articles.

#### **4. 1. Article I, *A Phenomenal Case for Sport***

The first article is meant to pave the way for the following three. Its mission is to (re)introduce contemporary philosophy of mind to the philosophy of sport. It is my opinion that most works concerning consciousness, knowledge and skills have centered round phenomenology, be it Dreyfus, Heidegger, Merleau-Ponty or Polanyi. Although I have mentioned some of these authors in several of the articles, I have intentionally stayed away from more thorough treatments. I believe the philosophy of sport should include both analytic

and phenomenological perspectives. Although the former has a tendency to end up with conceptual discussions leading almost nowhere, the latter has not always kept up to date on scientific progress.

The idea of the first article was first to establish a platform to work from. It starts with a *very* brief history of the last 50-60 years of main ideas in the philosophy of mind, leading up to Chalmers' distinction between *psychological* - and *phenomenal consciousness*. This distinction is central in all the articles. It is argued that if we want to know about consciousness in sport – the article argues that we should – we must know about both psychological and phenomenal consciousness. Which lead us to what Chalmers calls the easy, and the hard problem of consciousness. The easy problem is explaining psychological consciousness, the hard problem is phenomenal consciousness. Joseph Levine claims that the hard problem is two-fold. First, the subjective character of phenomenal consciousness; second: the problem of qualia. Together they form an explanatory gap. The article uses the work of John Perry to inquire if the hard problem really is that hard. Perry confronts (chiefly) the problem of qualia through the *knowledge argument*. The connection between knowledge and consciousness is the hub of article I. Article II focuses more on the problem of subjectivity. Perry argues that the knowledge argument can be solved by an appeal to reducing all knowing how into knowing that. First Perry argues that phenomenal consciousness, the qualia of what an experience is like, is a knowing how. When experiencing qualia, what we learn (the knowledge, if any) is to conceptualize and categorize, Perry argues. This knowledge (seemingly knowing how) can be reduced to knowing that according to Perry.

The first article argues that sport teaches us something important: not all knowing how can be reduced to knowing that. If that was the case, we would know both how to perform a certain skill (assuming that skill is know-how), and know what it was like to perform such a skill simply by having propositional knowledge (knowing that). The article argues that to know what it is like to perform a skill, one must know how to, and/or able to perform a skill. And this cannot be accomplished by knowing that (having all propositional knowledge in the world), the article argues. This brings us to a distinction not confronted in the article: the distinction between knowing how and the ability to do. One may argue that I have knowing how, but not the ability (see also 2. 4.). If I was a former world champion cliff diver, surely I had know-how of diving. But one day I dived into a submarine, resulting in paralyzed leg.

Some (e.g. Bennett & Hacker 2003, p. 149-151<sup>96</sup>) would argue that I still have know-how, but lost my ability. When this distinction is drawn, it looks easier to conclude like Perry that knowing how can be reduced to knowing that. But Perry does not make this distinction, and to get a what it is like experience one must certainly be able to do. At least that is what the first article argues. So apart from setting the stage for the preceding articles, the aim of the article is to show that contrary to certain beliefs, consciousness is present in sport performance. Sport is phenomenal in that sense. But the article also aims to show that sport can teach philosophy something: skills and experiences in sport show very clearly (better than the usual examples like the “redness of red”) that phenomenal consciousness is involved in skill, and that doing skills cannot be reduced to knowing that. It is a case for the importance of sport to philosophy. Mary is a super-scientist of neurophysiology, but what picture is drawn by neuroscience on the relation between consciousness and skill? And can the mind of the athlete be reduced by neuroscience? These are the focal points of article II.

#### **4. 2. Article II, *The Inner Game of Sport: is everything in the brain?***

The article centers around some neuroscientific investigations on athletes. The importance of this should be clear: neuroscience is making an impact on sport science. But sport science also delivers to neuroscience; supplying evidence on differences in brain activity (and probably structure) between remarkable performance and mediocre/poor performance. The article investigates the claim that skill is to be analyzed at the level of the brain, and what this means to understanding the mind (consciousness) of the athlete. The article questions how one can jump from observing brain activity to make claims about the mind; which is what the research reviewed do. *If* one is to make such a jump (we are talking about jumping across the explanatory gap here), one should at least do two things: 1) confront the problems (that is what the first article hopefully has done), 2) make the jump from a fitting theory. Neither is done by the reviewed research. So, the article asks: suppose we had a theory which confronts the problems laid out in article I, what kind of theory is fitting? It must surely be a neuroscientific theory.

The article then looks at Gerald Edelman’s works to see where they deliver, where they don’t and how they actually fit the conclusions made in the reviewed investigations. Edelman is chosen for several reasons: he confronts the problems associated with the explanatory gap (more than say Damasio). His “neural Darwinism” is arguably more “fitting”

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<sup>96</sup> They even claim one can have ability but not know-how (p. 151).

to sport science (and the reviewed research) than say Changeux. So, how well does Edelman fit the research and what problems do face him?

Edelman's theory fits the research because it wants to explain consciousness (the mind) in terms of neurons and the organization of the brain, so it is fitting as a base theory to make claims about the mind of athletes from brain imaging research. Edelman's theory does not support all of the conclusions drawn by the reviewed research. Edelman criticizes information processing theories, and the language of the research seems to be from this area. Edelman does not support the idea that automation is the highest level of expertise. Contrary to the reviewed research, Edelman argues that the mind of the expert is not cool and focused but wide and open.<sup>97</sup> One could of course argue that it would be better to choose a base theory which was more like connectionism, which is usually a kind of information processing theory. But one thing we perhaps should learn from neuroscience is the critique against classic cognitivism and information processing theories. Both Changeux and Edelman stress this critique. It could/should be interpreted as a critique against a functionalistic philosophy of mind too (which also would be mounted against Kim, see 2. 7.). At least that is one of the arguments in the article. This is also connected to article IV on mirror neurons: that article (re)launches a debate on cognitivism brought about by Moe (2005).

If we interpret Edelman as a critique of functionalism, he is trapped in this himself. I argue in article II that philosophically, Edelman ends up with a theory of consciousness which is part identity theory (sometimes token-token, sometimes type-type), part functionalism, and also a little bit of epiphenomenalism (like Kim). That is to bite over a little bit too much, at least philosophically. Edelman argues both that qualia have causal potency (they discriminate perceptions), and that they are epiphenomenal (how they subjectively feel do not have causal potency). Edelman gives us an explanation of *why* we have qualia, but do not explain why they feel like *that*. The first part is important to sport: it explains to us that athletes are conscious (they experience qualia), and that this kind of consciousness makes us able to respond in different ways when we do sport. Edelman also delivers an interesting theory which is worth investigations to developing talent, skill and knowledge in sport: this is the theory of neural Darwinism (ND). ND is a theory of how neuronal pathways are stimulated, selected and strengthened. In other words: how the brain develops in response to

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<sup>97</sup> Christof Koch agrees with Edelman, arguing that "the function of consciousness is to deal with all those situations that require a novel, nonstereotyped response" (2004, p. 213). Arguably, most top-level sports require novel responses, and hence not automation. The mind, or consciousness, of the expert is not one of automation accordingly.

stimuli/training. I believe there are lots to be learned from this kind of theory in sport science. Surely we must know about the brain either when we do sport psychology, pedagogy or studies on expertise. Unfortunately, Edelman does not deliver when it comes to phenomenal consciousness. The problem of subjectivity, explained in article I, is especially problematic for Edelman. Article II then, is an inquiry into what a neurotheory of consciousness can do for us philosophically (it is argued that it delivers on psychological consciousness, but not on phenomenal), and scientifically. The philosophical part is a practical engagement with some of the questions in the first article; the scientific part is sort of a “philosophy of sport science” – as to what we might expect in the future, and on what foundations such futuristic research is built upon.

#### **4. 3. Article III, *Knowledge and Skills: nothing but memory?***

The third article follows up where the second ends. It is also a kind of applied philosophy: applying philosophy of mind on empirical investigations of the mind. This time in the name of memory research.

Memory research is chosen for several reasons: the cognitive neuroscientific research program has done a lot of work on memory. Which I argue sport sciences has not, but should. Cognitive neuroscience has arguably two hobby-horses: memory and visual attention – and they come together in the name of working memory. Alas, Alan Baddeley has declared that if he had the chance to start afresh, he would have called working memory “working attention” (1999, p. 52). There is a relation between *memory* and *attention* then. So why is this interesting to philosophy (of sport)? I believe this is nicely illustrated by Christof Koch, neuroscientist with a philosophical agenda and a dedicated climber (2004, p. 154):<sup>98</sup>

By selectively *attending* to particular events or things out there, you choose one world to experience out of an uncountable number of universes. I feel this most vividly when engaged in a demanding climb. Everything but the motion of my body over the rock and the howling wind is relegated to perceptual oblivion. Gone is the strain of the pack on my back, my aching muscles, the looming thunderstorm, and the siren song of the void beneath me.

Koch argues that what you are conscious of is usually what you attend to, but that “their relationship may be more intricate than conventionally envisioned” (2004, p. 154). That is exactly what the quote shows. While the climbing Koch’s attention, his psychological consciousness, is on the motions of his body, it is precisely the strain of the backpack and the

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<sup>98</sup> I use some of Koch’s work on memory in article III.



void beneath that makes his experience a subjective one, one with phenomenal consciousness. These features make the experience of outdoor rock climbing unidentical to indoor plastic climbing, even though the attentional mechanisms and the mere movements might be identical. Phenomenal consciousness is not an epiphenomenon, like Kim argues (2. 7.) – it is causally potent. Phenomenal consciousness must therefore be studied scientifically to understand consciousness at all, as I have argued against Edelman in article II.

The article tries to show that knowledge, (motor) skill, consciousness and memory is deeply intertwined. And neuroscience shows us how by highlighting attention as a modality of consciousness, and attention as a kind of memory. Article I argues that there is consciousness in sport, and that knowing how is indeed knowledge. Article I also argues that knowing how and consciousness is connected. Article III takes a look at how this connection is understood in memory research. Instead of looking at a grand neurotheory of consciousness (like Edelman's in article II), the article looks at *some* aspects of consciousness researched by neuroscience. Like article II, the third article is sort of philosophy of "could/should be" sport science. It is meant to utilize philosophy of mind and -sport on ideas of reducing knowledge, consciousness and skill to memory.

After some initial divisions of memory types, the article starts by looking at how Kandel describes long-term memory on a molecular level. This is important to sport science because synaptic plasticity in the brain surely has something to do with learning motor skills. If we want to understand movement and skill in sport, we must understand synaptic connectivity and plasticity. That goes for sport science in general and philosophers of sport in particular. The article argues that there is a tendency to claim that motor skills simply are procedural long-term memory. The article argues that skills (in sport) are not only structure dependent (like long-term memory's structural changes in cortex), but also what Koch calls *active dependent*. The molecular basis for long-term procedural memory might be a necessary condition (and as such, definitively important for sport science) for skills in sport, but it is not exhaustive or sufficient is the argument. Skills are active, but so is what is known as *working memory*. Can we understand skills in sport by understanding long-term *and* working memory then?

Working memory is usually investigated as attention, and attention is one of the modalities of psychological consciousness described in article I (see also 2. 5.). Attention (or focus) is also the target of the expert's skills analyzed by the fMRI research in article II. If attention is part

of sport skill (and I do not believe anyone would argue it isn't), we must conclude that consciousness is part of sport skill (which some have argued it is not, e.g. Dreyfus 2007).<sup>99</sup> What we learn from the work on working memory is that the cognitive processes involved are connected to knowledge in long-term memory. In the neuroscience of memory, we might have found the methodology and tools for investigating the easy problem of consciousness. At least parts of it. The article argues that the hard problem of consciousness cannot be solved by research of (*sensory*- or working) memory though. Working memory is involved in visual attention and sensory memory in perceptual experience, but this does not exhaust phenomenal consciousness is the argument.

Summing up, we could say the article argues that although skills are often non-declarative, they still rely on earlier experiences together with (in principle) declarative knowledge of rules etc. This leads us to the following: earlier experiences influence how we feel in any situation. It is to say that phenomenal consciousness has impact on sport (skills). Further, there are several types of knowledge involved in sport skills, not only motor knowledge or procedural long-term memory. Knowledge in sport is both non-declarative *and* declarative. The same goes for consciousness. Sometimes they are to behold, sometimes they stay in the back. This leads us to the fourth and final article, which looks at the neurophysiology of mirror neurons and earlier discussions of tacit and background knowledge.

#### **4. 4. Article IV, *Skillful and Intentional Mirrors***

The final article is the summit so to speak of the thesis. At least it is the spearhead, or most specialized article. Article I is rather general, discussing lots of topics from the philosophy of mind (and epistemology) related to philosophy of sport. Article II confronts a general neurotheory of consciousness with general problems in the philosophy of mind and sport. Article III looks more specifically to memory research in general to see what it can and cannot give us when it comes to the questions raised in the first (and second) article. In the fourth and final article the spotlight of neuroscientific contribution to philosophy and sport science is narrowed even further. Article IV wants to bring forward what the discovery of

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<sup>99</sup> One might question if there is anyone who actually believes athletes do not think at all or are without consciousness. Hopefully there isn't. But when famous scientists and thinkers like Kandel, LeDoux, Dreyfus and Bargh express such views, they should be confronted. Koch, a dedicated climber, expresses the same views – claiming that top performance is non-thinking/non-conscious automation (see e.g. 2004, pp. 206, 235-236, 247). This is strange, since he *also* argues that the primary function of consciousness is to deal with novel, nonstereotyped response (p. 213). Koch should be able to see that top performance is nonstereotyped.

mirror neurons by Giacomo Rizzolatti would/could mean to discussions in the philosophy of sport. Especially to discussions brought about by Moe (2005), Breivik (2007) and Hopsicker (2007). Discussions on mirror neurons are also interesting to the philosophy of action (which has implications for philosophy of sport): the neuroscience of mirror neurons seems to indicate that our tendency to make fine or even coarse grained distinctions in actions is way too fine. A discussion on intentionality in the work of Rizzolatti, phenomenology and analytic philosophy would carry us too far away, but philosophy should lend an ear to empirical research rejecting our eagerness to serially deconstruct actions into causal related movements.

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Article IV is related to the first because Rizzolatti puts forward the idea that the mirror neuron system enables us to understand and perform intentional movements. Intentionality is one of the main components of psychological consciousness. Rizzolatti also argues that mirror neurons allow us to get an immediate understanding of the first person perspective of the other. If so, we have firstly a comprehensive grasp of how we understand other peoples minds (a classic problem in the philosophy of mind), and secondly a neuromechanism which can be investigated as any other observable feature. What we have then is a neuroscientific tool for understanding and investigating phenomenal consciousness. If Rizzolatti is right, a general neurotheory of consciousness (like Edelman's in article II) should include perspectives on mirror neurons. There are also connections between the critique of information processing theories in the second and the fourth article. Another connection is that of automation and skill. The automation view of skill held by the research reviewed in article II is severely criticized. One of the features of the mirror neuron system is a direct matching system that is seen as automatic. This link is not followed up in the article, and will not be here either. But the automatic features of the mirror neuron system are different from those who hold that "the more automation the better". The mirror neuron theory is closer to Edelman's: automation in action understanding releases energy in the brain to be used on other tasks – for example producing creative, flexible and masked responses – all hallmarks of expert skill.

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<sup>100</sup> Rizzolatti does not make a distinction between act and action. Actions are goal directed, that is what makes them intentional. Movements are not goal-directed (are non-intentional), but Rizzolatti argues that we rarely perform movements. We perform actions. Philosophically that is naïve of course, because we can surely conceive of movements which are not goal-directed but are more complex than mere movements of limbs, but let us not head down that path.

There are also several relations between the third and the fourth article: in article III I argue that working memory is connected to long-term memory. Rizzolatti argues action recognition is connected to motor knowledge, which is what I have described as long-term memory in article III. What Kandel calls (motor) *skill*, is probably closer to what Rizzolatti calls motor knowledge. To have a complete understanding of the mirror neuron system, one must also understand memory. And to understand the procedural memory involved in skill, one must also understand mirror neurons. Action recognition relies on motor knowledge understood as procedural memory. Article IV argues that action recognition relies on the skill of the athlete. Or in other words: the so-called cognitive skill of action recognition relies on a so-called motor-skill. Cognition and consciousness are certainly related – so consciousness and motor skills are also related – and this relation is unveiled by neuroscience. An especially intriguing relation is that between consciousness, implicit memory described in article III, and what is known as *tacit* knowledge. Koch delivers an interesting argument to why we have qualia: they are symbols of an enormous amount of information gathered through experience. This information stays tacit, but have nonetheless causal potency in conscious decisions (2004, pp. 240-243). We rely on memories to make decisions about here and now, and the future. These memories must be tacit, according to Koch, because the brain would never have the capacity to process all of our memories explicitly. A single quale is the symbol of the feeling in a particular situation made up by our life story, which stays tacit.

Finally, article IV provides a reply to Clark's argument (1. 1.) that consciousness and motor action are not deeply connected. Clark's conclusion is based on the work of Milner and Goodale (1995) and a lack of support for the alternative. The discovery of mirror neurons has provided such support.<sup>101</sup> Indeed, Rizzolatti himself confronts and denies the findings of Milner and Goodale (Rizzolatti & Sinigaglia 2008, pp. 38-44).<sup>102</sup> Clark (2008) himself seems also to have turned to an idea of "the extended mind". Interestingly, the first ever single-cell recording for mirror neurons on humans, mirror properties were found also in the medial temporal cortex (Mukamel 2010). If areas usually associated with memory actually do have motor and visual properties of mirror neurons then the links between motor skill, memory and consciousness is established empirically. Imagine what it would mean to philosophy and sport science if there were neurons with mirror neuron properties in the brain areas associated with

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<sup>101</sup> An extremely intriguing argument for the necessity of *skill* (very widely defined) to experience is delivered by Grush (1998). There is a link here to the knowledge argument worth investigating.

<sup>102</sup> Koch argues that dissociations have been found somewhere, but not everywhere (2004, p. 213).

procedural long-term memory. That would take the sting off arguments like those presented by Clark and Prinz for dissociating motor action from memory and consciousness.

Research on mirror neurons is undoubtedly in its infancy. But it is also some of the most exciting research around; for philosophy and sport science both. If obstacles like those Hickok (2009) raises can be surmounted, we may see the dawn of *motor consciousness*. With mirror neurons; neuroscience has at last taken the step beyond the brain to the outside world. With such a step, we are perhaps closer to a science of both consciousness and skill. But such a step also leaves doubts to the hope of reduction, explanation and prediction. Perhaps the most important message from the science of (mirror) neurons and this thesis is that not all answers to consciousness lie inside the brain.

## **5. 0. Difficulties, and Further studies**

It is perhaps dawning on five or six minds that physics too, is only an interpretation and exegesis of the world (to suit us, if I may say so!) and *not* a world-explanation  
- Nietzsche, BGE 14

### **5. 1. Difficulties, I: Conceptual confusion: using copy and paste when jumping between philosophy, psychology and neuroscience**

Nietzsche reminds us of something that also neuroscience must remember: scientific observations are interpretations. Raw data becomes observations as we interpret how they fit a hypothesis. How do we move from data to phenomena? Or more specifically in the neurosciences: how do we move from observing single-cell recordings (which is considered the *most* objective measurement) to statements about cognition, consciousness and other so-called mental phenomena? No matter how optimistic we are on the future of neuroscience, we must realize that the move from data to phenomena is not at unproblematic. I have tried to show (in article III) how distinctions between concepts like “implicit memory”, “automation”, “skill”, “non-conscious” are often blurred and become obliterate. This problem will always be present when we try the jump from neurons to cognitive phenomenon. Valerie Hardcastle and Matthew Stewart (2003) write specifically on this problem with single-cell recordings. Once we use a heavy theory laden concept like “consciousness”, “know-how”, or “attention” in a different context or field of science, things are likely to become a mess. Or worse, we are not necessarily talking about the same thing anymore. This is too often the case when neuroscientists try to do empirical (re)search on/for a psychological understanding of

consciousness (which is usually considered the same as attention) to answer philosophical questions regarding phenomenal consciousness. This is one of the issues in article II.

It might be good advice then, for philosophers to stick to their guns and let biological sciences go about their business. And ditto. The last decades have opened up the ground for empirical research on what have traditionally been philosophical questions about mental states, mind and actions. This technological revolution leaves philosophers with two approaches: the first is to shy away. The other is to take the bit in, hopefully knowing that you sooner or later will be bitten. For philosophers a sour bite might come from concepts that have been thought and written about for centuries and now suddenly appear in all kinds of literature without their philosophical etymology. I am not only thinking about “mind” and “consciousness” here, and I will not even begin to *try* nesting out this web. I have already problematized how easily concepts like “skill”, “knowing how” and “ability” are mixed (see 2. 4.). Add to that “procedural long-term memory”, “motor knowledge” and “automatic behavioural response” and you’ll get what I’m getting at. Let me just exemplify with some other concepts which have more or less sneaked back and forth passed the concept guards of psychology, philosophy and now natural (neuro) science.

Key concepts like “attention”, “awareness”, “conscious”, “focus” and “focal” are used extensively in different scientific fields. Like “consciousness”, we all have personal folk psychological ideas of what they mean. Indeed, we experience states of attention, awareness and focus every day. The concepts seem so familiar, like consciousness, that they perhaps need no clarification. But interesting things happen when we put these concepts together. In the discussion on psychological and phenomenal consciousness in 2. 5., I have tried to show that attention and awareness are not identical. On the one hand, attention seems to be something I use and have (“I put my attention to it”), while awareness is more of a state I am in (“I am aware of x”). This reflects how Chalmers highlights attention as functional and a good candidate for psychological consciousness, while awareness is more phenomenal in character. However, I can also *be* attentive (“I am attending to”), which makes the classification more fuzzy. Even when pointing to functional aspects, classifications seem to fade: notice the difference in being aware and being *consciously* aware. When you are consciously aware of something, it would be strange if you are not also attentive to that something. This leads us to the idea that attention seems to be some kind of spotlight that can be altered, focused – and plays a functional role. This is interesting because on a first meeting,

we might say that awareness is wider than attention (see 2. 5.). But if attention can be *focused*, that suggests that attention can also be wide, or directed to several things (or shifted back and forth). Conscious awareness also seems narrower than simple awareness. If attention can also be *focal*, it suggests that attention can shift between the focus of say x and y, but that only one thing (x) can be focal at a particular time. Add to that the difference between “conscious attention” (like in “it came to my conscious attention”), and simply “attention” and we are beginning to see a conceptual mess. I take it that “conscious attention” is signalling that what is attended to can be declared, while “attention” may mean that one can attend to tasks without declaring conceptually what one is doing, like we do when performing sport. This again leads us to the idea of the non-declarative, or implicit as automated, which again leads us to the idea that skills, since they are often non-declarative, are also automated. A similar problem present in this thesis is the distinction between knowing how and knowing that, assuming either that one is reducible to the other, or that they are essentially separate. Probably the conceptual mess is there because what we are trying to describe *is* a mess, in a literal sense. At worst it is a mess not distinguishable at all, at best the psychology and philosophy must be established *before* neuroscience comes knocking down our doors.

When neuroscience makes correlational or identity claims between neural events and the above examples, things start to get difficult indeed. Hopefully, one of the reasons philosophers are let in on the neuroscientific journey is to point (if not to solve) to such difficulties. An important contribution to further research in the philosophy of sport would also be to address this topic. We can just add “intentionality”, “tacit knowledge” and “background” to the list. Tacit knowledge, for example, might be both unconscious knowledge and implicit knowledge, and knowing how and automated skills might also be tacit knowledge. But is tacit knowledge, know-how and automated skill identical rigid designators? Probably not. Hopefully I have kept my own head above those conceptual troubled waters described here. However, even a quick bath makes everyone swallow some water.

## **5. 2. Difficulties, II: Philosophical methodology: should philosophers be quasipsychologists and quasineuroscientists?**

It might be argued that I have been too eclectic in this thesis, that I have borrowed some views from here, some from there and then used it wherever I’ve found it suitable. I guess I’m guilty as charged on this account too. But I have tried to use different theories, views and ideas

where they are hopefully appropriate. I honestly believe that philosophers interested in the mind should know something about the brain and neuroscience, something more than c-fibres and pain. I also believe that neuroscientists interested in the mind should know something about the philosophy of mind. Therefore I claim that it is appropriate both to use for example Edelman to criticize others and criticize Edelman himself on another occasion. The leading neuroscientists we have can be used accordingly on the work of others, but that does not mean that their own work is completely waterproof. I have taken some liberty then in using what I hope is valid information on the *brain*, and criticized the same information when I find it too eager in its jump to the *mind*.

Carl Craver (2007, p. vii) notes that there are neurophilosophers and there are philosophers of neuroscience. Neurophilosophers use neuroscience to discuss (traditional) philosophical issues, especially those concerning the mind. Philosophers of neuroscience target neuroscience to see how (traditional) issues in the philosophy of science are addressed. Patricia Churchland belongs to the class of neurophilosophers. In *Brain-Wise* (2002), she uses findings from neuroscience to address issues like consciousness, free will, learning and religion. Craver himself is a philosopher of neuroscience. He discusses for example what kinds of explanations are offered in neuroscience and what limits there might be to such explanations. We should perhaps question if there is any neurophilosophy worth taking seriously. For there to be such a thing, neuroscience and neuropsychology still have a long way to go. Meanwhile we should perhaps restrict ourselves to philosophy of neuroscience. But a less speculative neurophilosophy is bound to come sooner or later. I have taken the liberty to try out a little bit of neurophilosophy and a little bit of philosophy of neuroscience to address interesting topics related to sport sooner, rather than later. Perhaps there will in some not too distant future not only be a philosophy of neuro sport science, but even a neurophilosophy of sport.

### **5. 3. Difficulties, III: Constraints on technology (in neuroscience)**

There might be sceptics to how much impact neuroscience can deliver both to philosophy and sport science. For the moment, a major empirical constraint is measuring and recording brain events on moving animals. At the Centre for the Biology of Memory in Trondheim, Norway, neuronal events are recorded on rats while they try to find their way around a maze. Orienting in a maze is a classic memory test, and it is now possible to record neural events on moving



rats, linking spatial representation and memory to neural activity. Orienting in time-space is researchable by neuroscience – differences in skills might also be – to some degree as this thesis tries to show. Gunnar Breivik (2008) has written about the importance of vertical and horizontal planes in athletic excellence. Now, neuroscience might soon be in a position to see how the brain in athletes functions to put the body in these fundamental dimensions (as Breivik calls them). Now, that is major scientific advance. If we see the commence of approaches like those done on rats on humans, then neuroscience is damn close to revolutionizing sport science. Imagine recording all brain events on each footballer for an entire match. Surely only grumpy old men would not find such research interesting.

#### **5. 4. Further studies, I: the distinction between psychological- and phenomenal consciousness**

Lots of the thesis has rested on the distinction between phenomenal- and psychological consciousness. What if this distinction is a construction, and they cannot come apart, as I have hinted at in 2. 3 and 2. 5.? What would that mean? With a wide interpretation (see 2. 3.) it might be sufficient to simply exist and respond to stimuli to be said to have phenomenal consciousness. If we interpret phenomenal consciousness in this wide sense, which is what I have done on several occasions in the articles, then we might end up with allowing even zombies to have phenomenal consciousness. If on the other hand, like Chalmers and (sometimes) Nagel do, we demand that there is something *for* a subject to experience, then it looks like we are asking for some access to the feeling of being. On such an interpretation we must know that we are conscious and experiencing: we must be able to report or introspect somehow, or have psychological access to our phenomenal states. It seems to me that Nagel's original idea is not a distinction between mind and consciousness, or psychological- and phenomenal consciousness, but that everything about the first part (mind/psychological consciousness) is somehow entangled, inhabited or embedded in the latter part ((phenomenal) consciousness). I do not feel my usage of this problematic distinction hurts the thesis. I have used the standard distinction between the psychological and the phenomenal to show that considerations and explanations of consciousness *qua* consciousness continue without bringing the phenomenal aspect in. If we could establish (although I doubt that this could be done) that phenomenal consciousness was always present in any modality of the mental, the mind and consciousness; that would just make the arguments against (neural) reduction even

more powerful. Just how deep the roots of psychological and phenomenal consciousness grow together can be illustrated by a story from first person experience:

I was on a two day walking trip in the surrounding forests of Oslo with several friends. Some months earlier I had injured my knee badly, but with some support I was able to do the hike. On the second day, going down a steep and winding hill, I stopped and wondered: why do I not feel good about all this walking (I usually do)? I've been on a great trip, but I don't seem to be enjoying it. Then I realized that my experience of course was influenced by the knee trauma. Not surprising, but it suddenly had philosophical meaning. My psychological consciousness, like alertness, awareness and attention was constantly on the ground – making sure I did not fall, not getting more injured. This had the implication that my gaze was never up and above ground, I did not really have the experience of walking in a forest at all, and so I did not enjoy the walk either. I almost had a zombie mode/mood. Psychological consciousness was so occupied that phenomenal consciousness was low, or at least low in “feel-good”. This serves to state several important issues: when psychological consciousness is occupied (meaning high cortical activity in say areas associated with working memory – high attentional load), phenomenal consciousness goes down (or at least changes). This raises the further and more important question if psychological and phenomenal consciousness can come apart.

What about the other way around: low attention and low cortical activity. Low attention (a terrible concept, because athletes are certainly very concentrated when they perform – low attention means in this context low cortical activity in brain regions associated with focal attention (low attentional load)) seemingly means less psychological consciousness. That suggests more capacity for wider awareness, and maybe a stronger felt phenomenal consciousness. Maybe it is the case that when psychological consciousness is low, phenomenal consciousness is high? But this is obviously not always true. If awakesness is psychological consciousness, we would perhaps say that the more awake you are, the more strong a phenomenal state is felt. Other examples are so-called flow states, where the athlete is so focused that they seem to forget where and when, but have great subjective experiences (both psychological and phenomenal consciousness is high). Thomas Alsgaard (2008, pp. 119, 150-153) has reported on his extended awareness (remembering colours of spectators' clothing) and the correlating phenomenal consciousness (feeling great) when winning the 30 km cross country race at the Lillehammer 1994 Olympics.<sup>103</sup> If nothing else, we see how

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<sup>103</sup> Which is in stark contrast to the narrow focus of the experts in Milton's study (2007).

intertwined psychological- and phenomenal consciousness are. If they cannot come apart, then Edelman's attitude towards a person's life story must be revised: if the sum of earlier experiences influences our feeling of what it is like to be such and such in a particular situation (say a test of episodic memory), we cannot exclude this life story from the analysis of the situation. In other words: phenomenal consciousness has causal potency on psychological consciousness – the phenomenal state we are in (which is influenced by former experiences) is part of all our observable and reportable states. This has practical consequences: if you are doing research on working memory, research on long-term memory must be included because long-term memory says something about why working memory is such and such. I believe further research should investigate the possibility of separating psychological- and phenomenal consciousness.

### **5. 5. Further studies II: Skill and consciousness**

The “walking-story” further raises the issue of how skill changes both psychological and phenomenal consciousness. With a normal knee, I never paid conscious attention to where my feet were. I could jump streams, skip-step potholes and rocks and open both my psychological consciousness (attention) and phenomenal consciousness to experience smells, sounds and other sights. I suddenly realized how skill makes “phenomenal” in phenomenal consciousness. I also realized why so many people do not enjoy soccer, basketball, skiing or hiking: their psychological consciousness is so occupied that they never experience (positive) phenomenal feelings. Future studies of phenomenal consciousness in extraordinary athletes should be interesting to both sport science and philosophy of sport. Let me give some quotes from the late Norwegian guitarist Marius Müller to illustrate my point (Sviggum 1998):

It gives a hell of a kick feeling the wind from a 4x12 cabinet. It manifests physically in your body. It makes me play differently and it just feels right. I play better with all that volume, it gets the adrenaline going, which is important to me. (...) It doesn't matter how much you twist and tune your amp, your guitar sound comes from your fingers. You can modify what your fingers do by using different equipment, but what matters is how you hold the strings, how you make the strings vibrate, how you hold the plecter, how you strike. You just have to find what the best angle to hold the plecter and the speed of your strokes is for your fingers. This must be combined with where your fingers create the best sound between the bars. It's the same tone, but different sound. You just have to experiment with this to get the right feel. (my translation)

The feel theory described by Müller is similar to the feel theory Wertz promotes (1978). The strength of the feel theory is that it is not a standard formula for achieving greatness. Imagine musicians trying to play identical. Such an enterprise would soon leave little interest for

music, even classical music. The whole defining character of greatness in musicianship is interpretation, individual strokes, elaboration. Imagine a jazz pianist playing the same solo every time? It just wouldn't be jazz, if improvisation is considered a key element of jazz. If classical pianists played identical on every occasion, there simply wouldn't be any interest in hearing an artist twice, the whole idea of interpretation (which distinguishes the true artist and the fast "machine") would fly away. I really can't see anyone claiming that great jazz artists, or classical pianists are mindless/ unconscious. They must surely know where their fingers are, although they do not command their fingers with a prior declarative thought. Why then, do so many seem to believe that athletes are mindless or nonconscious when they move? Consciousness and how something feels should be "rediscovered" both in sport science and the philosophy of sport as something fundamental to almost everything else we are interested in.

On the one hand we might say that there is a physical description to what Müller is talking about. Sound waves, air pressure, acoustic conditions and so on. These physical events give rise not only to reducible events of neurophysiology (like release of adrenaline), but on the other hand they also give rise to a feeling or qualia. The point is that the same physical events give rise not only to qualia, but to different qualia. Consider a classical guitarist in the same event. It would be strange if the loudness and heavy thumping – the thunder in your belly – would make a classic guitarist play better. He would undoubtedly play differently, but probably not better, not in the ears of lovers of classical music anyway. This difference is of course the result of the two guitarists' lifetimes. We can imagine the same in sport: putting tennis players in front of the constant noise at Old Trafford – or even more profoundly: why is it so intimidating to play outside home court? The screams from the crowd is the same (in a physical sense) to everyone – and in the heat of the moment it must be hard to have any attention or awareness to whether they are cheering or booing you. Or imagine different players: some are best on the biggest occasions, some are Tuesday players, others are great on every occasion (like Michael Jordan). These differences are constantly intriguing to sport psychologists. I hope this thesis can motivate a further look to phenomenal consciousness to understand experts' skills and consciousness.

### **5. 6. Further studies, III: The mind as “experientionalism”<sup>104</sup>**

Thinkers like Clark (2008), Noë (2009) and Thompson (2007) have started to take neuroscientific findings to support a final settlement with the idea of the mental as something internal. For example, the mechanism of mirror neurons (probably working in conjunction with memory systems) might support and explain how experiencing something so-called mental is extended: when we observe another person hitting her thumb with a hammer, we feel the pain like the other because we have similar neural events. We might say that the mental state of pain is extended to, or from the other. Whether such theories are versions of externalism, or should be called “the extended mind view” is not important at the moment. More important is how these thinkers involve both neuroscience, philosophy of mind *and* phenomenology in their work. Such interdisciplinary approaches should be welcomed and used by the philosophy of sport.

### **6. 0. Does philosophy mean anything anymore?**

Suppose psychological consciousness can be studied and explained, for example by neuroscience. Certain aspects of attention and awareness can be studied by the neuroscience of memory, and so can the ability to consciously recall experiences. Awakeness can be studied by EEG measures. Intentional behaviour might be explained by the neuroscience of mirror neurons, especially motor intentionality. Explaining appropriate motor responses might be explained by mirror neurons among other mechanisms, and producing an appropriate motor response might be considered rational. We are perhaps closing in on the easy problem of the explanatory gap. If a piecemeal approach works, then perhaps the hard problem will some day fall as well. What is then left for philosophy? For the moment, at least philosophy of (neuro)science and conceptual clarification. Philosophers are still being allowed to board the ship of cognitive neuroscience. Philosophers of sport should jump onboard too, before the engines get running at a never-look-back pace. I hope this thesis can motivate philosophers of sport to start taking neuroscience seriously *and* contribute to discussions on what might be missing on topics like consciousness and skill. Philosophy does seldom have practical implications, but hopefully one consequence of this thesis might be a push forward to see what neuroscience teaches us on how the brain develops and we finally learn. Sooner is sometimes better than later, even when it comes to physical education, training and learning protocols.

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<sup>104</sup> “Experientionalism” is composed of “experience” and “extension” to form an -ism. On a closer look, there seems to be a dash of “expert” there as well.

If phenomenal consciousness (given a wide interpretation, see 2. 3.) is a minimum requirement for attributing consciousness to a creature, then consciousness should be quite common across species. It might also mean (at least in neuroscientific terms) that phenomenal consciousness is less complex than psychological consciousness. That is a justified belief if we take non-linguistic creatures to have what is it like experiences and hence phenomenal consciousness. This is to say that phenomenal consciousness may or can be implicit, or non-declarative. Turning to neuroscience, this is to look for the solution to the hard problem of consciousness in lower-laying regions in the brain, not neo-cortex. It should not amount to saying that phenomenal consciousness *is* a low-laying region like amygdala. Although we have learned from Damasio and LeDoux that amygdala have a causal role for emotions and feelings, events in amygdala are not identical to phenomenal consciousness. Joseph LeDoux himself seems to (sometimes) appreciate this point: “when I use the term *the self* I am referring to the totality of the living organism” (2002, p. 26). What should be included in “totality” is perhaps a philosophical discussion. If it means a person’s life story, neuroscience must reach the insight that “self” and “consciousness” is maybe best suited for philosophers after all. If we judge body and mind to be a closed system, or as extended, the neuroscientific fact about neural plasticity and connectivity seems to make hopes of full reduction just as impossible as Diderot and Rond d’Alembert’s idea of making the *Encyclopédie* contain all knowledge in the world. Both ideas miss their target due to the ever changing nature of the individual and world, and the lack of omnipresence. Science should strive towards objectivity and the so-called view from nowhere (or everywhere at once), although every view must be from somewhere. But if it is a *scientific* view, it can never be from *mywhere*.

What remains is that neuroscience *does* leave room for studying some implicit parts of consciousness. This is the lesson from the research on memory and mirror neurons, as well as the neuroscientists presented in this thesis. Phenomenal consciousness is quite often implicit it seems; it just feels like *that*. What we have also seen is that skills in sport are mostly implicit too. At the finish of this part then, we are at the start of article I: consciousness is a phenomenal case for sport.

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## **PART II**

### **Papers**

#### **Paper I**

Birch, J. E. (2009). A Phenomenal Case for Sport. *Sport, Ethics and Philosophy*, 3(1), pp. 30-48.

#### **Paper II**

Birch, J. E. (Forthcoming 2010). The Inner Game of sport: is everything in the brain?. *Sport, Ethics and Philosophy*, 4(3), pp. 275-294.

#### **Paper III**

Birch, J. E. Skills and Knowledge: nothing but memory?. Decisioned October 7<sup>th</sup> 2010 to minor revision in *Sport, Ethics and Philosophy*, due December 6<sup>th</sup> 2010

#### **Paper IV**

Birch, J. E. Intentional and Skillful Mirrors. Submitted to *Journal of the Philosophy of Sport* on October 17<sup>th</sup> 2010





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### A Phenomenal Case for Sport

Jens E. Birch

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## A PHENOMENAL CASE FOR SPORT

**Jens E. Birch**

*The article attempts to show some limitations to reductive accounts in science and philosophy of body-mind relations, experience and skill. Extensive literature has developed in analytic philosophy of mind recently due to new technology and theories in the neurosciences. In the sporting sciences, there are also attempts to reduce experiences and skills to biology, mechanics, chemistry and physiology. The article argues there are three fundamental problems for reductive accounts that lead to an explanatory gap between the reduction and the conscious experience. First, reductive accounts deal with objective observations; conscious experiences are subjective. Second, subjective experience seems difficult to identify with physical events described by chemistry, biology, mechanics or neurophysiology. Finally, sport involves knowing how and knowing how is also difficult to reduce to propositional knowledge, which is the reductive scientific/philosophical project. The article argues that sport provides an excellent platform to better understand what is wrong with reductive analysis in body-mind relations, since both conscious experience and knowing how are fundamental to sport performance.*

### Resumen

*El artículo intenta mostrar algunas limitaciones de las explicaciones reductivas en la ciencia y la filosofía sobre las relaciones cuerpo-mente, la experiencia, y la habilidad. Recientemente la filosofía analítica de la mente ha desarrollado una fecunda literatura gracias a las nuevas tecnologías y teorías en la neurociencia. En las ciencias deportivas también se dan intentos a la hora de reducir las experiencias y las habilidades a la biología, la mecánica, la química, y la fisiología. El artículo argumenta que las explicaciones reductivas tienen tres problemas fundamentales que conducen a un vacío explicativo entre la reducción y la experiencia consciente. Primero, las explicaciones reductivas tienen que ver con las observaciones objetivas mientras que las experiencias conscientes son subjetivas. Segundo, parece difícil identificar la experiencia subjetiva con los procesos físicos descritos por la química, la biología, la mecánica, o la neurofisiología. Finalmente, el deporte implica el saber cómo ['know how': conocimiento práctico], y es difícil el reducir tal saber cómo al saber proposicional, que es el proyecto científico-filosófico reductivo. El artículo arguye que el deporte proporciona una plataforma excelente para comprender mejor en qué se equivocan los análisis reductivos de las relaciones mente-cuerpo, ya que ambos, la experiencia consciente y el saber cómo, son fundamentales para el rendimiento deportivo.*

### Zusammenfassung

*Dieser Artikel versucht die Schwächen reduktionistischer Ansätze in den Naturwissenschaften und der Philosophie in Bezug auf Körper-Geist Verhältnis, Erfahrung und Fähigkeiten*

aufzuzeigen. Aufgrund neuer Technologien und Theorien in den Neurowissenschaften ist in jüngster Vergangenheit eine Vielzahl von Publikationen im Bereich der analytischen Philosophie des Geistes entstanden. Auch in den Sportwissenschaften gibt es Versuche, Erfahrung und Fähigkeiten auf die Biologie, Mechanik, Chemie und Physiologie zu reduzieren. In diesem Artikel wird behauptet, dass es drei grundlegende Probleme reduktionistischer Ansätze gibt, die zu einer Erklärungslücke zwischen der Reduktion und der bewussten Erfahrung führen. Erstens: reduktionistische Ansätze behandeln objektive Beobachtungen, bewusste Erfahrungen hingegen sind subjektiv. Zweitens scheint die subjektive Erfahrung schwerlich mit körperlichen Ereignissen vergleichbar wie sie durch Chemie, Biologie, Mechanik und Neurophysiologie beschrieben werden. Und schließlich: Sport erfordert praktisches Wissen und solcherlei praktisches Wissen ist ebenfalls schwerlich reduzierbar auf propositionales Wissen, was gerade die Aufgabe von reduktionistischen wissenschaftlichen/philosophischen Bemühungen ist. In diesem Artikel wird behauptet, dass der Sport eine hervorragende Plattform zum besseren Verständnis der Fehler reduktionistischer Analysen in Bezug auf Körper-Geist-Beziehungen bietet, da sowohl bewusste Erfahrung als auch Fachwissen von grundlegender Bedeutung für sportliche Leistungen sind.

### Résumé

Cet article s'efforce de montrer quelques limites des approches scientifiques et philosophiques envisageant de manière réductionniste les relations corps-esprit du point de vue de l'expérience et de l'habileté. Une vaste littérature s'est récemment développée en philosophie analytique de la pensée, en raison des nouvelles technologies et théories des neurosciences. Dans les sciences du sport, il existe aussi des tentatives pour réduire les expériences et les habiletés à la biologie, la mécanique, la chimie ou la physiologie. L'article démontre que trois problèmes fondamentaux découlent d'une lecture réductionniste et amènent à créer un fossé avec l'expérience consciente. Premièrement, les approches réductionnistes sont reliées aux observations objectives alors que les expériences conscientes sont subjectives. Deuxièmement, il semble difficile d'identifier l'expérience subjectives comme des événements physiques décrits par la chimie, la biologie, la mécanique ou la neurophysiologie. Enfin, le sport implique de savoir comment, et il est difficile de réduire ce savoir comment à une connaissance hypothétique qui est la forme réduite d'un projet scientifique ou philosophique. L'article montre que le sport fournit une excellente base pour mieux comprendre ce qui est faux dans l'analyse réductionniste des relations corps-esprit, car l'expérience consciente et le savoir comment sont tout deux fondamentaux pour la performance sportive.

### 摘要

本研究嘗試論證採用科學和哲學的化約論，來研究身心關係、經驗與技術，會有其侷限性。有關心靈的分析哲學由於神經科學的新科技與理論發展，增加了許多文獻產出，在運動科學領域，也嘗試將經驗和技術化約為生物學、力學、化學和生理學。本文論證採用化約論有三個根本問題，會使得化約的詮釋與主體意識經驗有所落差。首先，化約論適用於客觀的觀察而非主觀的意識經驗；再者，身體活動的主體經驗似乎與化學、生物學、力學或神經生理學的描述有所不同；最後，運動牽涉了將知識轉換為行動的瞭解，這個過程很難簡化為化約科學和哲學所尋求的知識命題。本文提出運動做了最佳的展示平台，來說明採用化約論分析身心關係的錯誤，因為意識經驗與將知識轉換為行動的能力，此兩者都是運動表現的重要基礎。

KEYWORDS consciousness; reduction; explanatory gap; identity-theory; knowing how

Here's a story on wine. I want to make two wines, Ba and Bo. I want them both to be excellent. I use the same grape variant, Nebbiolo, and I harvest the grapes on the same day. It is late October. The grapes are harvested by hand from different vines. I want to make Ba from vines cut with *guyot* and Bo from vines cut with *gobelet*. Both wines have the same amount of sugar, 17 grains per one per cent alcohol. During maceration, Ba lies for 18 hours, Bo for 16. I have decided to experiment with barrels. As a traditionalist I oppose the use of *barrique*. Ba spends 21 months in Slovenian *bottè*, Bo 23 months in French *bottè*. I do not have labels, so I keep them separated by having Ba in Bordeaux and Bo in Bourgogne bottles. I leave them on bottle for three years. Finally it is tasting time. I use the same glass, tasting both. I prefer Ba, but I don't know why.

Here's a story on soccer. I start playing soccer as a seven-year-old for a club. We practise approximately three times a week until I'm nineteen. I practise throw-ins, kicking, shooting, dribbles, heading and passing. I also work on endurance, strength, pace and flexibility. I guess I really don't work on flexibility, but occasionally I do some stretching after matches. I think soccer is a wonderful sport. You play with your friends, run on grass, watch and are being watched. I even watch other teams on TV, teams that are a lot better than my own. My favourite team is the Brazilian national team. I also talk a lot about soccer. I talk about shoes, length of shorts, flair, tactics and hairdos. I'm quite good at some soccer skills, and at others I'm quite bad. Sometimes I do some really good stuff on the pitch. Other times I'm completely out of the game. I don't know why.

Is there a connection between these two stories? If so, what is it? And what's the answer to the 'I don't know why' questions? I believe that there certainly is a connection between the stories – and that this connection has something to do with consciousness. Consciousness is also the reason 'why we don't know'. It is my belief that we find some answers to this encounter in contemporary philosophy of mind. And the answer, or story, is called the explanatory gap. The explanatory gap claims that when it comes to consciousness, there exists a hard problem that cannot be explained by reductive sciences. That is also my approach. I will use examples ranging from pregnancy to pole vaulting as we go along to illustrate how the hard problem of consciousness creates an explanatory gap. In the above examples, I will claim that the reason I prefer Ba to Bo cannot be reduced to differences in bottles, vine cutting or maceration time. I will also claim that the reasons why I'm sometimes not successful on the soccer pitch cannot be reduced to angles in joints, force vectors or neural activity.<sup>1</sup> Neural activity is a key notion here. After centuries in the dark, philosophy of mind has awoken. This is due to recent discoveries and improvements in the brain sciences, above all in the neurosciences. Neuroscientific progress is again pushing towards a reductive stance concerning consciousness. One such reductive account comes from philosopher John Perry. He claims that the questions in my examples can be answered and gives interesting arguments to how. I will argue that Perry is wrong. I will claim there are questions we cannot solve reductively, and questions concerning consciousness are in this category.

But what does all this have to do with sport? First, I think that sport provides excellent examples on how reductive strategies miss out on a key element of consciousness, the experiential dimension. Second, analytic philosophers rarely dig into

skills and knowing how when they analyse consciousness; they deal primarily with propositional knowledge.<sup>2</sup> I want to argue that sport, again, provides insight as to why such a tactic is not optimal. Third, the position that is defended throughout this article argues against a view which treats athletes as non-conscious. The key issue here is the relationship between consciousness and knowing how, and the phenomenal consciousness involved in sport. Finally, I believe that it is important for philosophers of sport to remind other sporting sciences such as mechanics, biochemistry and (neuro)physiology that the explanatory gap is alive and well. If this is so, philosophy is still a justified activity, even in the face of modern brain science. And if my argument is at all on target, so is philosophy of sport.

I think it is helpful to start by looking at what kind of consciousness is under debate, and then place Perry in the analytic landscape and discussions of the last 50 years.<sup>3</sup> This, I think, is not only helpful because it will clarify some major positions and their contributions to sport science, but also because philosophy of sport has had a tendency towards phenomenological approaches on the mental.<sup>4</sup> In this context, the discussion's focus is on the pillars of reductive and non-reductive physicalism. An initial statement of reductive physicalism may be: a position where all events, states and properties of human behaviour are reducible to physico-chemical or neuronal events, states and properties. Non-reductive physicalism, although sharing the belief that there exists nothing but physical matter, denies the idea that all human faculties are micro-reducible to physical statements without loss of meaning. According to non-reductionists, it is especially consciousness that escapes reductive accounts.<sup>5</sup> The limelight in this article will be directed towards identity theories as they are perhaps the prime examples of reductive physicalism. Next, I will give a more in-depth account of non-reductive physicalism and the explanatory gap. It is from this outline that I will look more closely at Perry's identity theory and how he deals with the explanatory gap. Before the concluding remarks, I will argue that Perry is unable to close the gap because consciousness is related to knowing how, and knowing how cannot be fully accounted for by reduction to knowing that. Finally, I conclude by claiming that although reductive sciences give us great insight, they are unable to provide a complete physical account of consciousness and sport. These sciences should acknowledge this and keep in touch with philosophy.

### Our Phenomenal Consciousness

Before turning to the more historic paths of the last 50 years, it will be useful to start with what this article is mainly about; the many faces of consciousness. After Nagel changed the focus of the mark of the mental (see below), much debate has been concerned with describing consciousness.<sup>6</sup> In this article I will use Chalmers's distinction between what he calls *psychological* and *phenomenal* consciousness (Chalmers 1996, ch. 1). What Nagel called consciousness is today called phenomenal consciousness and the old concept of mind is now standardly called psychological consciousness. Confusingly, phenomenal consciousness is often referred to as just consciousness, and the distinctions are not clear-cut.

According to Chalmers, phenomenal consciousness 'is the concept of mind as conscious experience, and of a mental state as a consciously experienced mental state'. Psychological consciousness 'is the concept of mind as the causal explanatory basis for behaviour' (Chalmers 1996, 11). Examples of psychological consciousness are awareness,

introspection, attention, reportability and intentionality. These psychological aspects say something about what consciousness *does*. The phenomenal perspective, on the other hand, says something about how consciousness *feels*. The central mark of phenomenal consciousness is experience. That is, the subjective quality of the experience. Perception, thinking and acting do not occur in a dark vacuum; it has a what's-it-like feeling to it. In this way, Chalmers, like Nagel, focuses on a minimal criterion for attaching consciousness to a creature: 'We can say that a being is conscious if there is *something it is like* to be that being' (Chalmers 1996, 4). Chalmers believes that what he has singled out as psychological consciousness could be ascribed to machines (or zombies), while phenomenal consciousness could not. This leads to his notion of the easy and the hard problem of consciousness. The easy problem is to give a full scientific description of psychological consciousness; the hard problem is phenomenal consciousness. What is it that makes phenomenal consciousness such a hard nut and even digs out an explanatory gap?

There are notably two things that make phenomenal consciousness hard to crack, and they will accompany us throughout the article: subjectivity and qualia. The hard problem is a twofold one: what's it like *for me* (the subjective dimension – Nagel's argument) and *what's* it like (the qualia dimension – Jackson's argument, see below). The subjective dimension is a question about whether it is possible to reduce subjective first-person knowledge to objective third-person knowledge without losing some important part. The qualia dimension is, to quote Colin McGinn, a question of: 'How can Technicolor phenomenology arise from soggy grey matter?' (McGinn 2003, 438). In *Purple Haze*, Joseph Levine argues that the qualia problem is a symptom of the subjective dimension of phenomenal consciousness (Levine 2001). He defends a physical monism, but believes that phenomenal consciousness cannot be reduced to physical theory. There is, he says, an explanatory gap that in principle cannot be closed.<sup>7</sup> Levine believes that rationality and intentionality (psychological consciousness) can be explained and reduced by syntax, logic, neurophysiology and cognitive science – the tools are there to start and end the mapping. But, Levine says, 'when it comes to (phenomenal) consciousness ... we are clueless' (Levine 2001, 6). Only to imagine what such a theory would look like without losing the phenomenal dimension seems difficult. The explanatory gap then, is a non-reductive physicalist's claim that some phenomena are not reducible to lower levels by identity or functionality. It is an epistemological, not an ontological claim.<sup>8</sup> This is the claim attacked by positions such as Perry's. It is also the claim that will be defended throughout this article.

### Analytic Philosophy of Mind from 1950

In the late 1950s, armchair philosophy turned to brain science to solve the mind-body problem. Classic articles such as 'Is consciousness a brain process?' (Place 2002) and 'Sensations and brain processes' (Smart 2002), established the so-called identity theory. The identity theory simply reduced mental phenomena in a quite elegant way: There is nothing mental above or beyond physical happenings in the brain; these happenings simply *are* the mental phenomena. Like water just is H<sub>2</sub>O, the mental phenomena of subjective pain experience, is just the objective physical phenomenon of c-fibre firing – M = P. Why I favour Ba is neural event z, my failure at the pitch simply is neural event y.

Identity theory was the new wine until Kripke's famous work, 'Identity and necessity' (Kripke 2004).<sup>9</sup> Crudely, Kripke's argument says: if M has just one property that P does not,

then M is not identical to P. According to Kripke, identity must be necessary, not contingent. Kripke's argument claims that what picks out something in one world must pick out the same thing in every possible world. What picks out the same thing in every possible world Kripke calls a rigid designator. Proper names are rigid designators because both Pelé and Edson Arantes do Nascimento pick out the same person in every possible world. Or: if every pain is identical to c-fibre firing, then there cannot be pain without c-fibre firing and vice versa. But surely we can imagine possible worlds where there are creatures that experience pain without having the same central nervous system as we do. But we cannot imagine a world where Pelé is not Edson Arantes do Nascimento; because Pelé simply *is* Edson Arantes do Nascimento. The conclusion is that pain simply is not c-fibre firing and pain cannot be reduced to happenings in the brain or CNS. The identity theory is false.

One interpretation of Kripke's argument is that there may be many ways to realise the same thing or property; it was an argument of multiple realisation. This led to another reductive physical strategy: functionalism. Functionalism comes in many different formulations, but they have some common features: functionalism defines mental states by their causal relations to each other and to inputs from the external world and behavioural outputs. It is thus relations as causal roles that are important, not the intrinsic qualities of the matter which instantiate the relations.<sup>10</sup> Hence, the multiple realisation argument claims that different matter can produce the same function. Computer functionalism is the typical case: the function of a computer can be built in many different ways – it is not the hardware, but the software that plays the crucial causal role. Transferred to brain science this means that it is not the matter of the brain, but its arrangement that plays the proper causal role in producing behaviour and mental states. In sport science it means that information is processed in a causal manner leading to certain (skilful) behaviour and ways of learning. These causal roles just happen to be a certain electro-chemical activity, but it doesn't have to be like that. Again; if we could reduce how these neurobiological foundations cause behaviour, it would be possible to duplicate behaviour with other kinds of material and on that basis increase our understanding of human behaviour.

Functionalism has had enormous influence on cognitive science, philosophy of mind and the way we think about sport. Skill acquisition, motor control and learning theories based on information-processing theories such as closed loop and cybernetic models are directly linked to (computer) functionalism.<sup>11</sup> Functionalism has also been the target for some serious criticism.<sup>12</sup> In this article I will concentrate on identity theories, since they are again in the forefront – and, if they are correct, can close the explanatory gap.<sup>13</sup>

### Non-reductive Physicalism and the Explanatory Gap

In this article I want to address two intertwined arguments against any form of reductive physicalism: the knowledge and the explanatory gap argument. These were both inspired by Thomas Nagel's classic article 'What is it like to be a bat?' (Nagel 2006). Arguably, it is Nagel who reintroduces *consciousness* in the mind-body debate, separating it as something special in the already confusing conceptual universe of the mental and mind. Four years earlier, Donald Davidson had argued for the unlawfulness of mental events from a full-blown physicalist perspective, and now Nagel helped establish what is now known as non-reductive physicalism (see Davidson 2006).<sup>14</sup> Nagel, then, claims that it

is consciousness that makes the mind-body problem difficult (Nagel 2006, 255). Like Davidson before him, he accepts the monistic ontology of natural science. What is it then that makes consciousness so special? Nagel's answer concerns what consciousness is. It is, he says, the feeling of what it is like to be something. This feeling is private and subjective. Science, on the other hand, deals with the objective. The mark of consciousness, for Nagel, is subjective experience, and this experience cannot be reduced to objective states like neurophysiology. So even though we knew all there is to know about bats, we could not know exactly what it would be like to be one. Such knowledge could be obtained only by being a bat, and to know exactly what it is like to be bat B, one must be bat B.<sup>15</sup>

In *What Mary Didn't Know* Jackson (2003) tells the story of the super-scientist Mary, who knows all physical descriptions of matter.<sup>16</sup> Jackson's knowledge argument portrays Mary living in a black-and-white room: she has never seen colours, but knows everything about them – from a scientific point of view. When she is released from the room she learns something new, Jackson claims – what it is like to experience colour. Jackson not only makes the claim that Mary learns something the physical sciences could not possibly teach her, but also the claim that physicalism is altogether false. The latter claim is not on line in this paper, the former claim is. And it takes a new form with Joseph Levine and the above-mentioned explanatory gap.

### Perry and Mary

Leading neuroscientists (e.g. Edelman 1992; 2006) argue against functionalism directly; others claim *only* grey brain matter can produce higher-order thoughts and feelings (see e.g. Changeux 1997; 2004). This has again promoted identity theory as a relevant philosophical position. Perhaps non-reductionism does not have the upper hand any more. One major scholar who denies the explanatory gap is John Perry (2001). He argues for an identity theory, and the reason is his trust in neuroscience and how identity theory closes the explanatory gap.<sup>17</sup> In a direct response to Jackson and Levine, he refuses substance dualism, but believes that the explanatory gap is a question about how concepts are used and refers to mental and physical states. First I want to examine his arguments against non-reductionism and then I want to argue that they are not successful in denying the existence of an explanatory gap.

Perry calls the zombie argument (the absent qualia), the knowledge argument and the explanatory gap argument descendants of Descartes's conceivability argument (Descartes 1996, 54).<sup>18</sup> Descartes claimed that the conceivability argument showed that 'I' cannot be identical with 'body'. His argument was an ontological one, going from the conceivability of disembodiment to the ontological possibility of a disembodied mind. Perry claims that zombie, knowledge and gap arguments all go from logical to metaphysical possibility. As such, he calls them neo-dualist arguments. Perry's intention is to show that if their ontological claims are unjustified, so are the epistemological ones. If he can do this, he has not only rejected substance dualism, but also non-reductive physicalism. Perry has two strategies: first to refute Kripke's argument on the contingency of mental properties, then to attack Jackson's knowledge argument. If both can be defeated, he claims there's no reason to believe there is an explanatory gap. In this article I want to concentrate on the knowledge argument, because I think it is more relevant to sport. But some remarks on Kripke are in place because this is thought to be an extremely strong argument against any kind of identity theory and might be so against



neuroscientific approaches to consciousness as well as mechanistic and biological ones to sport.

Perry's answer to Kripke's demand for necessity in identity is that scientific identities are not a priori; we discover them a posteriori. The identity between H<sub>2</sub>O and water is necessary, but it is scientifically discovered. Perry claims that it is absurd to question if water and H<sub>2</sub>O picks out the same thing in all possible worlds. What someone calls water could of course be made up of something else than two hydrogen molecules and one oxygen molecule, but then it would have different properties. In the same way, Perry denies that the relation between pain and neural events is contingent. If what we call pain would be caused by something else, then the feeling of pain would be different. But the identity is not there a priori. We have an intuition that mental events and neural events are not the same, but science will eventually persuade us that it is. If Perry is right about this, the zombie argument is also rejected: even though we can imagine zombies showing all signs of behaviour just like us without any phenomenal consciousness, this is metaphysically impossible. The reason is simple: if they act exactly like us, being identical – they must necessarily be identical – also when it comes to consciousness. I believe Perry's arguments are strong, though perhaps not conclusive. Sport provides good examples to why: there are many (also individual variations) ways to realise the same movement. There does not seem to be one necessary way to bend your knees to make a three-pointer. More important in this context though, is his encounter with the knowledge argument.<sup>19</sup>

In my introduction I wrote about two cases of knowledge gaps that seem different from Jackson's Mary case. My aim is to argue that the Mary, wine and sporting examples have something important in common. I want to do this by showing what I believe is Perry's flaw in his rejection of the knowledge argument.

Perry accepts the intuition that Mary learns something new when she steps out of her black-and-white room. But he denies that what she learns is a non-physical fact. This is also Levine's and my view. But what is it that Mary learns, according to Perry? It is to think about certain phenomena in a new way. Perry claims that what Mary learns is equivalent to what the Babylonians learned when they discovered that the evening star and the morning star is one and the same thing. Mary, knowing all propositional knowledge there is to know about experiencing red learns that *this* (the subjective experience) just is *that* (the propositional knowledge) – they are one and the same. What she learns is how to refer concepts to certain phenomena, nothing more.

How does this relate to sport then? Imagine a super-soccer-scientist. Let's call him Ronald. Ronald knows all there is to know about soccer, but he has never played the game. Would Ronald have complete knowledge of why I failed on the (introductory) pitch? What is it Ronald's missing? Well, it isn't an 'o' or the 'inho'. It is, of course, that he doesn't have the skill of playing, *and* he has not experienced how it feels to play. Would we agree with Perry that when Ronald actually got around to play the game, that what he has now learned is only to refer his earlier propositional knowledge to some experiences? That would be to claim it is only a syntactical-semantic difference between having all theoretical knowledge there is and that of really playing the game. Perry claims 'knowing what it is like to have an experience and knowing how to do something are both special cases of knowing that.' (Perry 2001, 158) What does this mean? It means that knowing how is philosophically uninteresting and can be reduced to knowing that. This is the case when we learn how to relate experiences (knowing how) to some physical descriptions (knowing

that), Perry says. To learn something new, on the other hand, is to gain a new description with a different truth-condition. For Mary to gain new knowledge, the truth conditions in Mary's descriptions of experiencing red must be different from the ones she actually experiences, and they are not. So she does not gain any knowledge she didn't already have. The same with soccer: the truth-conditions of my theoretical knowledge must be different from the ones I experience in playing. If they are not, they are the same thing and I have only learned, by experience, to relate theoretical knowledge to practical knowledge in a new way. And so, according to Perry, the practical part is not a genuine case of knowledge. Mary learns something all right, but it is not knowledge, according to Perry. All there is, is propositional knowledge and reductive physicalism. That, of course, also means that there is no explanatory gap either. If this is true, we must abolish our belief that we learn something special about the world and ourselves when we practise sport.<sup>20</sup>

### Knowing How, Knowing That<sup>21</sup>

Let's get back to physical skills and sport. What about Perry's claim that Mary (and Ronald) only learns a knowing how and how this shows there is no explanatory gap? There are three clear cut views on knowing how's relation to knowing that:

- (i) Knowing how is not a case of knowing that at all (Lewis's [1997] and Nemirow's [1989] view);
- (ii) Knowing how is a special case of knowing that (Perry's view);
- (iii) Knowing that is a special case of knowing how (Noë's [2005] view)

Nemirow's and Lewis's position is interesting, because it accepts there is a difference between knowing how and knowing that. Even more interesting, the position denies knowing how to be a genuine case of knowledge at all. The reason is that actual knowledge always involves some propositional content, and this content can be the subject of a belief. If there is no content to have a belief about, then there is no knowledge to be concerned with. Knowing how does not have such a content, if it did, it would indeed be propositional knowledge (knowing that). Skills, unlike propositions, cannot change truth conditions, I cannot play true or false soccer. To break the rules is not to play false in this concern. This conception of knowledge is based on the classical definition of knowledge as true, justified belief. And if true, practising sport does not generate knowledge. Since Nemirow and Lewis deny that knowing how is knowledge proper, there is no explanatory gap either.

I do not find this to be a satisfactory view. For one thing, even if it turned out to be correct, it would still be an arrogant view to argue that if skills are not propositional knowledge we do not have to concern ourselves with them – that skills cannot be interesting or troublesome to the physicalist. I sure would like to know both how it feels to score against Real Madrid at Santiago Bernabéu and to have such a skill. Secondly, if we agree that Mary or Ronald learn a new skill, the non-reductionist wants to argue that *this* skill is irreducible – which is no less troubling. To put it differently: if the reductive physicalist can only explain beliefs and desires, which together form propositional attitudes (the standard analysis of intentionality – labelled as psychological consciousness above), then again phenomenal consciousness is left out of the picture. But phenomenal consciousness is what we want to grasp. One cannot rule out phenomenal consciousness

just because it might be knowing how. But if we accepted that phenomenal consciousness is knowing how, it would be interesting to philosophers of sport because we believe sport to be a case of knowing how. If consciousness's most basic property is also a case of knowing how, then sport should be one of the prime examples in consciousness analysis. Wouldn't that be something? This is not Perry's view, though. He believes that knowing how *is* knowledge, but it is reducible to knowing that.

Perry's view is that we have to learn through experience to categorise 'x's as 'y's and then see that experience *x* is identical to some description *y*. It is not the learning situation that is the explanatory gap. The gap is between the *x* and the *y*. When we learn that *x* and *y* are the same thing, there is no gap. OK. We can agree that it is not the learning experience that is the issue here, but it is more difficult to swallow the claim that all knowing how is reducible to knowing that, so that all skills can be known through propositional knowledge. That must be Perry's view. If not, we are back to Nemirow's position. Let's look at an example.

My wife is pregnant. What kind of knowledge does this involve? Only propositional knowledge? I think we all can agree there is something it is like to be pregnant. I, being a man, have not experienced this. If I had all the physical facts about pregnancy, would I know what it was like? According to Perry, if I did indeed become pregnant, the only difference for me would be to relate my prior theoretical knowledge to diverse sensations of experience: this\* proposition is that\* sensation of pregnancy. Here the two \*s are identical, I must only learn to see that they are. In one way Perry is right. For example, my wife, being a doctor, has read a lot about labour pain; they are contractions of the uterus. So when she now experiences these types of contractions she can relate them to her previous knowledge. The proposition 'contraction of uterus' is identical to the proposition 'labour pain'; they cannot be substituted without changing truth conditions. Perry's view is sensible in this way. But does this exhaust all knowledge there is to it? If it does, then there can be no knowledge to pregnancy except propositional, and that means that also I can know all there is to pregnancy.<sup>22</sup> It also means that the theoretical descriptions tell me everything about the sensation itself, even what the experience of pregnancy feels like. Can there really be physical descriptions so that I can actually feel the foetus kicking inside me? That must be a ridiculous suggestion. What my wife tells me about her pregnancy is one thing (no matter how perfect the physical description); her own experience of it must, surely, be something else. If not, it would mean that there is nothing to know about the feeling of a foetus kicking, except the words describing it. It would be strange indeed if pregnancy is the only kind of phenomenality that cannot be reduced to propositional knowledge. Again, it must be emphasised that the suggestion is not that sensations during pregnancy cannot be related to concepts *describing* the feeling. The suggestion is rather that this is not all there is to it, and that the feeling of pregnancy itself constitutes some kind of knowledge beyond this propositional knowledge.<sup>23</sup>

### Wine, Soccer and Knowledge

Let's think about wine and soccer again. Why do I prefer Ba to Bo? Is it because of some propositional fact? Let's say, reducible to smell? Well, it is the experiential character of the smell I want to know about. So I want to know if that can be reduced to physical language. That would be a story of how the molecules of Ba and Bo hit the receptors on my tongue, the release of this and that amount of sodium and calcium in synaptic clefts,

and the neuronal travel through some millions of dendrites to the olfactory bulb and different cortical areas around the tip of the temporal lobe. Does this tell me *why* I prefer Ba to Bo? No, to do that we'd probably need some story of how I compare Ba to a representation of what I enjoy, and Bo to another. In comparing these representations, some new information must be gathered from millions of dendrites, starting some 'decision-making' action potential bringing the information 'I prefer Ba to Bo' along millions of axons to some other cerebral cortical area. But that still doesn't do the trick. We need to know how these representations came to me in the first place. Did I taste Ba at my uncle's once? That may very well be, but let us stop the story at my uncle's. It seems quite obvious that this type of reasoning would be scientifically impossible and of course different in each individual case. If you have tasted some bottles of fine wine you know that they are never the same. And that old bottle of Ba at my uncle's surely not the same as the one I tasted at the beginning of this article. The view that it gives me pleasant associations is not enough – it is the experience of the associations themselves I want to know about. It is indeed difficult to swallow a view that preferring some wine only involves propositional knowledge.<sup>24</sup> But I still really do know that I prefer Ba, even in cases where it is difficult to taste which is Ba, and which is Bo.<sup>25</sup>

And the same for sport: we can probably find mechanistic analysis for all joints in a pole vault. We could perhaps also find all neuronal events in the brain, and all forces working on the body, ground and pole. But is this identical to how it feels to do a six-metre jump? The suggestion is 'no' and the reason is that the reference between all the angles, the neuronal events and my feeling of what's it like does not refer both ways. We could agree with Perry that the sum of all these physical events must probably be exactly what they are to give me exactly that feeling of such a jump; with the slightest change in knee-angles, my proprioception and subjective experience would probably be a little different. For a reduction to be complete, the descriptions and feelings must be identical. But how can a what's-it-like feeling be identical to the description of angles or neuronal activity? If they were, the description must contain the feeling itself. But a feeling and its physical description is no more identical than a ball and its molecular description. So although you can know an awful lot about basketballs by physical descriptions, you cannot know how it feels to throw a ball. You cannot throw a molecular description, and you cannot reduce the subjective experience of throwing it completely by descriptions either. Descriptions are *only* concepts trying to *describe* my subjective feeling, they are not the feeling itself. This is not to say that it is a matter of failure that propositions and state of affairs are not identical. The failure lies in the attempt to reduce phenomenal states to physical descriptions, or eliminate the existence and/or the importance of phenomenal states.

If propositions cannot contain the phenomenal feeling of jumping, can they contain the skill of jumping? Are the propositions identical to the skill? Consider Ronald, the super-soccer-scientist again. He knows all the theoretical knowledge there is about soccer. We are not talking about all there is to know about soccer today; we are imagining a full-blown theory here. Obviously Ronald cannot leave his armchair after studying the beautiful game and walk right on to Nou Camp and shine.<sup>26</sup> Obviously. So how can one even try to claim that the knowledge of actually playing soccer can be identical to Ronald's knowledge? If Ronald practises hard, one day he may master some skill such as a 100-foot pass in a stressed situation. Is this then a case where his theoretical knowledge is finally identical with his knowing how? That would be to say that he really did know how to

make such a pass all along, but only now is he relating the knowing that in a correct way. In this moment the knowing how and knowing that is identical. But if the two cases of knowledge actually are one and the same, then Ronald's former theoretical knowledge must be a knowing how in every instance. To put it another way: his former theoretical knowledge is now, related correctly, a knowing how. Ronald now knows the feeling of kicking the ball in a certain way. And now he can relate all of his former thoughts about soccer to the executive movements. If not, the two are not identical. At best they are identical at one particular time, when Ronald can say 'so that was what the book meant. Now I know myself.' But he didn't before, and he certainly did not have the skill. He really didn't know anything about either the feeling, or the good way to move. What he knew was there was a certain way to move, a good one, but didn't know how to do it – he lacked the skill. We could argue then, that there are actually two things that Ronald is missing: (1) the experiential dimension and (2) the skill. The dichotomy of the objective knowledge of physical theory and the subjective experience is again in front of us. To learn a skill, to experience something phenomenally, it seems we must have first-person experience – it will never be enough to know something propositionally to gain full knowledge of skills or phenomenality. If this is in any way close to the target, we can conclude that phenomenal consciousness cannot be reduced to physical theory and that knowing how cannot be completely reduced to knowing that. What Ronald knew was that there was a certain way to move, a good one, but he didn't know how to do it – he lacked the skill.

I want to finish with a few lines on the relation of knowing that, knowing how and consciousness. What is most stunning about reductions of experiential feelings and skills to propositional knowledge, like Perry's, is its obvious contra-intuition. Where does the project of identifying bodily, felt phenomena with theoretical sentences come from? I think one reason is Jackson's argument described as a problem of *knowledge*. If taken by a standard account of knowledge, it must be propositional knowledge that Mary learns when she leaves her room and experiences red. Another reason is perhaps Nagel's description of the bat's feeling of *what* it is like to fly around using sonar as perception. The 'what' also makes it sound like there is some proposition to be known to the bat. It might be less tempting to think about phenomenality as propositional knowledge if the phrase had been '*how* it is like'. This may sound trivial and just a philosophically constructed play on words, but I think it has something to it. In any case, it strengthens the link between phenomenal consciousness and knowing how, which Perry (and Papineau) acknowledges. Otherwise it might still be tempting to resolve the so-called mind-body problem by an appeal to the philosophy of language, as Perry tries to. My suggestion is not that language and consciousness are not related. It is rather that to solve (or reduce) questions of phenomenal consciousness by conceptual analyses alone seems to be starting off on the wrong foot. The reasons are simple: I do not need a language to experience things bodily, and although our concepts communicate our states well enough, they do not put *you* in *my* experiential state. How could they? Propositions are identical to themselves, not to the state of affairs, like the phenomenal states, they describe. No wonder giving birth may be accompanied by the utterance 'I didn't expect it to be like this'. As would your first skydive if not based on similar experience but on so-called complete descriptions of everything from aerodynamics to neurotransmission. Our language is again confusing: *what* I experience is different from *how* I experience. In the first case the answer could be 'fear, followed by happiness', perfectly reduced to knowing that. In the latter the answer should be 'I guess you have to do it yourself', a case

of non-reducible conscious experience. If these two cases are not identical, then there is an explanatory gap. I have argued that they are not, and so there is. But that should not trouble us. At least it should not trouble us to such an extent that it pushes us towards a physicalism so reductive it leaves out the phenomenal dimension we daily experience.

The conclusion must be that both (i) and (ii) described in the section headed 'Knowing How, Knowing That' are wrong. Knowing how is knowledge in itself and worth investigating (against i). And, knowing how is something different than knowing that (against ii). I have not discussed the third position: that all knowing that is a special case of knowing how. That might actually be true, but it is not necessary to state this stronger argument to show that there is something wrong about (i) and (ii).

### Conclusions

I hope this very limited and incomplete journey through contemporary analytic philosophy of mind has taught us something important. I have argued that reductive accounts of consciousness lack something crucial: the phenomenal part. Nagel's argument is that physicalism and science deal with objective studies and the feeling of what's it like is a subjective experience that cannot be reduced in an objective, scientific manner. If true, sport sciences must admit that the athlete's own experiences cannot be exhausted by analyses in biochemistry, neuroscience and mechanics. Another question is whether the athlete's own experiences are important to natural sciences of sport. My suggestion is that they are. It would be wrong for sport sciences such as mechanics to change an athlete's style on the basis of some general model of correctness. The gap is once again between the objective (the mechanical description) and the subjective (the particular athlete). To put it differently: it would be strange to tell an athlete that what he does is wrong because it differs from one type of reductive account, if the outcome obviously works for the athlete. The phenomenal feeling of what's it like to hit the ball in a good way is customarily the starting point for a reductive analysis, not the other way around. And it should continue to be like this. It leaves the window open for phenomenal consciousness – the athlete's feeling of what his way of moving around in the world is like. Then there's the question whether this phenomenal consciousness is also reducible. If it isn't, natural sciences must confess that there is an explanatory gap. The suggestion here has been that this gap is in principle unbridgeable. The first reason is the subjective-objective dichotomy. The second reason has been an argument against identity theories. If identity theories were indeed true, there would be no explanatory gap. But to bridge this gap identity between brain events and phenomenal consciousness must first be empirically established. It cannot be presupposed like Perry does. The article has questioned whether it is possible to establish such empirical evidence. The final argument was against the temptation to reduce knowing how to knowing that: if all knowing how is identical to knowing that, there is no phenomenality or skill left out by reductive science. But if there is just one case of knowing how that is not reducible to knowing that, then the identity theory Perry presents must be false. I have argued that it is, via the experience of pregnancy to skills in sport.

The last argument against identity theory is perhaps the most interesting to the philosophy of sport. It is an important discussion, since reduction from knowing how to knowing that is exactly what physical sciences in sport are trying to do. I have argued that phenomenal consciousness is somehow related to knowing how. Actually, it is Perry's (and

Papineau's) claim. Perry argues that what we learn in new experiences is knowing how to relate concepts to experiences. I have argued that even so, this does not explain the subjective experience of phenomenal consciousness. Besides, it creates a new problem: reducing skill to knowing that, since skill and knowing how certainly are related.<sup>27</sup> If practising sport is a knowing how in terms of skill (and I believe most people would agree it is), practising sport might also be knowing how sport experiences feel. Although I would not claim knowing how and phenomenal consciousness is one and the same, a weaker thesis may be proposed: even if all cases of phenomenal consciousness are not cases of knowing how, all knowing how involves phenomenal consciousness because there is something it is like to knowing how to do *x*, *y* or *z*. If my suggestions are right, then sport is full of phenomenal consciousness, which would imply that sport is a good place to study phenomenal consciousness. This not only shows how important sport can be, if like me you believe phenomenality to be important. It also shows how interesting and important sport sciences are and should be.

Maybe it is time philosophers started to realise that the issues concerning us most about human nature should first and foremost be a practical doing, a knowing how, and only later an armchair activity – a project to describe these doings, a knowing that. There is also a scientific lesson to be learned: reductionism and identity theories in philosophy of mind are prompted by new discoveries in neuroscience. But what neuroscience really shows us is yet to be decided. Philosophers' hankering to reduce our interaction with the world to sub-neural states is perhaps *passé*. Neuroscience, itself a reductionistic project, may show that reduction is incomplete in mind-body questions. Leading neuroscientific theories show such a strong interdependence of brain, body and environment that our conception of 'brain' as something detached is perhaps even a misconception (see Changeux 1997; 2004; Damasio 2000; Edelman 1992; 2006; Kolb and Wishaw 2006). This interdependence suggests that to have propositional knowledge, a knowing that, is impossible without interacting with the world in a knowing how way. If so, then the old 'true, justified belief' notion of knowledge must be abandoned. These neuroscientific questions are all up for empirical grabs. While we wait for further developments in the astonishing brain sciences, it is a relief to see that a ruthless reductive science hints at its own philosophical failure. The relief is that mind-body issues are still too important to be left to the natural sciences alone. And the main reason for this is phenomenal consciousness – just what may be regarded as a prime target for philosophers of sport.

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#### NOTES

1. Moe makes similar points, but he does not deal specifically with consciousness *qua* consciousness (see Moe 2007).
2. There have been similar contributions in the field, but not specifically on the mind-body problem (e.g. Whitehead 2007).

3. The article will not discuss substance dualism of any kind. The article concentrates on different physical monisms.
4. Although McNamee (2007) seems to argue that analytic philosophy has dominated the field in general, I believe phenomenology has dominated the body-mind part. Recent examples are Breivik (2007), Kretchmar (2007) and Ryall (2008), others include Hughson and Inglis (2002) and Morris (2002).
5. Brief, but good literature on the concept and versions of physicalism are provided by Horgan (1995) and Mylnak (2003). See also Kim (2005, chs. 2 and 4).
6. The works of Ned Block, Tyler Burge, Peter Carruthers and David Chalmers are noteworthy (see Block 1995; Burge 1997; Carruthers 2000; Chalmers 1996).
7. McGinn's argument is that we are cognitively closed from 'seeing' our own consciousness – it is a bodily deficit. Nagel argues that the gap is due to the impossibility of making subjective states objective. Levine, like Chalmers, claims that the gap exists because of a difference in physical and phenomenal concepts.
8. This article does not question if there are any other entities than physical ones – the ontological claim that physicalism is simply false or true. Instead, it is the epistemological claim that within a physicalist framework we could know everything about the universe and human beings that is questioned. This distinction between ontology and epistemology has been criticised (see e.g. Horgan 2004), but I believe it is fruitful in the following discussion. See also footnote 14.
9. See also Kripke 1980.
10. Lewis (1995) is the classic example of a reductive functionalism. A good overview on different functionalist positions is provided by Block (2004).
11. To review the enormous amount of such approaches goes far beyond the scope of this article, but some major contributions include Williams and Hodges 2005, part I; Honeybourne 2006; Piek 1998, part II; Schmidt and Lee 1999.
12. In the philosophy of sport, one such criticism comes from Moe (2005).
13. Two of the most influential arguments against functionalism are the inverted (see Shoemaker 1982) and absent qualia argument (cf. Searle 2006). The inverted qualia argument claims that it is possible that a system/computer/person might make precisely the same colour discrimination that I do, but when confronted by red objects it has the kind of experience that I have when confronted by blue objects. If this is true, functional reduction is not the proper way to analyse phenomenal consciousness. John Searle's 'Chinese room' argument (absent qualia) invites us to imagine a confined English-speaking agent who understands no Chinese. This person has a rulebook for transforming strings of symbols to produce further symbol strings. These symbol strings are in fact Chinese expressions. The person is an excellent rulebook performer and is soon capable of producing perfect answers in Chinese to Chinese questions. Now, would we say that this person understands Chinese? Searle's answer is 'no'. If we change the person with a computer, we can ask if the computer has any qualia related to its language manipulation. Even if we granted that the computer actually understood the language in question, we would not grant it the experience of qualia – no matter how complicated or functionally brilliant it was. Or that is Searle's suggestion, anyway. And if it is true, functionalism about conscious experience is false. This would also mean that if consciousness is involved in skill and motor control learning, information-processing theories built upon functionalism might not be the appropriate way to approach these themes in sport. I think we have



- every reason to argue that consciousness is involved in sport practice, for novice and expert. We are not zombie-athletes.
14. Davidson's anomalous monism is usually considered a token-token identity theory which claims that mental predicates and concepts are governed by principles of rationality, but physical predicates and concepts are not. Therefore it is not possible to reduce the former to the latter. An underlying premise is the absence of strict psychophysical laws. This unlawfulness combined with the irreducibility of the mental, makes Davidson's physical monism an anomalous monism. Jaegwon Kim makes strong arguments against non-reductionism in general and Davidson in particular (see Kim 2005; 2006). Kim argues that from the acceptance of ontological physicalism, it follows that we must also accept full reduction. If not, we must choose substance dualism or epiphenomenalism. This also means that one cannot separate ontological and epistemological questions concerning reduction of consciousness. These arguments should not go unnoticed, but to deal with them here would carry us too far away.
  15. Nagel holds a position where species of the same kind may share viewpoints and diminishing the difference of particularity. Nagel's position seems to say that the closer two species are to one another; the easier it will be to share viewpoints. So it is easier for a human being to know what it is like for a gorilla to see something, than a bat (see Nagel 2006, 258–60). This also holds for individuals sharing similar backgrounds, meaning that it is easier for the author to know what it is like to celebrate a nation's constitution today, than 200 years ago. Still, it is not possible for person A to know exactly what person B feels when they enjoy such a celebration. And this first person knowledge is the mark of phenomenal consciousness, although it is more or less approachable due to likeness in biological constitution and individual life story.
  16. The article is an elaboration of the knowledge argument and a direct response to objections mounted to Jackson's earlier article (see Jackson 2006).
  17. For other recent and similar identity accounts, see e.g. Block and Stalnaker 1999; McLaughlin 2001; Papineau 2002.
  18. There are many interpretations of Descartes's conceivability argument, but a short one may be stated like this: (i) I can conceive that I, a thinking thing, can exist without my body existing. (ii) Everything that I can conceive is logically possible. (iii) If it is logically possible that  $x$  can exist without  $y$ , then  $x$  cannot be identical with  $y$ . An excellent overview of the debate on conceivability and possibility from Descartes to Kripke to contemporary philosophy is provided by Gendler and Hawthorne (2002).
  19. Actually, I think identity theorists shouldn't worry too much about absent qualia arguments because these are directed more strongly against functionalism. Functionalism claims that we can get human-like behaviour from different building blocks. The zombie argument says that we can have human behaviour, but may risk zombie minds. This is of course also an argument against AI and conscious machines.
  20. Another identity theorist, David Papineau (2002), argues that we conclude reduction is false because we have trouble accepting scientific proof of identity between events in the brain and phenomenal consciousness. When we come to accept this identity, there is no more mystery to this than there is between water = H<sub>2</sub>O, or Pelé = Edson Arantes do Nascimento. And then the explanatory gap is gone. Papineau, like Perry, rests his case on how language works. The explanatory gap is seemingly there because language double-instantiates; language creates an illusion of distinctness. So in questions of consciousness we must accept that pain and c-fibre activity just is the same thing. Papineau still believes

that a science of qualia is impossible. This is because phenomenal concepts are vague and refer differently than physical concepts (Papineau 2002, ch. 7). The phenomenal concepts are coarse-grained and so they may refer to different events in the brain, the reference is uncertain, but they always refer to events in the brain. Papineau's conclusions are puzzling. First, it might very well be that physical and phenomenal concepts refer differently. But this does not make it true that there is mind-brain identity. Just because there is identity between molecular combinations and folk concepts elsewhere (H<sub>2</sub>O/water), that does not grant us a conclusive reason to accept an identity theory of brain-mind. Second, how can the link between phenomenality and brain be vague if there is identity? If there actually is identity, then this phenomenal feeling must be exactly this brain event. This cannot be a vague relation. That the concepts are vague does not make the relation itself vague, because there is, according to Papineau, only one thing – there really isn't any relation at all, there is identity. But if there is only one thing and we know the neural part of the story, it must be possible to have a science of qualia. If we cannot, there is still an explanatory gap.

21. It is beyond the scope of this article to give a thorough analysis of the concepts 'knowing how' and 'knowing that'. I will use them loosely like Ryle (See Ryle 1949, 28–41).
22. Nemirow and Lewis must in this regard claim that experiencing labour pain or kinaesthetic feelings are cases of know-how and not epistemological interesting, or that they are cases of knowing that (Perry's view). The former seems even worse off. I for one find it extremely interesting to know how it feels to have a foetus kicking in my stomach. The problem does not go away by claiming what Mary and Ronald are missing is know-how.
23. If Perry himself actually believes there exist physical descriptions that would generate the feeling of a foetus kicking, or give a person advanced soccer skills, is beside the point. But a position claiming that all experiencing and skills could be exhaustively reduced should. If not one must accept there exists an explanatory gap. Perry does deny such a gap.
24. There is surely propositional content in the story: 'it is true that I prefer Ba', but the point is that this truth cannot be reduced further by propositions because it involves subjective conscious experience.
25. We can compare this kind of preference as knowledge to examples of blindsight.
26. This point is also made by Steel (1977, 99).
27. The argument is meant to say: if you claim phenomenal consciousness is knowing how, what then?

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## THE INNER GAME OF SPORT: IS EVERYTHING IN THE BRAIN?

5

**Jens E. Birch**

10

*The article deals with the following: (1) Three brain imaging studies on athletes are evaluated. What do these neuroscientific studies tell us about the brain and mind of the athlete? (2) Empirical investigations will need a neuro-theory of mind if they are to make the leap from neural activity to the mental. The article looks at such a theory, Gerald Edelman's 'Neural Darwinism'. What are the implications of such a theory for sport science and philosophy of sport? (3) The article appreciates some of the neurosciences applications, but questions the hope of giving a complete theory of mind.*

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**KEYWORDS** philosophy of sport science; neuroscience; Edelman; consciousness

Between ourselves, it is not at all necessary to get rid of 'the soul' at the same time, and thus to renounce one of the most ancient and venerable hypotheses – as happens frequently to clumsy naturalists who can hardly touch on 'the soul' without immediately losing it. (Nietzsche 1966, 12)

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The neurosciences are the new loud.<sup>1</sup> Not only can the electric activity in the brain be recorded by electroencephalography (EEG), but single cell recording techniques can actually show which individual neuron fires in a certain movement or visual stimuli. And the temporal and spatial resolution of functional magnetic resonance imaging (fMRI) vastly outperforms positron emission tomography (PET), so we can see what parts of the brain are used for certain tasks.<sup>2</sup> These techniques are likely to improve rapidly.

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We all know that movements in sport are not generated by muscle and respiratory systems alone. The brain is involved in everything: you cannot see the ball without events in the occipital lobe, nor find your balance if the cerebellum is damaged. Neither can you choose between a pass and a shot without summations in axon hillocks, or extend your arm without events in the motor cortex. It seems that neuroscience should really be the sport science *par excellence*. Maybe the brain is a much better indicator of athletic ability than Vo2 max or 1 RM?<sup>3</sup> It certainly seems self-evident that the brain must be studied to get a more complete understanding of sport and physical activity. The neurosciences might give us solid empirical answers to questions like those raised by Breivik (2008) on the nature of movement.<sup>4</sup>

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50 At the moment imaging techniques such as fMRI are limited in use because the  
person being scanned must lie still. But in some near future, we could probably analyse  
what goes on in the brain while playing basketball. What we want to know then, is how  
the mind of the athlete is related to the body and the world. The neuroscientific revolution  
has also made sure that philosophy of mind is, if not the new loud in philosophy, certainly  
55 louder than it has been for centuries. It is considered plausible to study not only the brain  
and behaviour, but mind and subjective experience. And to do this in hard, scientific  
research language. How do these new scientific discoveries and theories relate to  
philosophy of sport and mind? It is the aim of this article to relate philosophy of mind, the  
neurosciences and a kind of philosophy of sport science. I believe this to be important  
60 because if you are going to ask and hopefully answer philosophical questions from a 'new'  
scientific perspective, we should have some insight into what philosophical water we are  
treading. This also concerns sport science because the neurosciences may teach us a  
valuable lesson about a great many things: first and foremost that the mind is intertwined  
with the movement of the body. That will be argued for in this article. It will also be argued  
that consciousness (see below) is the mark of the mental, and as such must not be left out  
65 in the cold by studies of movement, brain and mind in sport. (Human Kinetics' ad  
magazine for the first ever volume of biological sport psychology (Acevado and Ekkekakis  
2006) claims on page 45 that 'Cutting-edge research bridges the mind-body gap'. And  
Acevado and Ekkekakis (2006, ch.1) claims there is integration between mind and body at  
last. Williamson (2006, 29) seems to believe that understanding brain function is the same  
70 thing as understanding the mind. Finally the mind is being studied in sport by the  
empirical biological sciences. Or maybe it is only the brain that's being studied?

In this article I will first analyse three articles on fMRI and sport. What new insight can  
the neurosciences offer to studies of the mind in sport? If neuroscientists want to say  
something about the mind of the athlete, they'll need a base neuroscientific theory of  
mind. If not, it will remain just neuronal talk. One of the world's leading neuroscientists,  
75 Gerald Edelman (1987; 1992; 2006), presents such a theory. So the second part of this  
article will analyse the theory of Edelman and how the above-mentioned empirical studies  
fit such a theory. The link between the empirical work on sport and Edelman might seem  
at bit hazy, since the empirical work does not site such a theory. To make the leap from  
brain activity to mental activity, one needs a deck from where to jump. Without such a  
80 theory, relations between brain and mind remain speculative at best. The mission is to take  
a look at what such a theory *might* look like. The neuroscientific theory of Edelman is  
especially interesting to philosophers of sport because it puts more emphasis concerning  
the second half of the mind-body relationship. The theory makes claims beyond the scope  
of molecular and neuronal activity and moves to how the brain develops consciousness  
85 through the body and the world. Can we hope then, for a theory that goes from neuronal  
activity in the brain to higher cognitive aspects involved in sport? If so, the sport sciences  
must lend an ear to the new data arriving every week in neuroscientific journals and  
books. As Graham McFee (2007) says, at least we should hear their options before we wave  
them off. In the third and final part, this article argues that the neurosciences give us a  
90 better understanding of mechanisms underlying many aspects involved in sport. The big  
question is: is everything there is to sport in the brain? Would we know everything about  
sport if we could see and record every brain event during actual performance?  
Throughout this article I will use the distinction from analytic philosophy between  
psychological and phenomenal consciousness (see e.g. Chalmers 1996, ch.1).<sup>5</sup> Although

not clear-cut categories; psychological consciousness is what the mind *does* (awake, aware, alert, intentional, rational). Phenomenal consciousness is how the mind *feels*, the ‘what’s it like’ character (see Nagel 2006). It has been argued elsewhere that it is phenomenal consciousness that is the mark of the mental and what separates a conscious creature from something non-conscious.<sup>6</sup> This will not be discussed here, but be a platform for this article. This article will argue that the mind is equivalent to both psychological- *and* phenomenal consciousness. The article concludes that phenomenal consciousness is an important part of practising sport, but that phenomenal consciousness is not reducible to neuronal activity or organisation. If so, neither fMRI studies on sport nor theories like Edelman’s can provide complete accounts of the athlete’s mind, even if all brain events may be seen during actual performance. Without a complete account, an explanatory gap will remain unabridged also by neuroscientific methods or techniques.<sup>7</sup>

### Sport and the Neurosciences

It is an empirical question if the neurosciences make an impact on studies of mind in sport.<sup>8</sup> I will give but three examples: ‘The mind’s eye: Functional MR imaging evaluation of golf motor imagery’ (Ross *et al.* 2003), ‘The mind of expert motor performance is cool and focused’ (Milton *et al.* 2007) and ‘Why did Casey strike out?’ (Milton *et al.* 2008). In these articles, fMRI is used to study the mind of the performing athlete. That is interesting indeed. These studies are worth examining a bit further.

‘The mind’s eye’ (Ross *et al.* 2003) is a study of which brain areas are activated when visualising the golf swing. A first-person perspective is included – the subjects’ mental rehearsal of their golf-swing – as well as a third-person perspective: the active brain areas indicating the neural events causing, correlating or being identical with the mental imaging. It is, so to say, a reductive explanation of mental events in sport: reducing the mental event of imagery to neural events in the brain. And as such, it is also philosophically interesting, because the article suggests that this kind of reduction is possible and valuable. Six subjects with handicaps from 13 to 0 were tested in a ‘rest’ scan, scanning the brain while the subjects mentally imagined sitting at a beach. This was compared to brain scans of the visualisation of the golf swing. The study showed that the number of brain areas involved, and their degree of activation, diminished with lower handicap. And they conclude this has implications for (golf) learning theory, because compensatory increased brain activation due to failed automaticity may be resistant to conventional teaching methods (Ross *et al.* 2003, 1043). The study also showed that fMRI scans can feasibly be used to test effectiveness of visualisation techniques for athletes. That is not bad at all. I will comment on what I believe is problematic in the study below. But first, I want to go deeper into the related works of Milton *et al.* (2007) and Milton *et al.* (2008).

‘The mind of expert motor performance is cool and focused’ (Milton *et al.* 2007) is philosophically interesting because it makes daring claims. In the abstract, the author ‘suggests that the disparity between the quality of the performance of novice and expert golfers lies at the level of the organisation of neural networks during motor planning’ (*ibid.*, 804). If that is so, neuroscience really should be *the* sport science. This study compared pre-shot routine for six LPGA players against seven amateurs with less than two years’ experience. Using fMRI, the golfers were analysed when viewing a non-golf scene (for control), and then when mentally going through a pre-shot routine for a 100-yard

swing. As in Ross *et al.*'s study (2003), the experts had fewer brain regions activated and also less activation in the central regions. This means less energy needed for execution and implies more efficiently organised motor programmes. Only the novices activated lower-laying regions, the limbic areas and basal ganglia. This might be due to more fear and anxiety (normally associated with the amygdale in the limbic system), but the authors have another explanation. They suggest that novices have more trouble filtering out irrelevant information. Because beginners are not on the same level of automation, they must make conscious choices demanding more time and reducing accuracy (in actual performance). If the authors are correct in their analysis, they hope fMRI studies might stress the importance of sorting out relevant information and perhaps even develop more efficient teaching protocols (*ibid.*, 811).

In 'Why did Casey strike out?' (Milton *et al.* 2008), we can read the fascinating story of what is going on in baseball batters' brains. The article reminds us that baseball cannot be fully analysed by biomechanical physics. We also need an account of what goes on in the neural networks involved in motor programmes (*ibid.*, 43–4). The article's subtitle catches the drift: 'The neuroscience of hitting'. The authors argue that a baseball batter could never calculate the speed, angle, spin on the ball and come up with the right motor response, simply because the brain cannot possibly calculate these factors in the time available (*ibid.*, 44–7). This is a good example of practical implications from neuroscientific studies to sport science: the information-processing/functionalist model should not be the model theories are based upon.<sup>9</sup> I will return to this topic in the discussions on Edelman's theory, and in the section below, 'Reduction and the explanatory gap in the neurosciences'. On the positive side, neuroscience can give us a clue to what actually goes on inside the head of the athlete. In the case of baseball, Milton, Solodkin and Small argue that it is (a) the interpretation of the pitcher's movement and (b) the filtering of information that is important to finally preparing the motor programmes for the movements of the swing (*ibid.*, 49–52). To do this appropriately, the mirror neuron system comes to the rescue: when person A see another person B *perform* hand/arm movements, the same neuronal events occur in the motor cortex of A and B. So, we are in some way able to 'see' inside the brain of another person and predict the behavioural output: B's movements are mirrored in A's brain.<sup>10</sup> In this sense, we do not process information in some kind of calculation. Rather, it is done automatically (or 'mirroredly') in the brain. When movements are mirrored, we know intuitively what is going to happen – without conscious or processed thought.

We can sum up the two articles on golf making comparisons between novices and experts thus: novice golfers have higher brain activation than experts in almost all activated areas, and the novices activate more areas as well. These studies illuminate how the neurosciences are beginning to put their mark on sport science.

### From Brain to Mind?

There are several things that are problematic in the two fMRI studies on golf: the few subjects (six and 13); that the data on activation areas and strength are at best diverse; or that blood oxygen level dependent (BOLD), which fMRI shows, does not actually show neuronal events *directly* – only the amount of oxygen used by brain areas. Neither can fMRI show the type of neuronal activity, so it cannot be determined whether the activity is excitatory or inhibitory. Another empirical problem is the time course: neural events occur

in milliseconds – BOLD can only be measured a couple of seconds later. And why should we assume that a phenomenal state in visualising golf would consume more oxygen than a comparable phenomenal state? We might also want to object, with Paul Davis (2007), that other qualities such as courage are not under consideration in these studies, so we are just getting a very narrow answer to what expertise amounts to. Although important, these worries are not my major targets. 190

First, I would rather attack the supposition that the studies rely upon, namely ‘that mental rehearsal is somehow analogous to the motor planning that occurs with natural movements’ (Ross *et al.* 1041). That is indeed a key assumption. But how can we know that? If we cannot, at best we have seen the brain activation in imagery and mental pre-shot routine. At worst, we have only seen the brain activation in imagery and mental pre-shot routine in a laboratory, which might be quite different from the actual mental performances. If that is the case, all we have learned is that fMRI or its future replacement *might* be useful *if* it can be applied in real situations. 195 200

Second, is it feasible to think that the difference in performance lies at the level of neurons? On the one hand, it is not very surprising that brain activation differs both in subjects overall and in correlation with expertise. But on the other, it certainly does not explain why one is an expert and the other not. If that was the case, we could imagine that one could learn all there is to golf by exercising inside the MR machine to find the most efficient neural network and organisation. But I think we have very good reasons to believe that this would not do the trick. If we are to take Edelman’s theory discussed below at face value (and I think researchers like Milton, Ross and others should) it seems our brains must have bodily contact with the world to develop the enormous amount of synaptic connections that make up efficient neural networks and pathways. In a way, sport is a good counter-argument to an identity theory of mind:<sup>11</sup> if visualising and actual performance actually *were* identical on a neuronal level (which they are not since visualising also contains the inhibition of bodily movement), then visualising movements would do the same trick as performing them.<sup>12</sup> As we all know: it doesn’t.<sup>13</sup> To debate whether embodiment is conceptually necessary for skill possession or not is not where this article is going. The point is to see what sport science can gain from the neurosciences and maybe what not. 205 210

Third, how does one go from an efficient neural network to a focused neural network (Milton *et al.* 2007, 805)? Efficiency is shown by making the same (or better) performance by use of less energy. BOLD data suggest that something like Edelman’s ‘neural Darwinism’ (see next section) develops synaptic connectivity which is necessary for efficient networks in the brain. So we might say that neural networks are efficient in completing a task. But are the expert’s neural networks focused? If you simply answer yes, then you are leaning towards an identity reduction; neuronal events *are* the mental state of the performer. If you think that to be focused is just the filtering of information (like late or early selection) and this causes some brain activation to decrease, then you hold an information-processing theory.<sup>14</sup> I will argue below that neither position is favourable in mind- and sport analysis. But what is it to be focused anyway? Isn’t it a certain way to be in a situation, a ‘what’s it like’ or a state of phenomenal consciousness? It does not even have to be efficient, but it has a certain qualitative feeling about it. What might be called a lack of qualitative noise (efficient) is not necessarily the same as qualitative clarity (focus). The articles under discussion describe this as automation, but I would claim that most states of automation are not the prime candidate for focus. Being absorbed by the situation, what I 215 220 225 230 235

would call focus, is a quite different phenomenal state. Also, it seems strange that Milton *et al.*'s article argues that activation of the limbic system and basal ganglia is correlated with conscious thought and not automation (Milton *et al.* 2007, 810). The standard analysis is that conscious thought (meaning conceptual or a thought *about* something) is correlated with the neo-cortex. The limbic system and basal ganglia, on the other hand, are normally involved in the automaticity of the central nervous system. In evolutionary terms, the neo-cortex is necessary for human conscious thought. The article claims that the experts have more activation in the middle frontal cortex, and this explains a larger degree of automation. But it might be the other way around. This is not the place for what it means to be an expert, but it is appropriate to remind ourselves of Dreyfus's thoughts on expertise (Dreyfus and Dreyfus 1986): the expert does not act automatically, but intuitively.<sup>15</sup> On this interpretation of expertise, the expert must come up with novel movement because each situation is different. The expert does not act automatically, but in a fluent, coping and skilful way. Automatic behaviour is signified by the intermediate skilled person, showing the same solutions for slightly different situations.

Finally, Milton, Solodkin and Small think that it is unproblematic to go from pre-shot golf routines to the actual pre-swing baseball routine (Milton *et al.* 2008, 50).<sup>16</sup> In 'Why did Casey strike out?', it is argued that a baseball swinger has a pre-swing routine similar to golfers, so if fMRI studies on expert golfers show high activation in occipital cortex and cingulated motor area, low in the rest, then it should be the same in baseball. How so? The golfer's pre-shot routine is on a static ball, with no weather – ruled out in Milton *et al.*'s study (2007, 805) – and no opponent. What Milton, Solodkin and Small classify as the baseball batter's pre-swing routine has mainly to do with the opponent: the wind-up, the shoulders, previous pitches and so on (Milton *et al.* 2008, 47–8). The pre-routine of the baseball batter I find to be a perfect example of non-automation because the expert batter must adjust to each situation. I also believe that each golf shot is novel and not a kind of automation (though of course some muscular contractions are). But what Milton *et al.* have studied is not novelty. That is, their method shows what an expert would do *if* (s)he was in a situation of complete knowledge. The golfers/batters cannot possibly visualise a situation where they must adjust in the moment – creating novelty. They already know what is going to happen, because the opponent is themselves. In real sport, though, it is always a new situation. It certainly is in the meeting between pitcher and batter. Edelman and Tononi (2000, 142) describes exactly this situation:

When the tasks are novel, brain activation related to a task is widely distributed; when the task has become automatic, activation is more localized and may shift to a different set of areas. ... [W]hen tasks are automatized and require less or no conscious control, the spread of signals that influence the performance of a task involves a more restricted and dedicated set of circuits that become 'functionally insulated'. This produces a gain in speed and precision, but a loss in context-sensitivity, accessibility, and flexibility.

Clearly Edelman suggests that it is not the expert performance which needs less and narrow brain activation; it is the simple, automatized task. Edelman claims that in a novel situation – what I have claimed typifies top-level sports – brain activation is different, meaning not automatized.<sup>17</sup> We appreciate that neuroscience can give a fuller understanding of the brain-body relations in sport. But when Milton, Solodkin and Small claim that 'what appear to distinguish a good athlete from a poor athlete in these sports

are the activities that occur within the six-inch space between the batter's ears' (Miklton *et al.* 2008, 49), we must insist that sport performance is no more reducible to neuronal events alone than to biomechanical physics.

The three studies above claim to see into the mind of the athlete. But do they? The only thing they look at is brain activation. So is mind identical to brain? Or does the brain cause mind? To get from brain events to mental events, we need some kind of theory. Preferably a neuronal theory, since neurons provide the data under discussion. What, then, do the leading neuroscientists tell us about mind and brain? And do these theories change or strengthen our views of brain, body and mind in sport? Edelman's theory below is one example of the new neuroscientific views on the mind-body problem and how the brain and body relate and develop through interaction with the world. As such it has impact on the philosophy of sport. But in addressing philosophical issues, a theory also encounters philosophical problems. Are they accountable for in neuroscience? As philosophers of sport, we should point out that the part of mind called phenomenal consciousness plays a major role in sport (I will argue for this later). Therefore, consciousness should be studied in a serious way. Can the neurosciences be this way? At least they claim to study consciousness both seriously and scientifically.

### Consciousness and Edelman's 'Neural Darwinism'

So what's all this neuroscience about, really? Nothing but another reductive biochemical explanation of psychological phenomena? Well, yes – and, no. The most interesting thing about (some of) neuroscience is the attempt to include the phenomenology of subjective experience into hard scientific language. On the other hand, neuroscience is, to speak with John Bickle (2003), 'ruthless reduction'. That is, neuroscience is at large bottom-up reductions in terms of neural activity and synaptic transmission. How neurons communicate and cause things to happen is not the issue in this article. The issue here is how theorists take this knowledge and make further claims, especially philosophical ones about body, brain and consciousness.

Former Nobel Prize winner Gerald Edelman has high hopes on behalf of science (1992, xii): 'We are at the beginning of the neuroscientific revolution. At the end, we shall know how the mind works, what governs our nature, and how we know the world.'<sup>18</sup> Edelman wants to build a bridge between the humanities and the natural sciences and his bridge to close the gap is one of neuroscience. To do this, even subjective experience must be explained in neuroscientific terms. Of course, that will also close the explanatory gap. Philosophers of sport may then hypothetically ask: if we actually could see every brain event during performance, is that all there is to know? In *Bright Air, Brilliant Fire* (1992), Edelman puts forth his theory of 'neural Darwinism'. He also attacks cognitive science and (computer) functionalism. This has important implications for sport science.

Edelman's theory of 'neural Darwinism' – and Changeux's neuronal epigenesis (2004)<sup>19</sup> – tries to explain how the central nervous system goes hand in hand with genetics and non-determinism. This has interesting perspectives for training and development in sport. We might say that Edelman's theory could provide a neurophysiological framework to Searle's background capacities discussed by Moe (2007). Edelman's theory claims that our DNA codes for our biological-anatomical make-up while the brain is almost a neural *tabula rasa*. This is due to the enormous amount of neurons in the foetal and infant brain. During life these neurons are destroyed and pruned, and synapses diminish. Groups of

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330 neurons make up neural networks which if stimulated are then strengthened by greater synaptic connectivity. To be effective, neural networks must be stimulated in a good way.

③ This view of what constitutes an effective neural network looks similar to Milton *et al.*'s.

335 Learning, then, is to eliminate. That is, we are genetically disposed to anything, but since neural patterns are developed momentarily – and if not, die – we lose capability.<sup>20</sup>  
 340 So, according to Edelman's neuro-theory, we could all do any kind of sport, probably even at excellent level. But since the capacity of the brain and stimulations are limited, only some skills are developed. Like Ross and Milton, Edelman gives us a neuronal answer to why some are better than others in sport: they have more effective neural networks, greater synaptic connectivity and better regulation of neurotransmission. Edelman deepens our knowledge because he also gives us answers to how this happens: the ruthless neural selectionism from the interplay between the individual and the environment. Since neuronal and synaptic growth is most modular after birth and neurons die quickly, this interplay is most effective in the child's early development. The morphology of neurons also tells us a lot about the difficulty or ease of learning new skills for adults: if similar neural networks exist due to earlier stimuli, things are easier. We can compare this with the impossibility of Japanese adults trying to learn the 'ra' sound (see Changeux 1997, 244). This isn't news to people engaged in sport, but the neurosciences give us a better explanation of *why* it is so. That is after all what science is about.

350 Another interesting aspect of Edelman's theory is the importance he puts on embodiment. The brain is embodied, of course, but the relationship is so tight that he actually paraphrases Merleau-Ponty's old saying 'you *are* your body' (Edelman 2006, 24). Edelman also stresses the embeddedness of the body in the world through sensory inputs and effects. Again, from the *empirical* stance of the neurosciences, there can be no creature/creation acting like humans without embodiment and embeddedness. It is through the body's interaction with the world that neural networks and synaptic connections are selected and strengthened. That is a consequence of 'neural Darwinism' (and Changeux's epigenesis). This is significant to philosophers of sport because it reminds everyone of the importance of not only the body but its movements in the world. Without the movements of the body, neuronal growth and efficiency is heavily impaired, it is a necessary condition for human development. The neurosciences actually put the body back in pole position. This should be a relief to us, and in this respect we should embrace the neurosciences.

365 One of Edelman's main concerns is to state the importance of grounding any study of mind in the biological brain. Consciousness cannot come from any kind of matter; the matter must be biological and neuronal. Biological and neuronal matter has its own life story, from conception through life. This journey is a fundamental and necessary component for consciousness. This 'evolutionary morphology' is not to be found in non-biological matter, and so computers and other machines cannot have consciousness (Edelman 1992, 29). Edelman denies functionalism's multiple realisation argument and any kind of computer analogies and cognitive science built upon this kind of theory (Edelman 1992, 13). This is of great importance, because if he is right, we must abandon most of our literature on skill learning and motor skill development based upon information processing theories.<sup>21</sup> Edelman's view *could* be thought of as a base theory for Milton, Solodkin and Small's scepticism regarding information processing accounts in sport studies.<sup>22</sup> Edelman's concern, though, is still on the brain's *organisation*. For consciousness to be realised in the brain, the brain must not only be built by proper biological matter,

the brain must also be organised in the proper way (Edelman 1992, 16). Edelman sees the brain's complex organisation and body-world involvement as one of two reasons not to fall into 'silly reductionism' or embrace an identity theory of mind. The other reason not to hold a simple reductionist view is the individual's life story and morphology. This is what makes us able to categorise qualia (the qualitative features of experience) and establish subjectivity.<sup>23</sup> To Edelman, qualia are just sense impressions. Edelman's theory of neural Darwinism provides an explanation of what consciousness *does*: it is a power evolved by natural selection to make fine-grained discriminations between sensory perceptions. But to answer 'what's it like', how consciousness *feels*, is a question concerning the individual's life story and as such not a scientific encounter (Edelman 1992, 135–6, 151).<sup>24</sup> We might say Edelman has shed light on psychological consciousness, even an answer towards *why* we have consciousness. Why there is subjectivity is explained in brute brain science, but phenomenal states of subjectivity are ruled out as epistemically uninteresting. So unfortunately we are not enlightened on the phenomenal part of consciousness and still left with an explanatory gap. For sport this means that the neurosciences may enrich our knowledge on the possession, but not the acquisition, of skills. For sport science, the latter is probably most interesting.

In his later work *Second Nature* (2006), Edelman is more optimistic. He assures us that we 'can study consciousness even in the face of subjectivity' (Edelman 2006, 9). How the neurosciences could possibly bridge the gap between the athlete's subjective experience of sport performance (the phenomenal part of consciousness) and the objective third-person perspective of the natural sciences (and neuronal language), is what this article questions. Edelman includes phenomenal consciousness in his theory, stating that we could be able to create a device with internal phenomenal states which could be measured neurally (ibid., 10). Now that would be something. It is what would be needed for people such as Milton, Ross and others to go from studying brain activity to making claims about the mind of the athlete. Again Edelman tells us the neuroscientific story of how this could be done to explain not only intentionality but also phenomenal consciousness (ibid., 14). Through his work on robots designed on brain models, he and his collaborators have managed to build robots with discriminatory power and some ability to learn. So, if qualia are discrimination and robots can discriminate, we can learn something about human consciousness from these robots. This certainly sounds like information processing theory and computer analogies. Edelman denies that it is, because his robots are built on how the brain (not a computer) works. But his view is a perfect example of functionalism's multiple realisation argument: mentality can be built in different ways by different matter.<sup>25</sup> Edelman takes phenomenal consciousness to be the subject's qualia, in his theory meaning some distinguishable sensory input (ibid., 2–14). Consciousness, then, is a value system which selects some inputs from others, and selects an output from others.<sup>26</sup> This picture doesn't look very different from Milton *et al.*'s: the mind of the expert gathers perceptions and acts accordingly. In neuronal terms, this is the summation of inhibitory and excitatory inputs in the axon hillock, nothing more. Phenomenal consciousness is to categorise what qualia are reduced to: sensory inputs, and then select responses (Edelman 2006, 36–40). Of course, if this is all there is to consciousness, we are probably capable of creating a 'conscious' device and study its processes. Most computers do some sort of selectional process, just like the 'brain based' robot Edelman describes (2006, ch. 12). But what happened to the 'what's it like' feeling of phenomenal consciousness? That's what we are looking for in consciousness studies in



425 philosophy, and that is what is meant by qualia in philosophy. We want to know not only what consciousness *does* (categorise and select according to Edelman, the psychological part), but how and why things *feel* the way they do (the phenomenal part). If we want to know the mind of the athlete, then we must know what it feels like to be in the state of selecting a certain response.

### 430 **Reduction and the Explanatory Gap in the Neurosciences**

Philosophy of science normally operates with three kinds of reduction: bridge laws, functional- or identity reduction (see Kim 2005, ch. 4; Levine 2001, 94–6).<sup>27</sup> A full-blown theory of consciousness will need more than neural correlates. So the neuro-theory above must be some kind of reduction of mental events to neural events.<sup>28</sup> Edelman argues that the brain's complex organisation separates the neurosciences from simple reduction. Empirical evidence from the neurosciences themselves also goes against simple reduction: evidence shows that even identical twins have different brains and that brains process the same assignments differently at different age levels (Edelman 1992, 25). This is because the brain is made to develop in accordance with new inputs, so the brain's plasticity makes it difficult to make universal claims. This means reducing one activity to neural events in one person does not equal the neural events in another person doing the same activity – maybe not even among the persons themselves from time to time. Edelman himself argues against identity reduction (Edelman 1992, 170, 198). That is interesting because the new wave of identity theories is based on the hope of full reduction from the neurosciences.<sup>29</sup> It also means that projects such as Milton's, reducing expert performance to organisation of neural networks, is questionable because two different athletes will not have identical networks and neural events doing the same movements. A consequence might be that brain imaging would only help the particular athlete, not give general recommendations.

450 What about functional reductions? Functionalism defines mental states by their causal relations to each other and to inputs from the external world and behavioural outputs. It thus appears to resemble neuroscience: stimuli coming into, say, the retina, are being sent through the *nervus opticus* to the thalamus, then to the visual cortex and finally some perception/representation is instantiated. Edelman's theory seems to have some aspects of reduction through both identity (there is nothing mental above or beyond neuronal events) and functionality (for instance emphasis on organisation and creating a 'conscious' robot).

460 What is puzzling is that Edelman is clearly a big opponent of cognitive science, computer analogies and information processing theories – in a word: functionalism. At least he rejects a computational functionalism. In this case he resembles Milton, Solodkin and Small's denial of the brain's *computation* of a ball's velocity, angle and spin. Edelman's argument is simple and powerful: the brain is neither built nor works like a computer; neurons do not carry information (Edelman 1992, 27). If the neurosciences are going cognitive, they should not be built on some vague and outmoded version of functionalism. How do we reduce consciousness then? Edelman's strategy is almost an eliminative materialism; explaining qualia away. How something feels to me is something it would take a life story to deduce (it is a result of an individual's morphology) – so we should not ask for a scientific explanation or reduction (Edelman 1992, 136; 2006, 139–40).  
470 But, since Edelman claims qualia are discriminatory information from the world to the

subject, he has given qualia (a) an evolutionary history (without qualia we could not distinguish how sweet feels from bitter), and (b) causal power (they make a difference in the world – we act upon the discriminatory information). But if qualia have causal powers, they should be reducible because we (and certainly Edelman) believe that only physical events can be causally potent. And if qualia have this power through how it feels, this subjective experience must also be reducible. Edelman, though, claims that qualia are some kind of epiphenomenon and as such are not reducible (2006, 145). The problem is that if they are epiphenomenon they cannot have causal potency. But, that is exactly what Edelman has given qualia, since they provide us with information about how the world is and feels (2006, 139–41). Edelman's position faces the argument of Jaegwon Kim: non-reductionism of consciousness leads to epiphenomenalism and no causal power (see Kim 2005).

Any neuro-theory of mind will face these two problems: (i) the irreducibility of consciousness; (ii) mental causation. The first leaves us with an explanatory gap and Edelman believes there is no such thing. The latter problem is certainly not what a neuroscientist would want. It is not the problem sport scientists would want, either. At least if you think consciousness does make a difference in the world of sport. It would be an awkward position to go all the way to argue how the body shapes the brain through interactions with the world and then end up with no causal connection between brain and consciousness. Edelman's position here is confusing since he argues both that only a brain developed by neuronal selection through a bodily lived life can create consciousness, *and* that a robot built *like* a brain (but not by biological matter) can have consciousness. It is not clear how these two statements are to be reconciled. A major problem is that any kind of functionalism seems incapable of explaining phenomenal consciousness since it is the behavioural output that matters, not how it feels to behave that way.<sup>30</sup> That might also mean that a neuroscience based on functional reduction is not the place to look if you want to study both psychological and phenomenal consciousness in athletes.

In short, if Edelman claims that qualia cannot be reduced to neural events, they must either be non-physical events or epiphenomena. He sticks with the latter. But then qualia cannot have causal powers. He must either give up his account of what qualia do, or go for full reduction. In the reduction attempt, though, he falls into some kind of bio-robot functionalism – and the same position he least of all wants to be associated with: information processing theory.

Edelman's theory discussed in this article wants to have a cake and eat it too. It wants a biological functionalistic identity theory. That might be OK in some waters, but when treading philosophical ones, it is not. For one thing, the individual differences and plastic properties of the brain should amount to an insight about consciousness: it is unaccountable for by an identity-like scientific theory. So Milton; expertise is not just in the head. Neither can a functionalistic theory explain phenomenal consciousness. So there is still an explanatory gap both in consciousness studies and in sport sciences. This gap will not be closed even if imaging techniques improve so drastically we actually could see brain and neural events in persons actually playing a game. Edelman believes his approach to studies of consciousness is not reductionistic – I have tried to show that it is. He also believes that there isn't an explanatory gap, and if there is, it isn't science's mission to close it. I have argued that when dealing with consciousness, this is also wrong.

### Consciousness in Sport

520 So far I have argued two things. First, the neurosciences can teach us a great many things about how the brain/body/person integrates sensory inputs and behaviour, perhaps even rational behaviour. Second, that the neurosciences cannot, contrary to some claims, close the explanatory gap between phenomenal consciousness and reductive accounts of humans. So what? Well, I believe there are some very serious *whats* here. The first question we have to ask ourselves: is there phenomenal consciousness in sport? 525 Second, if there is, is it important in our sporting practice and science? It is time to argue for a view that says 'yes'.

I think it is easy to agree that in practising sport we execute the psychological part of consciousness. It certainly seems that athletes are awake (not sleeping), alert (ready to act) and aware (of opponents/objects). It also seems that sport is intentional (in a goal-directed way). We have intentions about bodily movement, desires to do them and beliefs about how. The main point in this article remains the same: awareness and intentionality in humans do not happen in the dark. There is a 'what's it like' feeling when practising sport. This is the phenomenal consciousness of the athlete. What about it? 530

The story that qualia freaks want to tell is that we have a feeling related to our decisions and experiences. According to Damasio's neuro-theory (see Damasio 1994; 1999; 2003), without this feeling, decisions tend to be irrational. Maybe we could also say with Damasio that when we do sport, we do not compute, we *feel*. It might be the case that expert golfers have a different kind of phenomenology when they visualise or do their pre-shot routine than beginners. We can certainly subscribe to the different feel of mastering something than not. Phenomenal consciousness is perhaps the difference of being in a situation. The intention of beginners and experts is probably the same when visualising. Maybe it is the way we just *are* in a situation that makes the difference. Put this way, our phenomenal consciousness makes a difference in how we respond on the field. It has causal potency. It does not mean that psychological consciousness does not make a difference. We should have this perspective on sport: when we practise sport – are intentional, attentive, aware – we do not do it in the dark. On the contrary, we have a very strong 'what's it like' feeling in these moments. I do not even feel obliged to argue that we do.<sup>31</sup> Rather, I do believe that it also a major reason to do sports. Why else would we? 540 Action without phenomenal consciousness is the picture sport sciences, bearing upon other reductive sciences, paint, though. Neuro- and muscular physiology goes on without any consciousness involved. Still, hardly anyone believes that the mental is not important in sport. Sport psychology is full of literature on mental training, awareness and attention in sport. But there's surprisingly little about phenomenal consciousness.<sup>32</sup> The same is true of skill learning and motor skill development. They are presented in a reductive, often functionalist programme that leaves phenomenal consciousness out of the picture, as if the way we feel doesn't matter. Like Edelman, I believe that we must take biology seriously and not build theories on computer models. Sport is an activity for biological creatures, and if our brain is not built or works like a computer we should abolish such ideas. The importance of evolutionary morphology must be emphasised; we could not learn anything without interplay with the environment. But again, phenomenal consciousness has a story to tell. And the story is that there is still an explanatory gap in the natural sciences, because phenomenal consciousness makes a difference and so must be taken into account. Philosophers of sport must remind reductive sciences that the gap must be 545 550 555 560

admitted and resolved, not explained away. Especially when fMRI pictures showing brain activity are claimed to be mind and skill. 565

### How the Neurosciences Change Everything and Nothing for Sport<sup>33</sup>

Studies of sport seem remarkably far from dealing with consciousness. My claim has been that either consciousness is left out altogether or it is treated in a reductive physicalist way, close to an identity or functionalist theory. If this is true, there is an explanatory gap both in the neurosciences and in sport sciences. I have tried to show that there is. I have also tried to show that we can be taught a great deal from the neurosciences. For instance, cognitive science has had a long reign in explaining, let's say, how memory and learning are involved when establishing athletic skills. On the basis of neurobiological evidence, Edelman denies representational memory, the sort of account often held in cognitive science. Edelman claims that memory is no more a representation of the outside world than an antibody is a representation of a virus.<sup>34</sup> A better understanding of mechanisms behind memory and learning are surely important to sport science, and if the neurosciences can increase our understanding of them – excellent. But we have to remember that what a person does in the laboratory is probably not the same as in real sport. So to make suggestions as to what athletes actually do is difficult. But where else do studies such as Ross's, Milton's and Edelman's contribute to our understanding? 570 575 580

Ross's and Milton's studies show that standard or simple situations should call for low and limited brain activation. This enables the athlete to have more capacity when difficult and novel situations arise. This is certainly true for stamina and strength factors, and they might have shown it to be reasonable for the brain as well. They have also shown that activation in the occipital lobe is high in experts. This might mean that the brain's importance lies in what meets the eye: information, knowledge, preparation comes through the retina. This again means that training regimes should focus even more on visual information gathering, for example on how many factors can be dealt with simultaneously in visual attention. If their suggestive thoughts on mirror neurons are close to the target, it might mean that training should always be done with human opponents and not some kind of simulation or machines.<sup>35</sup> Except for high occipital activation it is the cingulated and supplementary motor systems that do the experts' job. Milton *et al.* argue that this is a sign of the experts: they have higher activation in a narrow area (lateral premotor cortex and superior parietal lobe) – meaning only those areas necessary to execute the movement. For the rest, less is more. That is something to think about for us with a higher handicap than our shoe size: the golf swing is a *small* movement, it does not take a lot to hit that little ball. How do we then, transfer this into useful knowledge? 585 590 595 600

- (1) Give up on information-processing theories; the brain does not work like that. The idea that the human brain is an information-processing unit is not supported by neuroanatomy, neurobiology, the neuro-theories of Edelman, Changeux (see footnote 19) and Damasio (see footnote 24), nor the empirical work discussed in this article. 605
- (2) Because the interaction between body and world creates neural networks that are necessary for (efficient) movements, we should stress repetition and reduce theory for children as well as adults. This is a consequence of Edelman's and Changeux's theories. Synaptic connectivity in neural networks are first and foremost selected and formed by senso-motoric actions. 610

- 615 (3) Neural networks and synaptic connectivity are most plastic and selective in infancy and childhood. Edelman's neural Darwinism and Changeux's epigenesis explain how synaptic connectivity is established and pruned when used, and dies if not. Since neural growth and diminishing is greatest in our very first years, the golden age of skill learning is probably much earlier than 8–12 years of age, so there should be more focus on motor development and coordination at an earlier stage – for example in kindergartens. This does not call for early specialisation; on the contrary, it is necessary to build a wide platform of different movement solutions.
- 620 (4) Mirror neurons might show us how important good modelling is, but also *why* it is so important. Milton's claims based upon Rizzolatti's discovery of mirror neurons suggest the following: if there is strong congruence on a neuronal level between performer and observer (neurons being mirrored), then an expert doing the modelling will be better for both action recognition and imitation.
- 625 (5) More stress should be put on the visual system, especially familiarisation with varied, speedy motions of several objects and persons. This follows both from the role mirror neurons is said to play in action recognition discussed by Milton, but also from the empirical evidence found by both Ross and Milton: experts have higher activation than novices in the brain's visual cortex.

630 Articles such as Ross's and Milton's give us a better understanding of how the brain functions, how it integrates stimuli, coordinates organs and limbs, develops and initiates movements. The neurosciences give us the opportunity to study and understand the neuronal events necessary for physical activity. This can be used in many concerns, from blocking the athlete's awareness of pain and thereby reducing fatigue associated behaviour (see Craig 2006), or how exercise affect emotions (see Panteleimon and Acevado 2006), to an explanation of why psychosomatic illnesses might be altered through physical exercise (see Meeusen 2006). In this respect the neurosciences change everything on how we understand the lower-level workings of the brain. But when it comes to the complexity of phenomena such as sport itself or the athlete's subjective experience of sport, all this doesn't change a thing. I have argued that one of the reasons why this is so is that the neurosciences assume some form of functionalism, computationalism or identity theory, all notoriously infamous for not explaining phenomenal consciousness. Focusing on computational and/or neural mechanisms will not capture phenomenal consciousness, simply because those levels of description were never meant to.<sup>36</sup> That is why brain imaging is not mind-imaging.

### Gap Junctions in the Postsynaptic Neuron

650 A final comment must be given on the key assumption shared by neuroscientists, namely that human cognition in general and consciousness in particular is describable by neuronal structure and organisation.<sup>37</sup> This is actually quite puzzling. It seems that the neurosciences undermine their own project of defining human cognition and abilities through neurons by insisting on how they must develop through the whole body's relationship with the external world. If neuronal development is so heavily dependent on the body's interaction with the world, how then can everything reside in the brain alone? One might argue that the neurosciences may study the possession of conscious life and skills, but maybe not the acquisition since that depends on lots of external factors. But, the

science itself explains the modularity and change of internal neural networks and synaptic connectivity. That means studying skills in the head might leave us with just coarse-grained explanations and predictions. On the one hand, the neurosciences demonstratively show us the importance of the body. On the other, they dismiss the role of the body and world when it comes to consciousness, concentrating only on neurons. Since the neurosciences naturally deal with neurons, that is fine. But when dealing with consciousness, it is not. If phenomenal consciousness is a part of sport, and I have argued that it is, the neurosciences cannot give a complete account of sport performance either. If so, seeing all brain events during performance will leave us with question marks. Still, the importance of the brain must not be underestimated by sport scientists. Describing sport cannot be done by muscular or skeletal analysis alone. No surprise there. The surprise comes from the study of tiny neurons: the tremendous role of the body in shaping not only neuronal networks in motor cortex and cerebellum but our mental life as well. The body then, shapes both the mind and the brain.<sup>38</sup>

In some ways, neuroscience really is the new loud. And I do believe that some discoveries concerning how the brain enables perception, memory, movement and mental imagery are relevant to sport science. These discoveries are not only relevant; they should even renew some theories of sport science. But when it comes to consciousness and subjective experience, I would rather speak in the tongue of hip hop group Public Enemy's Flavor Flav: don't believe the hype.

#### NOTES

1. I will use the term 'neurosciences' in the plural because the research is being done in a cluster of intertwining fields: neurobiology, neurophysiology, neuropsychology, molecular biology and genetics. The neurosciences are new in a historic sense; and loud when it comes to impact.
2. EEG provides a continuous recording of overall brain activity through electrodes placed on the scalp, which measure large, active populations of neurons producing electric potentials. Single cell recording measures change in the response rate of an isolated cell. This is achieved through inserting a thin electrode into the brain. Both PET and fMRI measure changes in metabolism or blood flow in the active brain. Normally, a PET scanner determines the brain's local need for oxygen by injecting water with radioactive oxygen into a subject. With fMRI, imaging is focused on the magnetic properties of haemoglobin. The fMRI detectors measure the ratio of oxygenated to deoxygenated haemoglobin – called the blood oxygenation level dependent (BOLD) effect. For a more extensive treatment of the methods of (cognitive) neuroscience, see Gazzaniga 2002, ch. 4.
3. 1 repetition-maximum indicates maximum strength; V o<sub>2</sub> max (maximal oxygen uptake) indicates aerobic capacity.
4. Breivik tries to integrate fundamental questions about the body's dealing with the environment, bodily intentionality, the positioning of the body in the vertical (and horizontal) field and proprioceptive awareness. These questions relate to the neurosciences, e.g. to the neurophysiological system of proprioception.
5. For a more thorough treatment of consciousness and the explanatory gap in sport, see Birch 2009.
6. See Birch 2009, Chalmers 1996, Levine 2001 and Nagel 2006.

7. The expression 'explanatory gap' is usually associated with Joseph Levine (2001, ch. 3). It describes the problem of reducing subjective experience (the phenomenal consciousness of a first-person perspective) to the objective language of science (a third-person perspective) without losing something along the way.
- 710 8. Keil *et al.* (2000) argue for the impact of neuroscience and particularly Edelman's views for sport psychology.
9. A related critique from the philosophy of sport comes from Moe 2005.
10. The discovery of mirror neurons (see Rizzolatti and Sinigaglia 2008) may have tremendous impact on sport science, but is not the issue in this article.
- 715 11. For a short treatment of identity theories, see Rosenthal 1994.
- ⑥ 12. Even Jeannerod (1999) has accepted that imagery and activity are not identical brain events. Although not the topic here, visualising and neuroscience should certainly be a hot topic for sport scientists. Among interesting findings, see e.g. Lacourse *et al.* 2005 and
- 720 ⑦ 12. Rodriguez *et al.* 2008. A presupposition is of course that the neural events are identical. An identity theorist might claim that doing moves is better, but that is only because the events in the brain are not identical with the visualiser's. If that is the case, the key supposition of Milton *et al.* (2008) is certainly false.
13. See Birch 2009 for a critique of identity between brain states and skills.
14. To review the myriad of different views and theories in the field is far beyond the scope of this article. I believe it suffices to make a distinction between identity theory and functionalism. Short and simple, it might be said that all information-processing theories are functionalistic at bottom, but not all functionalists hold an information-processing theory. James Gibson (1979) might be said to be an example of the latter.
- 725 15. For a more radical view on automaticity and consciousness, see Bargh and Chartrand 1999.
- 730 16. Milton *et al.* also claim that we can take the golf results to account for other kinds of fast-ball sports (2008, 49).
17. Of course, it is likely experts still have more restricted activation than novices in novel situations. The claim is that it is not always preferable to have as little and narrow activation as possible.
- 735 18. Another famous neuroscientific contribution comes from Jean Pierre Changeux (1997; 2004), who shares several of Edelman's views. Consciousness is, according to Changeux, a regulatory system, and to examine consciousness is to examine 'its different states and identify the mechanisms that guide the change from one state to another' (1997, 145). Changeux describes the regulatory system as an evaluative mechanism for the surveillance of linking mental objects. The brain and the central nervous system then, are also *sufficient* conditions: 'From the interplay of these linked regulatory systems, consciousness is born' (1997, 158). These linked regulatory systems are neuronal groups in the reticular formation, 'piloting' information to cortical areas, and receiving information as to what is being performed through re-entries in loops. To explain consciousness is to explain these regulatory systems through neurons and mechanisms between them.
- 740 Changeux also emphasises subjectivity and qualia (2004, xii–xiii). Changeux believes the key to understanding subjective experience is the biological matter and organisation of the brain (2004, 9). Changeux opens for individual variation due to environmental adaption, epigenesis – neural Darwinism in Edelman's words. Still, he claims that qualia are not necessarily inaccessible to scientific investigation. Even though experiencing
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- qualia is different to every person, it is 'reasonable to expect that these shared qualia may be correlated with physical brain states' (2004, 74). Changeux believes that a person's experience of, say red, is constant and this implies constant neuronal states. If so, then subjective oral information can be correlated with brain states. It is a somewhat strange position to hold this identification of brain states and oral exclamation alongside the individual epigenesis. It seems that Changeux believes that questions of subjective experience can be answered if the underlying neural states of qualia can be identified. When this is done, there isn't more to be said about subjective experience. This neural state *is* the subjective dimension of consciousness. This certainly sounds like a strong form of identity theory, and is in empirical controversy with the claims Changeux also makes: if each individual brain differs due to environmental inputs, the same type of physical event just cannot be the same type of mental event. Instead, we would expect the same type of mental event to be instantiated from different types of physical events. 755
19. Changeux (1997; 2004) shares several of Edelman's views. Consciousness is, according to Changeux, a regulatory system, and to examine consciousness is to examine 'its different states and identify the mechanisms that guide the change from one state to another' (1997, 145). Changeux describes the regulatory system as an evaluative mechanism for the surveillance of linking mental objects. The brain and the central nervous system then, are also *sufficient* conditions: 'From the interplay of these linked regulatory systems, consciousness is born' (1997, 158). These linked regulatory systems are neuronal groups in the reticular formation, 'piloting' information to cortical areas, and receiving information as to what is being performed through re-entries in loops. To explain consciousness is to explain these regulatory systems through neurons and mechanisms between them. 760
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20. Changeux states the possibility that brain hemispheres are equal at conception, but then develop different structures and functions due to stimuli (1997, 241). 770
21. Information-processing theories use computer models as a base for their claims. In this respect they are functionalistic accounts, philosophically speaking. In functionalism it makes no difference if the computer's (or brain's) functions are generated through electrical, mechanical or chemical mechanisms. To review the enormous amount of such approaches goes far beyond the scope of this article, but some major contributions 775
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- 800 include Honeybourne 2006; Piek 1998 (part II); Schmidt and Lee 1999; Williams and Hodges 2005 (part I).
22. Edelman's critique of information-processing theories is much more fundamental. Milton *et al.* simply acknowledge that the brain's capacity is too limited to work in such a way.
- 805 23. For a brief discussion of qualia, see Block 1994. Birch 2009 discusses qualia in relation to sport.
24. Antonio Damasio (1994; 1999; 2003) claims that *feelings* must be understood if we want to understand consciousness. Damasio thus puts forth an account of consciousness as constituted by the neurophysiology of feelings.
- 810 Damasio's theory says all creatures with a central nervous system have some kind of homeostasis, the regulative and life-preserving mechanisms. To secure an effective homeostasis one needs a continuously updated picture of the creature's status. Most of this is done automatically and non-consciously in the lower-laying regions of the brain: the thalamus, hypothalamus and epithalamus. Damasio's account is in opposition to Milton *et al.*'s (2007) on this point. The evaluation of body status with some response Damasio labels emotions. Feelings are the knowledge of these emotions (Damasio 2003, 92). The life-preserving benefit is that feelings can overrun otherwise automatic responses and we get a more flexible, adaptable creature with choice. Damasio claims that the brain forms maps of what goes on in the body; this is the internal relation of brain-body. He calls this the somatic marker hypothesis (1994, ch. 8). An emotion is a significant difference in such a map, such that some sort of response is necessary to preserve life in a fitting way. A feeling is the knowledge of such a change, and the choice of how to deal with it. Damasio gives us a neuroscientific theory as to how a sense of self is developed and how this makes interaction with others possible (see also Whitehead 2007). Consciousness is the conscious feeling of a change in body states that arises to neo-cortex, and a complex and effective life-preserving mechanism for novel and changing environment (Damasio 2003, 207–8), just like those we experience in sport performance.
- 815 In philosophical terms I believe Damasio's theory is a kind of representational theory of mind. The standard claim is that consciousness is the higher-order representation of some lower-level state. I hope the link to Damasio theory where feelings are the higher-order knowledge of a lower-level emotion is quite clear (see Damasio 2003, 87, 194). Damasio claims that a somatic marked emotion becomes conscious when accompanied by a thought. His theory is similar to Rosenthal's (2005) in this respect, but the somatic marker also resembles Lycan's (1997) 'monitor-theory'. A problem that faces representational theories, and Damasio's, is the question of what makes the higher-order state conscious: it is not enough to say it represents the lower-level. Damasio might have enlightened our views on what feelings *do*, but not how they *feel*. He has not enriched philosophy when it comes to the hard problem of phenomenal consciousness.
- 820 25. The same view is shared by Edelman's long-time collaborator Giulio Tononi (2001, 298).
26. Edelman claims consciousness is the process of selectional re-entrant of groups of neurons in cortical areas (see Edelman 2006, ch. 3–4).
- 825 27. I will not deal with bridge law reduction. As Kim explains (2005, 98–101), it is not appropriate in mind-body relations.
28. Or to quote Pasko Rakic: 'Although many have speculated whether the reductionist approaches of developmental neurobiology could ever be harmonised with the largely integrative approaches of cognitive neuroscience, it now appears as though that time is coming' (Gazzaniga 2004, 3).
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29. Block and Stalnaker (1999) and McLaughlin (2001) build their theories on Crick's 40 Hz hypothesis (see Crick 1994).
30. For an excellent overview of objections to functionalism, see Levin 2004.
31. For an argument, see Birch 2009. 850
32. There are exceptions, especially from phenomenological psychology. See e.g. Thompson 2007.
33. This subtitle is inspired by Greene and Cohen 2004.
34. For a detailed discussion of Edelman's view on memory, see (Edelman and Tononi 2000, chs. 8–9). 855
35. See Milton *et al.* (2008, 53–4). It must be emphasised that congruent mirror neurons have only been found for hand movements, and to some degree, the mouth (see Gazzaniga 2002, 535).
36. See Revonsuo 2000 for a more detailed critique of cognitive neuroscience.
37. Again, perfectly stated by Rakic (see Gazzaniga 2004, 3). 860
38. See Gallagher 2005.

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## Skills and Knowledge: nothing but memory?

...seemingly opposite things, linked, knit together, even identical perhaps. Perhaps! But who is willing to worry about such dangerous Perhapses? - Nietzsche BGE, 2

In a funny and provocative book review called *How Tracy Austin broke my heart*, the late American author David Foster Wallace (2006) wonders: what do the greatest athletes think about when they perform their absolute best under immensely pressure? Wallace concludes that athletes don't think about anything at all. That is why their biographies are utterly boring and why they cannot answer the usual question "how does it feel?" in any interesting way what so ever. There's just nobody at the other end of the line.

We could say Foster Wallace asks what an athlete's skill consists of, or what knowledge (s)he possesses. His conclusion seems to be popular opinion about athletes: that they do not think when they perform, so they do not know anything either. To answer questions about thinking, one would perhaps turn to psychology. Since we are dealing with sport; sport psychology. The picture Wallace paints of thinking and knowledge is one of declaration and recall. To recall and declare something, one needs memory. Surprisingly, sport psychology seems almost completely uninterested in the topic of memory. None of the textbook greats contain a chapter on memory.<sup>1</sup> So sport psychology does not seem able to give answers to Foster Wallace's questions.

Who else would we turn to but the philosophers then? Another way to phrase the initial question about thinking and knowledge is that athletes are not conscious, especially when they perform at high levels or great complexity. The standard philosophical analysis

goes something like this:<sup>2</sup> To think is to have a mental content in language (or visual images) before, or accompanying some action. To be conscious is to be aware of this content, so you can retell, recall or declare the content of the thought. If you cannot, it was an instance of unconscious processing – the states did not reach consciousness. In sports we usually call this automation, so athletes do not have to think or pay attention to what they do.<sup>3</sup> In this line of reasoning, to think is to think *about* something and there is a somewhat vague identification between automation and the non-conscious, and thought and declaration.

When thinking is considered thinking *about*, what knowledge can you possibly be said to have if it's non-declarative? In this article I will approach questions of thinking and knowledge by a philosophical inquiry into the relation between memory, consciousness and skill. All the time *knowledge* and *consciousness* have shovelled up thousands of books and papers; *memory* has hardly been treated seriously in philosophy.<sup>4</sup> That is a surprise given the above analysis about knowledge as a conscious state *of* x, and the intuition that to know x, one must remember x. Discussions of memory are also lacking in the philosophy of sport. This is odd considering all the effort on themes like *skill*, *knowing-how*, *expertise* and *learning*. A rare exception comes from philosopher John Sutton (2007), who has contributed to the topic of memory and skill. Sutton argues that athletes surely think: they use simple maxims like 'move the feet', they reflect during and after training, and above all: athletes exhibit flexible embodied intelligence. This flexible intelligence is appreciated in the entanglement of thinking and doing, according to Sutton. I have sympathy with Sutton's views, but where he goes for the 'linked', 'the knit', I will argue for a more radical view. John Sutton uses research on memory to reach his conclusion, and so will I. With the recent contribution of neuroscience, memory research has come a long (perhaps even *the*) way in studying both skill and consciousness.



It seems philosophers should turn to neuroscience to get a better picture of an athlete's skill, thinking and knowledge. Most of us believe thinking, and perhaps knowledge, has something to do with the brain. If a skill is knowledge, knowing how perhaps, it might be the brain we should study. In this article I will first give an overview over types of memory. I will consider whether skill is memory and if memory is reducible to neuronal structures. I will then argue that reducing (procedural long-term) memory to neuronal structures is not an exhaustive explanation of skill. Skills also have something to do with consciousness will be my claim. Third, I will investigate the idea that consciousness is working memory, and if working memory is reducible to neural events. If so, it might be argued that skills are (procedural) long-term memory *and* working memory, so that skills are in fact researchable and reducible by neuroscience after all. I am going to argue that consciousness is not the same as working memory, or any other kind of memory. I will summarize the reductive programme of neuroscience, before finally returning to Foster Wallace's suggestion that excellent performance necessitates not-thinking and non-conscious athletes. I will argue that this idea rises from the belief that automation is a non-conscious process and non-conscious processes do not involve thought. I am going to argue that this is wrong. If so, there is no reason to believe that athletes are not thinking, and hence are, like Foster Wallace believes, stupid. Hopefully this article can start fruitful discussions on the relation of memory to closely linked topics on knowledge and skill put forward recently in the philosophy of sport by Birch (2009), Breivik (2008), Eriksen (2010), Moe (2007) and Sutton (2007), among others.

### **Memory at a glance**

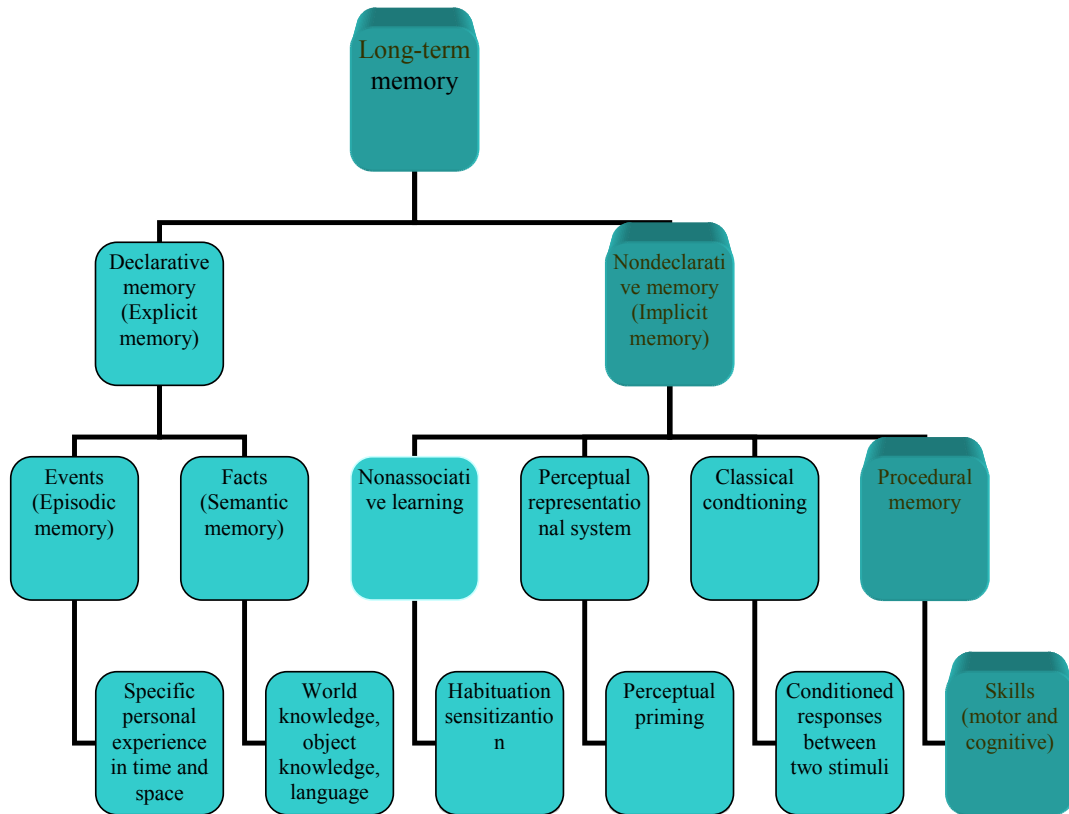
Psychology and neuroscience has made great advances in the study of memory, and these insights may change or strengthen our views on topics like learning, knowledge, skills

and attention in sport. At least they are worth investigating for philosophical discussions. One of the many problems in the study of memory is to describe what memory is, and to address how many kinds or systems there are. This theme is far beyond the scope of this article.<sup>5</sup> We will begin with simple distinctions between *short-term*, *working-* and *long-term* memory.

*Short-term memory* is the storage of small amounts of “material” over periods of a few seconds. We usually say things like “it was just in my mind, but now it’s gone” when we refer to this (lack of) memory. *Working memory* is usually described as a system helping us maintaining and manipulating information when performing a task. An example may be to remember the digits in a phone number (short-term memory) *and* accumulating them one by one. I will return to working memory after a discussion of long-term memory and the neuroscience of procedural long-term memory.

*Long-term memory* describes our capacity to store and retain information and knowledge over long periods of time. Long-term memory can helpfully be divided like this:  
(Gazzaniga, Ivry and Mangun

2002)



Explicit memory concerns those memories we can retell, they are all *declarative*.

Episodic or *event* memory is autobiographical memories of experienced episodes. The work done on golf expertise by Beilock and Carr (2001) and Beilock, Wierenga and Carr (2003) is in this area. Episodic memory is what we use when we do mental time travels back to when we scored our first goal on the field. *Semantic* memory stores our knowledge of the world, like Anfield Road being the home court of English football club Liverpool. My episodic memories of Anfield Road then, are about those experiences I had when I was actually there, while semantic memory is the knowledge that Anfield Road is the place where Liverpool F.C.

plays their home games. The latter I can remember and know without ever having been to England.

Implicit memories are *non-declarative*, or they do not have to be so. We learn a new skill and are able to perform an effective motor response through repeated training. But we do not have to tell this to anybody, or recall any thoughts about it to ourselves. We can, but then we are using explicit memories, according to models of memory. During the performance there does not have to be any act of declaration. We all recognize how performance falters if we try to declare what we are doing, like trying to command the arm to hit a back-hand in tennis. I believe it is important to see the platform memory research starts from: a (sport) skill *is* a kind of memory; procedural long-term memory. If we do not remember what or how to do, we do not possess the skill.<sup>6</sup> We simply do not *know*. I will not consider the other types of implicit memory, instead keeping focus on procedural memory and skills.

### **Kandel throws light on learning and long-term memory**

Eric Kandel received the Nobel Prize in physiology or medicine in 2000 for his work on the molecular basis of memory and learning. He and his colleagues have spent a lifetime studying structural changes in the animal brain due to external stimuli, or training. This tells us something significant about how neuroscience defines skill in molecular terms, and how (sport) skills are acquired and maintained.

Kandel works within the framework sketched out above, that motor skills are implicit, procedural memories. A motor response is learned if it is manifested by a structural change in the brain; the (motor) response has become a long-term memory, it is a skill. Long-term memories are stored in the same cerebral cortex area where that information was originally

processed. Memories of visual images are stored in the visual cortex, motor skills primarily in the motor cortex and the cerebellum. How? A single stimulus strengthens a synapse by increasing serotonin release in an interneuron. This again increases cyclic AMP and protein kinase A in the postsynaptic neuron, again causing an increase in transmitter release and uptake in a motor neuron. This is the (in a very simplified form) molecular basis of short-term memory. For a short-term memory to become long-term memory, a *structural* change must take place. This requires synaptic growth: Protein kinase A have to activate a regulatory protein called CREB in the cell nucleus. CREB-1 activates gene expression, and CREB-2 suppresses gene expression. To grow new synapses CREB-1 must be turned on, CREB-2 switched off. By repeated stimulation this is exactly what happens. In understandable terms: several stimulations (what we would call training) causes synaptic growth in sensory, inter and motor neurons.<sup>7</sup> This is the molecular definition of long-term memory. It seems it might also be the molecular basis of motor skills. If not all long-term memories are skills, all skills are long-term memories under this definition. Hopefully we have an excellent vantage point for more advanced training and learning regimes. But we also have a scientific platform for philosophical discussions as to what skills and know-how ontologically *are*. Perhaps some might oppose that the neuroscience of memory does not believe that a skill *is identical* to memory. Memory just plays a causal *functional* role, they might argue. But in memory models this distinction fades away so that there is no difference between procedural memory, motor memory and skill. We see this clearly in Kandel's work (2007, 279).<sup>8</sup>

Implicit memory is responsible not only for simple perceptual and motor skills but also, in principle, for the pirouettes of Margot Fonteyn, the trumpeting technique of Wynton Marsalis, the accurate ground strokes of Andre Agassi, and the leg

movements of an adolescent riding a bicycle. Implicit memory guides us through well-established routines that are not consciously controlled.

The tennis skill of Agassi is an implicit memory then. And implicit memories are, since they are non-declarative, not consciously controlled. That must be a surprise to all interested in tennis, especially Agassi himself. Quotes like this about skills and memory resembles the identity between synapses and thinking presented in the opening sentence of famous neuroscientist Joseph LeDoux's *Synaptic Self* (2002, ix): "The bottom-line point of this book is "You are your synapses"". There is no doubt of the identity reduction between skill and memory by Kandel, or brain and thinking-consciousness-self by LeDoux.

But when Agassi plays tennis skilfully, he not only uses procedural long-term memory. He *at least* relies on types of memory: A) He knows the rules (semantic memory). B) He knows he has performed a move x on occasion y successfully before (episodic memory). A) and B) must be present in Agassi's consciousness somehow, implicitly or explicitly. C) Agassi knows how to do move x (implicit procedural motor memory). D) Agassi has his attention directed on appropriate conditions for the present task. There is definitely a relation between memory and skill, but the relation cannot be limited to long-term procedural memory. To understand how A), B), C) and D) are present in skill, the activeness of working memory is perhaps just as relevant.

### **Working memory**

There are several models of working memory, but I will concentrate on Baddeley's model as presented in his latest work (Baddeley, Eysenck and Anderson 2009). What distinguishes working memory from short-term and long-term memory is that working

memory is active, just like skills are active. While long-term memory is a storage system, skills are performances. Working memory both stores and *process* information. Working memory has a functional role as an underpinning system for cognitive activities. Working memory is surely worth investigating for understanding skill.<sup>9</sup> Baddeley's model has four main components: The phonological loop, the visuo-spatial sketchpad, the episodic buffer and the central executive.

The *phonological loop* is responsible for temporary storage of acoustic and speech-like information. The phonological loop is probably not very important for sport skills and I will not go more into it. The *visuo-spatial sketchpad* resembles the phonological loop's functions for visual and/or spatial encoded objects and arrays. We experience this when we try to remember places or moves by visually recalling images. The visuo-spatial sketchpad is clearly important for (sport) skills as different as chess, curling, basketball and tennis for selecting moves and strategies (condition B) above). We see the link between memory and skill again also in imagery: imagery has something to do with memory, and imagery helps improving skills. Thanks to scientists like Kandel and LeDoux, we have a good account of the mechanisms for creating this kind of knowledge/memory. The *episodic buffer* is a storage system binding different stimuli/information together. The episodic buffer allows the visuo-spatial sketchpad to interact with long-term memory. The episodic buffer holds information from the ongoing present *and* (long-term) memories in store (A, B) & C) above). The episodic buffer is where, according to Baddeley, working memory meets long-term memory. Finally, the *central executive* controls attention. The central executive is thought to direct attention to the task at hand, (D) above), monitor the appropriateness of behaviour and manipulate information of the other subsystems. This is very important to our discussion of skill and memory. The central executive is described by Baddeley as that part of working

memory that focus and directs/switches attention (2009, 53-56) – obviously important in sport skills.

Baddeley's model of working memory can be used to see how much more is going on than procedural long-term memory, C) above. The analysis of working memory enables us to understand that skilled athletes *know* plenty, including what philosophers call propositional knowledge, or knowing that, e.g. A) and B) above. Agassi must surely know several facts (semantic memory) about tennis, although it is in his non-declarative tennis performance he exhibits this knowledge. It is *we* (and Foster Wallace) who do not appreciate his knowledge in action. We must realize that the various facts and experiences Agassi knows has causal potency and is driving his actions. Thus Agassi's every stroke is a sign of knowledge, and understanding working memory helps us see that it is. So in addition to using/having procedural long-term memory, it actually seems Andre Agassi is conscious. Perhaps he's even thinking.

### **Consciousness and memory – are they one and the same?**

From the above discussion we should accept that skills are not merely procedural long-term memory, but also semantic, episodic and working memory. To be skilful isn't simply a matter of motor knowledge, but also of propositional knowledge. An athlete must also be intentional, goal-directed, and focus attention in successful performance. Perhaps we should attribute consciousness to athletes as well? Empirical investigations of consciousness have mainly focused on *attention*.<sup>10</sup> Attention, as we have seen, is easily understood as a working memory capacity. So, the question remains: if consciousness just is memory, then perhaps a sporting skill just is memory after all. And if consciousness as working memory/attention is reducible to neuronal events, then skills are too.<sup>11</sup>



Sport psychologists have, for various reasons, not paid enough attention to attention. Stephen Boutcher (2008) reviewed the research on attention and sport performance. Boutcher shows that studies support the popular view that highly skilled athletes are able to focus on nothing but the task, because only information regarding the task is coming through some attentional filter, and that motor behaviour is automated. Automation means lower cortical activity in the brain, meaning attention is narrow. Attention in sport psychology then, is to have narrow focus and low attention. We could say that researchers on attention in sport often work with the hypothesis that athletes do *not* pay attention to procedural motor tasks since they are automated or implicit as we have called it above.<sup>12</sup> This perhaps supports the initial statement by Wallace that athletes do not think, and so consciousness is left out of the picture. What also lacks in research on attention in sport is the relation to memory. A start in this direction is done by Murphy, Nordin and Cumming (2008). Their model describes how attention is “the selection of certain perceived stimuli to be processed in working memory”, and “(t)he information that enters their consciousness is selected by their attention” (2008, 309). That’s to say attention is consciousness’s tool, and hence not identical. They also show the relationship between working memory and long-term memory: if mental imagery is supposed to have any effect, what is currently in working memory (your attention on a motor image) must neuronally manifest itself in long-term memory.

There are positive sides to studying consciousness as attention: neuroscience can study brain events during cognitive tasks and teach us about the function of the brain when we are attentive, surely beneficial to sport science. The problem is that philosophical tradition has taught us that attention and consciousness are not identical, and so neuroscience study only a part of consciousness. David Chalmers (1996, ch. 1) makes the distinction between

*psychological* and *phenomenal* consciousness. Psychological consciousness is what the mind *does* (awake, attentive, intentional). Phenomenal consciousness is the way the mind *feels*, the ‘what is it like’ character (see Nagel, 1974).<sup>13</sup> To be attentive is to be conscious *of* (x), it is psychological consciousness. Consciousness as attention then, is the mental content we are focused on. When our attention is on something (x), we can (usually) declare of what – we *know* that we are attentive/conscious *of* (x). If I cannot declare (x), I was not conscious of (x), and I do not know (x) (Chalmers 1996, 26-27). This is how knowledge traditionally have been identified as *propositional* knowledge (knowing that), in opposition to procedural knowledge (knowing how). When we are conscious *of* our knowledge, it falls into the category psychological consciousness, or declarative memory in our discussion above. We are paying attention to knowledge so to say, or we have explicit memories. We see that knowledge, consciousness and memory are deeply intertwined. But consciousness is something wider than attention.

When studying attention, we study psychological consciousness, but just a small part. The conscious state *awake* is something different than attention; I can lie awake in bed not paying attention to anything. *Awareness* also seems different than attention. I can be aware of many things while paying attention to something else. Agassi is aware of his foot’s position at the line when serving (*knowing without observation* (Anscombe 2000, 13-15), or in physiological terms: *proprioception*), while his attention, or attentional *focus* is the opponent. While Agassi’s attention is on x, he surely knows/am aware that his racket is in his right arm and the left is bouncing the ball. Attention is narrower than awareness, perhaps the spotlight of awareness.<sup>14</sup>

The distinction between the explicit (conscious) and implicit (unconscious) comes in handy for the neuroscientist or psychologist at this point.<sup>15</sup> If the explicit (conscious) part is

something we can measure through the neuroscience of working memory/attention, and the implicit (unconscious) part can be studied by the molecular basis of long-term memory, then that is all there is to consciousness. Baddeley describes working memory as a global workspace (2009, 42, 57) where the episodic buffer retrieves information through conscious awareness. When the relation between working memory and consciousness is operational, one has a tool for empirical investigation.<sup>16</sup> I have argued that attention does not exhaust consciousness - the study of attention is a limited study only of psychological consciousness. We have seen from the above discussion on memory that knowledge and skill consist of declarative-, non-declarative memory and attention, and none of them come apart easily. I will argue below that phenomenal consciousness must also be included. But can phenomenal consciousness be explained by the neuroscience of memory? If so, the hard problem of consciousness (Chalmers 1996, xii) might be solved. It is to this question we must now turn.

### **Phenomenal conscious memory**

Penelope Rowlett (2009) has related psychological and phenomenal consciousness to memory.<sup>17</sup> Rowlett believes working memory might be identified with psychological consciousness. This is to suggest that attention is the same as working memory and that attention *is* psychological consciousness. Both suggestions are problematic, but I shall concentrate on Rowlett's identification between short-term memory and phenomenal consciousness. Rowlett does not think short-term memory *per se* is identical to phenomenal consciousness. Rather it is something called *sensory memory*. Sensory memory is the brief holding system for information presented to the different sensory systems. Research suggests a storage system for all senses, but most work has been done on so called iconic (visual) memory and echoic (auditory) memory.<sup>18</sup> I will investigate Rowlett's contribution and relate it to our discussion.

In Rowlatt's account, phenomenal consciousness requires memory. Rowlatt claims that without memory we cannot be aware of bodily sensations or sensory perceptions (2009, 72). Do we need memory to experience then? Let us say that we knew exactly how the sensory memory Rowlatt identifies with phenomenal consciousness worked. Let's say we could knock out a narrow bit of sensory memory, say by inhibiting glutamate release. Then Eric Cantona delivers one of his famous kung-fu kicks to my right knee. Would I then not feel pain?<sup>19</sup> Or not know the pain's origin? Or are these two one and the same? Mechanical touch causing instant pain is normally described by triggering A-fibres causing a reflexive reaction to pain. It seems strange to say that no sensory memory makes no A-fibre firing. The aches you usually feel after getting kicked and have some sort of cell damage or soreness are correlated with the infamous C-fibres firing. If C-fibres fire after sensory memory is knocked out; do I not *feel* the pain, or do I not *remember* the pain's origin? To claim that I do not feel, have pain or am aware of any bodily sensation at a particular moment if I have no sensory memory, is a vague claim at best. When the pain is gone (C-fibres stop firing), maybe I do not remember I was in pain. I do not remember my phenomenal state. The sensory memory Rowlatt describes must be *psychological* consciousness. Sensory memory is being able to remember/categorize/conceptualize and pay attention to the bodily sensation of phenomenal consciousness. It seems to me this is her own description (2009, 76), but she makes a conclusion that I argue is wrong: while sensory memory does seem a necessary requirement to *categorize* phenomenal states, it does not seem necessary to *experience* phenomenal states. We see the difference between phenomenal consciousness and sensory memory as perception in sport all the time. For example when footballers *know* there is a team player behind their back, without having perceptions of it. They probably do not hear the running in a big stadium, they obviously do not see, and they hopefully do not smell. But they do know

somehow, they do experience. This kind of awareness seems like a case of blindsight, a kind of phenomenal consciousness.<sup>20</sup> Simply put, in Rowlatt's account the distinction between memory and perception becomes blurry, so that to have perceptions is the same as being in a 'what it is like' phenomenal state. I have argued this is wrong, and so the neuroscience of sensory memory does not explain phenomenal consciousness.<sup>21</sup>

### **Koch on memory and consciousness**

Although I do not support Rowlatt's view, her contribution takes a much needed approach to the connection between the philosophical conceptual framework of consciousness and neuroscientific (memory) research. The problem is that empirical evidence does not support Rowlatt's conclusions. Christof Koch's *The Quest for Consciousness* (2004) is the culmination of Koch's and the late Francis Crick's work. I will discuss some of Koch's general ideas on memory and consciousness, and then give further support to my rejection of Rowlatt's identification between sensory memory and phenomenal consciousness.

The paradigmatic cases of patients H.M. and Clive Wearing are discussed by most researchers on memory, including Koch.<sup>22</sup> H.M. completely lacks episodic and semantic memory. But he is able to learn and retain new skills. He can improve his drawing abilities, though he has no memory of how he gained them. Wearing cannot learn anything new, but interestingly his piano and conducting skills have largely remained. We must conclude they are both conscious, and are knock-down cases against any argument that episodic or semantic memory is necessary for consciousness.

What about working memory? Koch argues attention and working memory is not the same. Research suggests that the number of items that can be held in a person's working

memory span is 8-10 (2004, 197). Koch points out that attention is not on 8 items, perhaps only one at a time. Attention, at least focal attention, is narrower than working memory. Koch argues that working memory is not phenomenal consciousness simply because patients with damage to working memory are able to distinguish and respond to changes in objects. They're just not able to report it afterwards (2004, 198-199). But they do experience, and are conscious. Phenomenal consciousness is not working memory. Koch's conclusion about memory and experience is simple (2004, 187):

“Primates use a multitude of distinct modules to retain information. These modules differ in what they store, how the material is acquired and for how long it can be accessed... Yet almost none of these are needed to experience something.”

Koch uses an operational definition of memory: “memory is the retention over time of experience- dependent internal representations” (Roediger, Dudai and Fitzpatrick, 2007, 11). According to this definition, memory is the retention of experience, not the experience itself. But the phenomenal consciousness Penelope Rowlatt discusses must *be the* experience. Like Kandel, Koch argues for a fundamental distinction between activity-dependent memory (short-term and working memory), and structural memory (long-term memory). Koch argues that this distinction is important because the Neural Correlates of Consciousness (NCC) depend on activity-dependent memory, but not on structural memory (2004, 189). Koch argues that activity-dependent memory can be traced by brain imaging or cell recordings and so be correlated with consciousness. In other words: the neural activity of sensory memory must be long and/or strong enough to give rise to a conscious precept accessible by working memory (Koch 2004, 203). Koch is saying that sensory memory through working memory

might be correlated with psychological consciousness, not phenomenal consciousness. At least such an approach might lead to fruitful empirical investigations on consciousness.

If we are to include phenomenal consciousness in a neuro-theory of consciousness, there must be NCC's for phenomenal consciousness too. But when Koch claims that NCC's depend solely on short-term and working memory, I believe he is wrong. Think of an example: What it is like to climb *Z* should be different for Reinhold Messner and Rowlatt. It should also be different for Reinhold-novice and Reinhold-expert. The difference in skill might, among other things, be describable as a structural change in the brain (see the section on Kandel above). So both phenomenal consciousness and NCC's must be related to long-term memory as well as sensory memory. I am not claiming that phenomenal consciousness *is* long-term memory, only that phenomenal consciousness will differ due to differences in long-term memory. This should not come as a surprise. It would be strange to claim that an experience is not affected by earlier experiences, long-term (procedural) memory. It might be said that to find NCC's are impossible if one is to include a person's life story in each experiential moment.<sup>23</sup> Perhaps, but that's an empirical, not a philosophical concern. Phenomenal consciousness depends on long-term memory as well as active dependent memory like working and sensory memory.

To sum up, phenomenal consciousness cannot be episodic or semantic memory because we can experience without remembering anything *about* the experience. Neither is phenomenal consciousness working memory, because experiencing and managing tasks is not the same thing. There is controversy about what in the brain contributes to, what depends upon, and what working memory is made up of. This is partly due to the insight that working memory relies on previously acquired knowledge, also known as long-term memory (see e.g.

Baddeley 2009, ch. 3, and Roediger, Dudai and Fitzpatrick 2007, ch. 7). Single-cell recordings in the prefrontal cortex suggest that working memory as a neuronal event is like the Nicholas Cage movie: gone in 60 seconds.<sup>24</sup> Experiencing is an on-going thing though. You do not have to remember your experiences, or pay any attention to something to be conscious.<sup>25</sup> Phenomenal consciousness is a small but important requirement, lacking in computers and zombies, ever present humans.<sup>26</sup> It does not seem that working memory, sensory memory or any kind of declarative memory *is* phenomenal consciousness. So if consciousness is part of athletic skill, memory research cannot completely explain skill.

### **Skill, knowledge and memory in the neurosciences**

It is time to recapitulate. A brief sketch of a neuroscientific account of skill, knowledge and memory goes something like this:<sup>27</sup> A skill is some kind of knowledge (knowing-how perhaps). To know something we must remember. If we do not remember how to x, or do not remember that y, we do not know x or y. Alas, knowledge must be some kind of memory. If skill is knowing how, then it must be memory (procedural long-term memory perhaps). Memory has something to do with the brain and is researchable by neuroscientific methods and techniques. So, skills can be researched by the neurosciences.

We have two reductions then: First, skill is (procedural) long-term memory. Second, (procedural) long-term memory is structural changes in the synapses between neurons (synaptic plasticity).<sup>28</sup> So, if a skill (A) is long-term memory (B) and long-term memory is synaptic plasticity (C), then a skill is reducible to synaptic plasticity:  $(A=B \wedge B=C) \rightarrow A=C$

We have a perfect reduction by identity, telling us that a skill is nothing above or beyond synaptic plasticity. There isn't more to say about skills when such an analysis is done.



I have argued that this picture of skills and knowledge in sport is wrong. I have argued that a skill is not identical to long-term memory ( $A \neq B$ ). It is also questionable if long-term memory is identical to a localizable spatial structural change in synapses between neurons ( $B \neq C$ ). It seems memory must be something more than synaptic plasticity. To have a memory we must also have a neuronal (re) firing. If we accept this, memory is not something that lingers in our brain. Memory is a (re)lived event, what neuroscientist Gerald Edelman (1992) calls a *remembered present*. A certain synaptic structure is necessary for motor skills, but to perform a skill a (re) firing of neurons must occur upon the synaptic structure known as long-term memory. Neuronal firings are seldom identical to each other, so each performance/memory is (slightly) different. Memory cannot be reduced to synapses, since there is nothing going on before neurons start firing. And when they do, they are not necessarily identical. The synaptic structure in the brain is a static thing at time  $t$ , a necessary condition for a repetitive motor act like doing the same drive at the golf range over and over again. A skill is not static; it's dynamic and adaptive. According to Edelman, memory is not a small scale model of external reality, but a dynamic process that enables us to act:

“In a complex brain, memory results from the selective matching that occurs between ongoing, distributed neural activity and various signals coming from the world, the body, and the brain itself. (...) it is the ability to re-create an act separated by a certain duration from the original signal set that is characteristic of memory. (...) it is, in some sense, a form of constructive *recategorization* during ongoing experience, rather than a precise replication of a previous sequence of events.” (Edelman and Tononi 2000, 95)

In Edelman's neuroscientific theory, skill or memory is not something one has, it is something one does.

It is perhaps comprehensible that a skill is not identical to memory, since skills are performed in the present, while our intuitions (aside from Edelman's) tell us that memories are about the past.<sup>29</sup> It is more radical I believe to argue that memory is not identical to synaptic plasticity. Basically I have argued above that synaptic plasticity are necessary, but not sufficient explanations of skills. Skills are ongoing actions and performances with environmental and social dimensions, while synaptic plasticity is not. The same counts for memory as synaptic plasticity. If either one of these two lines of arguments has got a ring to it, skills are not exhaustively explained by the neuroscience of memory ( $A \neq C$ ).

### **A final countdown: feeling and thinking in sport**

I hope our consideration of skill, knowledge, consciousness and memory have given us better armoury to deal with Foster Wallace's question. We started off asking whether a sport skill is procedural long-term memory. I have argued that a skill must be a whole lotta more. Skills must at least consist of using knowledge like rules (semantic long-term memory), planning on the basis of earlier experience (episodic long-term memory), being able to focus and shift attention (working memory), notice experiential changes (iconic memory), and finally being in a certain conscious state, the phenomenal 'what is it like' state. The neuroscience of memory contributes on everything except the latter, I have argued. Procedural long-term memory is obviously important for the successful performance of certain movements, but there would be no movements what so ever without the body's respiratory system, muscular system and so forth.. This point seems so naïve that mentioning it should be unnecessary. But the reductive strategies of pinpointing everything to a certain location must be more nuanced. If a skill were indeed a certain neuronal structure, we could just cut it out, put it on the table and watch great sport skills take place. Obviously that's not going to

happen. And obviously a skill is not identical or reducible to some neuronal structure. On the contrary, a skill is an active embodied performance in an ever changing environment. We still have to admit and accept that what the neurosciences teach us about memory is important, even crucial perhaps for our discussions of skill, consciousness and knowledge. In this final section I will try to relate the discussion so far to our initial question about an athlete's thinking and knowledge.

When athletes do all the things we have described, why do people say they are not thinking? Perhaps it originates from the dubious claim that skills are automated motor acts. These are seen as implicit or non-conscious processes, and non-conscious processes are seen as non-thinking processes. Skills might be *implicit* (meaning non-declarative), but that does not necessarily mean automated.<sup>30</sup> Skills are also intentional and goal-directed; they are consciously effectuated (what we have called psychological consciousness). Would anyone actually claim Agassi, Katarina Witt, Bobby Charlton or Michael Jordan, are not conscious when they perform? That they do not know what is happening? That they are like autumn leaves? And that there is no phenomenal what's it like difference between doing sport and doing the dishes? This seems to be the account held not only by Kandel and the neuroscientists mentioned here (see footnote 27), but also by people like Dreyfus (2007) and Bargh (1999).<sup>31</sup> But it cannot be the case that athletes are *non-conscious*. Sport skills are examples of human consciousness as flexible, attentive, focused, creative and done in phenomenal states.<sup>32</sup> Skills are not done without consciousness or thinking. Rather, in skills, different knowledge melts together in both psychological and phenomenal consciousness. The tip of the iceberg is the actual performance we see; behind it is the athlete's life story. In sport, knowledge and thinking is evident in every move; showing consciousness *as* physical prowess. Not as intertwined, but as one. In skilful performance, everything from procedural

long-term memory, muscle power and working memory come together, creating both spectacular performance and a very strong phenomenal conscious state of 'what it is like'. The term '*phenomenal* consciousness' could have come from sport: it is a great and special feel, a very strong state of being. Maybe that is why athletes come up short when questioned "how does it feel?": they know you have to experience it yourself.

I have argued it is wrong that skills are non-conscious and non-thinking performance. I have also argued that knowledge is embedded in skill and so is exhibited in many forms. The view of thought and actions as distinct has perhaps survived from what Evan Thompson (2007) calls a Cartesian hangover.<sup>33</sup> To bring thought back into body, writers have gone for different inclusive views. Philosophers like Sutton (2007, 778) go for action as the intertwining of movement and thought, neuroscientists like Antonio Damasio (2003) go for parallel processing, a kind of dual-aspect theory. These attempts are not going to rid us of the idea that thought is something distinct and separate from bodily movement. Instead we must come to see that even seemingly automated movements are indeed conscious and thoughtful. Sport movements exhibit intentionality, flexibility and conscious control. Perhaps movements are not automated at all; they just feel like it because they are fluid and habitual. The claim that implicit means non-conscious and non-thinking arises perhaps because we humans have a tendency to double instantiate. Nietzsche (GS, 13) describes this tendency:

"... people separates lightning from its flash and takes the latter to be a *deed*, something performed by a subject, which is called lightning...as though there were an indifferent substratum behind the (...) person...But there is no such substratum; there is no 'being' behind the deed, its effect and what becomes of it; 'the doer' is invented as an afterthought, - the doing is everything."

This is not supposed to be a discussion of Nietzschean ideas. I will only finish with stating that Nietzsche is onto something when he claims people double a deed; first as cause and then as its effect. In other words, the reason why athletes do not seem to think in the heat of the moment is because we look for a thought *and* an action. If there are not two things, we conclude like Foster Wallace that athletes do not think at all. When we double instantiate, we will look for the thought before (like Descartes and Wallace), parallel (like Damasio) or intertwined (like Sutton). If instead we accept, with Nietzsche, that there is only one thing, then we see the thought all the time. Simply because the action *is* the thought.

## Notes

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<sup>1</sup> See e.g. Horn (2008), Tenenbaum and Eklund (2007), Winberg and Gould (2003). Beilock, Wierenga and Carr (2003) review memory research in sport. They show that most work is done on the ability to recall and describe performance. I will try to show it is the work on working memory and long-term memory that deserves interest, not *episodic* memory.

<sup>2</sup> The belief that a mental act comes before, and is distinct from a motor act has a long tradition. Works of Davidson (1963) and Goldman (1970) are related to Aristotle's (2004a) practical syllogism, but also to Descartes' (1996) writings.

<sup>3</sup> See e.g. Schmidt and Lee (2005).

<sup>4</sup> Both Plato (1997, 85) and Aristotle (2004c, 449b-450b) discuss memory, but memory has hardly been present when philosophers have discussed knowledge and consciousness since.

<sup>5</sup> For discussions, see Roediger, Dudai and Fitzpatrick (2007).

<sup>6</sup> There is a philosophical distinction here between *being able* to, and *knowing how* to. One might say that I still know how to ride a bicycle after I paralyzed my legs, but I'm not able to. This leaves the question if skill and know-how are the same. It is strange to claim that a paralyzed person have cycling skills, but perhaps (s)he has know-how? We usually say it is possible to lose a skill, like when choking before an audience, but perhaps the person still has know-how. This article does not leave room for debating such subtleties. For a discussion connected to neuroscience and memory, see Bennett & Hacker (2003, ch. 5).

<sup>7</sup> The causal chain for strengthening a synapse is long-term potentiation (LTP). LTP is one kind of action potential, for example in the brain's hippocampus. LTP is considered a necessary requirement for the transformation to long-term memories (Gazzaniga, Ivry and Mangun (2002, ch. 8).

<sup>8</sup> Kandel (2007, 132-133) uses the distinction between 'knowing that' and 'knowing how' unreflectively, where the first is equivalent to explicit memory, the latter to implicit memory.

<sup>9</sup> Ericsson and Kintsch (1995) present a theory of how experts encode information into long-term memory faster and keep information more directly accessible than non-experts. I will not discuss their theory since it limits itself to a difference in explicit memory performance. For a critique of Ericsson and Kintsch, see Gobet (2000).

<sup>10</sup> See Baars (1997, ch. 4), Gazzaniga (2002, ch. 7, 16), Kandel (2006, ch. 23) and Koch (2004, ch. 9-11).

<sup>11</sup> Goldman-Rakic (see e.g. 1996) used single-cell recording to identify the neuronal events of working memory. If consciousness just is working memory, the identity reduction is fulfilled.

<sup>12</sup> Sport psychology underestimates attention as part of skill since "less is more" - meaning less cortical activity associated with attention is better for high performance. I would rather interpret attention in skills as *better* attention.

<sup>13</sup> For a more thorough treatment of psychological and phenomenal consciousness in sport, see Birch (2009).

<sup>14</sup> There's a link here to Polanyi's (1962) concepts of focal- and subsidiary /tacit awareness/knowledge worth investigating.

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- <sup>15</sup> See e.g. Gazzaniga, Ivry and Mangun (2002, ch. 16).
- <sup>16</sup> An example is the subtitle of Kandel's work (2006): "the emergence of a new science of mind".
- <sup>17</sup> Rowlatt uses the term *access* consciousness, but I believe we can substitute the terms without much further ado. This has not been controversial in philosophical literature lately.
- <sup>18</sup> See e.g. Roediger, Zaromb and Goode (2009).
- <sup>19</sup> Pain, a raw feel, is standardly considered a prime example of phenomenal consciousness; it is something it is like to be in pain (Kim 2006, ch. 1, 8).
- <sup>20</sup> For a philosophical discussion on blindsight and consciousness, see Holt (2003).
- <sup>21</sup> Brain regions involved in sensory memory have so far been difficult to pinpoint, as Rowlatt admits (2009, 73). They range from regions in sensory cortex, to the lateral pre frontal cortex and inferior temporal lobe and the hippocampus, temporal parietal and dorsolateral prefrontal cortex (Koch 2004, 203). It could be argued that one can have perceptions without having sensory memory. One could have neural events in the V1 of visual cortex without having neural events in the brain regions associated with sensory memory.
- <sup>22</sup> See Milner, Corkin and Tauber (1968) and D. Wearing (2005).
- <sup>23</sup> Edelman (1992, 135-136) uses this line of argument when he claims that neuroscience does not deal with a person's life story. That is fine of course, except when dealing with matters like exhaustive theories of consciousness.
- <sup>24</sup> See e.g. Fuster (1973).
- <sup>25</sup> Does one need to be awake to have a phenomenal state? It is common to claim that we have to be awake to be conscious (Searle 2002, 7), but I believe this refers to psychological consciousness. It seems there's something it's like being asleep, distinct from what it's like being awake. Maybe there's even a phenomenal state of a coma?
- <sup>26</sup> In the philosophy of mind, a zombie is usually described as an agent with psychological consciousness (showing intention, attention, rationality), but without phenomenal consciousness. There's no 'what's it like' state to being a zombie, (Chalmers 1996). Both Wallace and Koch (2004, 194) seem to have a zombie view of athletes. But they must be wrong: there is a *very* strong 'what's it like' state when performing sport, as most can confess.
- <sup>27</sup> See e.g. Gazzaniga (2002, ch. 8), Kandel (2006, ch. 8, 10), LeDoux (2002, ch. 5), and Koch (2004, ch. 11).
- <sup>28</sup> See e.g. LeDoux (2002, ch. 6).
- <sup>29</sup> Interesting investigations important to understanding sport skills not covered here is the ability of predicting and planning the future. This is seen as a *memory* capacity by e.g. Schacter, Addis and Buckner (2007).
- <sup>30</sup> For a critique of expert performance as automation, see Birch (forthcoming).
- <sup>31</sup> Dreyfus (2007) argues that expert skills are intuitive and hence goes on without consciousness interfering. Bargh (1999) argues that *most* of our life is automated and consciousness is more or less an epiphenomenon. Although Dreyfus' view is more nuanced (see Eriksen 2010) than simply stating 'experts are not conscious', Breivik's (2007) and Montero's (2010) critiques of Dreyfus' exclusion of consciousness are on target.
- <sup>32</sup> An important contribution here is Montero (2010). She challenges the idea that (conscious) attention and (bodily) awareness hinders highly skilled movement.
- <sup>33</sup> Thompson (2007, ch. 8) delivers a broadside to the idea that consciousness is reducible to the brain. His counter example to the brain in the vat argument is somewhat analogue to the rejection of the reducibility of skill presented here.

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## **Intentional and Skillful Mirrors**

In the mid 90's there was a major neuroscientific discovery which might drastically alter sport science in general and philosophy of sport in particular. The discovery of *mirror neurons* by Giacomo Rizzolatti and colleagues in Parma, Italy is a substantial contribution to understanding brains, movement and humans. Famous neuroscientist V. S. Ramachandran believes the discovery of mirror neurons “will do for psychology what DNA did for biology”.<sup>1</sup> Somehow, mirror neurons have not received the deserved attention in the philosophy of sport. It should be time to reflect on implications and consequences. The discovery of mirror neurons may increase our insights about motor knowledge and intentionality, about our ability to learn, understand and finally produce motor actions.

In this article I will first examine what mirror neurons are and how they function in monkeys and humans. Second, I will review some objections to the so-called mirror neuron theory of action recognition, and try to reconcile some of these objections. Third, I will inquire into some implications for philosophy, which I believe are also fundamental to several topics in the philosophy of sport. Fourth, I will try to relate some of the most interesting aspects of mirror neurons to the recent debate by Breivik (4), Hopsicker (21) and Moe (28) on motor intentionality, skills and knowledge. Finally, I will speculate on what further neurophysiological research might and might not teach us on the nature of being a moving subject.

### **Finding mirror neurons, finding out how they work**

The discovery of *mirror neurons* happened almost by chance. While Rizzolatti and colleagues were doing single-cell recordings on macaque monkeys grasping for objects, something extraordinary happened:<sup>2</sup> when an experimenter accidentally grasped a cup of coffee, the same neurons fired when the monkey *observed* the experimenter as had fired when the monkey itself had *done* the act of grasping. Neurons were found in the brain's motor area F5 that responded both when a monkey performed a motor act, and when observing another monkey or human performing the same act. That was an astonishing incident. It meant action

observation causes in the observant the automatic activation of the same neural mechanism triggered by action execution. Rizzolatti and colleagues established the hypothesis that contrary to the belief that the motor system was a purely executive system in a serially organized brain, there were actually neurons that had both visual *and* motor properties, working in parallel. The now famous mirror neurons allow a direct matching between the visual description of an action and its execution. Mirror neurons match movements we observe to movements we can do, and so understand their meaning. Without a mirror neuron system, we would not understand what other people were doing it seems. Let's take a further inquiry into the properties and function(s) of mirror neurons.

It was long thought that not only neurons, but also different brain regions had distinctly functional properties. Not so. The posterior motor areas (F1-F5) are heavily connected to the parietal lobe and the cingulate cortex, suggesting that sensory information from the parietal lobe is used to organize and control movement by coding the space around us. The motor system works in parallel with the sensory system so that we are able to differentiate objects and implement movements. When long term planning and intentions associated with the cingulate cortex kick in, we may begin to talk about *actions*. That processes in the brain are widely distributed and work in parallel is not new (2; 7; 14), so what is? It is the scientific understanding that perceiving and planning could not be done without a moving body in a world. The distance, orientation and possibilities of an object are impossible to grasp without a reference to the body. This is what philosopher Evan Thompson (40: pp. 13-15) calls the enactive approach, which is a neuroscientific turn, perhaps a Khunian paradigm-shift, away from a deconstructive understanding of the body. The parallel workings of the brain is crucial to act appropriately in the world, and the motor system is both part of and in itself a cognitive system.

The best way for evolution to make things happen fast and fluid is to give neurons *more* than one property. Rizzolatti gives an example (34: p. 21): picking up an object, say a ball, is a combination of two processes, reaching and grasping. It may seem that reaching precedes grasping, but neuronal recordings show that grasping starts simultaneously as the arm moves to reach. The hand assumes the shape needed to grasp instantly! To grasp something, activation of the primary motor cortex (F1) is required.<sup>3</sup> F1 does not respond to visual stimuli and cannot transform the geometrical properties of an object to make an appropriate grasp.

This is done in the F5 (34: p. 22). F5 does not code individual movements but motor *actions*, which are goal directed. Single cell-recordings show that bending a finger when scratching does not activate the same neurons as does bending a finger to grasp (34: p. 23). The same mechanical movement has different *meaning*, and hence different neurons activated. A portion of these neurons in F5 are called *canonical* neurons and respond selectively also to visual objects: an individual neuron fires both when a ring is grasped for (motor property) and when only seen (visual property). The same neuron does not fire when a square is seen, or grasped for (34: pp. 26-29). Through what Edelman calls “neural Darwinism” (14), or pruning of synaptic connectivity, we learn how different motor responses lead to efficient prehensions. Rizzolatti’s interpretation is that F5 contains a vocabulary of motor acts (34: pp. 35, 46-47) so that we have a repertoire which is at the basis of cognitive functions usually associated with the visual system. Some of the neurons in F5 then, discharge both when we do, and when we observe: the motor and visual responses have the same functional meaning.

Unlike canonical neurons, the mirror neurons in F5 are not activated when observing objects, but when observing motor acts involving object interaction (34: pp. 79-80). Mirror neurons come in classes of specific acts, like grasping, reaching, holding etc. There are two major types of mirror neurons: *strictly congruent* and *broadly congruent*. If a mirror neuron is strictly congruent it means the observed action and the executed action have virtually identical neural activation. If a mirror neuron is broadly congruent then the observed and executed acts are connected, but not identical. Most of the mirror neurons (70%) seem to be broadly congruent (34: pp. 82-84). Finding a strictly congruent mirror neuron is a task for single-cell recording, and in the myriad of neurons very difficult to detect. Finding broadly congruent neurons can be done by imaging techniques like functional magnetic resonance imaging (fMRI) and is what have supposedly been done in human brains.<sup>4</sup> There is a question of course whether we should apply the term ‘*mirror neuron*’ to a neuron that is not strictly congruent. This is perhaps why neuroscientists have come to speak of a mirror neuron *system*, which reflects congruent activity in the same brain region when observing and executing. In philosophical scrutiny we might argue that only a system with properties which *appears* to be like mirror neurons has been detected in humans, since it has not been registered strictly congruent mirror neurons by single-cell recordings in humans. This aside, what are mirror neurons good for? What is their function?

At first glance we might believe mirror neurons would benefit replication of other animals' movements, and hence be beneficial to learning. Or, that mirror neurons prepared us to act, since we would get a head start on an animal without mirror neurons (or one with a more poorly developed system). But no. Rizzolatti argues that imitation is involved in the construction of a motor image used in a preparatory stage. The macaque monkey has mirror neurons, but does not imitate, only higher primates imitate. Mirror neurons must hence have an earlier evolutionary origin and another *primary* function, namely action understanding (34: pp. 94-97). Since mirror neurons have both visual and motor properties, visual information and motor knowledge can be coordinated. The motor knowledge we possess can be used when observing others. Having motor knowledge is necessary and sufficient to understand the sensory information involved in the action of others (see below). Rizzolatti claims motor knowledge is "of fundamental importance for building a basic intentional cognition" (34: p. 106). The mirror neuron system provides the mechanism where an animal combines visual inputs with its motor knowledge to understand the actions of another animal. It means that we do not have to reflect upon what another animal is doing, but understand directly and hence can make responses quickly if needed. But what do we know about mirror neurons in humans? And are they different from the neurons in monkeys?<sup>5</sup>

### **Mirrors in humans**

Electrophysiological techniques like electroencephalography (EEG) have been used on humans to support the claim that there is a mirror neuron system in humans.<sup>6</sup> In addition there has been several brain imaging studies (like fMRI) supporting the mirror neuron theory and more is coming all the time. Brain imaging localizes brain areas and circuits involved in the mirror neuron system, so that it is possible to find *where* the human mirror neuron system is. Cytoarchitectonic differences in the human and monkey brain make areas functional and spatial un-identical, but at least brain imaging might make us able to know where to start looking when new technology comes on knocking. With fMRI (and similar brain imaging), there can only be evidence of a mirror neuron *system*, and the neurons involved cannot be claimed to be anything more than broadly congruent.<sup>7</sup> We are not even sure what the homologue of macaque F5 is, but evidence suggests it is Brodmann's area 44 (BA 44) (34: p. 121).<sup>8</sup>

The evidence collected show that compared to monkeys, the human mirror system has more cortical space, respond also to non-object related arm movements and code temporal aspects of individual movements (34: pp. 115-118, 124). This probably means that the human mirror system has more fine grained action understanding, but also other functions. Rizzolatti argues that it is still action understanding that is the primary function. What else might it be?

Although macaque monkeys do not imitate, humans do. Might the mirror neuron system be involved in imitation, and the transmission from observing actions to motor abilities? Are mirror neurons important for *learning*? Rizzolatti argues that “the mirror system is involved in the imitation of acts already present in the observer’s motor repertoire, suggesting an immediate motor translation of the observed action” (34: p. 143). This implies that mirror neurons are involved in imitation, but not learning. Rizzolatti states that in addition to the mirror neuron system we must have a control system that inhibits motor movements. If not, we would replicate every movement we observed. So, if we are to learn by imitation, mirror neurons might be a necessary condition but not sufficient (34: pp. 148-153). The mirror neuron system provides a mechanism coding sensory and motor information required to imitate; a mirror neuron system might hence give us a head start to imitation and learning.

Research on mirror neurons is putting its mark on imitation learning for the sport sciences as well, nicely reviewed by Stefan Vogt (42). The subject of observational learning is also of interest to sport science, and mirror neurons might play a part here too (39; 41), although Rizzolatti himself is downplaying this part. If the mirror neuron system in fact does contribute in observational learning, it would appear to be beneficial whenever we are observing experts on the driving range, swinging a bat or throwing/catching a ball. Neuroscientific research on mirror neurons might thus change or influence both instruction- and learning protocols.<sup>9</sup> Rizzolatti does not *deny* that a mirror neuron mechanism has implications for learning; he is merely claiming that learning is not the primary function. The main reason is that mirror neuron activity is increased by already present (motor) knowledge, so mirror neurons do not seem to be involved in learning movements from scratch. Mirror neuron activity might modify or enhance skills/motor knowledge though. Maybe we should say that learning enhances the mirror neuron system more than vice versa. We will see later that an enhanced mirror neuron system has the consequence of recognizing subtle differences in actions, so learning through training and mirror neurons are certainly connected. If it is action

understanding and not learning that is the primary function of mirror neurons, we might claim that mirror neurons contribute more to a philosophical theory than a pedagogical theory. But there are voices arguing that mirror neurons do not play a role in action understanding. Let us listen to one of them.<sup>10</sup>

### **Hickok's critique - and some answers**

We must be cautious not to be seduced by motor theories, be they of language, perception or cognition. As philosophers of sport, it is of course easy to be against intellectualism (see e.g. 32) and embrace theories which emphasize embodiment and motor action. Perhaps we are too easily led astray by say the philosophy of Merleau-Ponty, the ecological psychology of Gibson, or in this case the mirror neuron theory put forward by Rizzolatti and colleagues. Philosophers of sport would be good sports if they were the most skeptical to such accounts. We must not forget that there is overwhelming empirical evidence that cognition can be dissociated from body and movement and perhaps this is why by far most of traditional philosophy has been occupied with theories not involving body or movement. It is a sound endeavor therefore to scrutinize the mirror neuron theory; *especially* if we like it and feel that bodily movements just is *it*.

I will in the following review some serious objections to the mirror neuron theory of action understanding. I will also give some comments on how/if these objections can be reconciled. Gregory Hickok (20) raises some difficulties for the mirror neuron theory, which all stem from skepticism towards any motor/embodied theory (20: p. 1229). Hickok's problems are based mainly on a critique of inferring mirror neurons in (macaque) monkeys to humans. Underlying this are some further problems which I will briefly evaluate before moving to seven particular problems.<sup>11</sup>

Hickok initially complains that it is not clear what 'action understanding' means in different texts, by the same and different writers, and in different experiments (20: pp. 1230-31). This is of course a problem, but not particularly for Rizzolatti and other mirror neuron proponents. This is a problem that encounters any enterprise in its infancy. Nor should we forget that philosophers have argued for centuries, and probably always will, about the meaning of concepts like 'action' and 'intention'. We should not demand too much of semantics in this



department I believe, but like Hickok we should urge for consistency. In Rizzolatti and Sinigaglia's pivotal book (34) they take 'action understanding' to mean "to immediately recognize a specific type of action in the observed 'motor events'", "movements take on meaning for the observer" who "*perceives the meaning* of these 'motor events' and *interprets them* in terms of an *intentional act*" (34: pp. 97-98). Action understanding must thus be understood as perceiving and interpreting motor events as intentional acts. The mirror neuron system is regarded as a direct neural mechanism doing this so we can use information to respond in the most appropriate manner, *without* explicit, conceptual or reflexive thought (34: pp. 97-98). It is the lack of conceptual content that makes it an embodied theory of cognition, which Hickok generally opposes. Hickok does not deny the existence of mirror neurons *per se*; he denies that their (primary) function is action understanding. As we have seen, mirror neurons are linked to the F5 in macaque monkeys and it is not clear what the equivalent brain area is in humans. Hickok rightly questions the empirical basis for inferring the existence to humans. This problem might be resolved in the (nearby) future if single-cell (or similar) recordings can be done on humans *in vivo*. Until then, we will only have brain imaging like fMRI showing (increased) brain activity in brain regions *supposedly* having mirror neurons. Hickok is of course right when he warns to make claims about functional properties across species when location does not hold across species. But that does not mean there isn't a mirror neuron system for action understanding in humans. Hickok argues though, that the function of mirror neurons is not action understanding in monkeys either.

The first problem raised by Hickok is the *lack of evidence* for action understanding in monkeys (20: pp. 1231-33). If this core claim is undermined, there really isn't much left for the mirror neuron theorist. Hickok's hypothesis is that lesions to F5 in monkeys should disrupt action recognition. But this kind of evidence is scarce or variable. It also follows that if one does have action understanding when F5 is impaired, mirror neurons are not the sole mechanism for action understanding or this function is overestimated. Hickok argues there are indeed ways to represent and understand actions without the brain areas of the mirror neuron system (20: p. 1232), and that only a small percentage (15%) of the mirror neurons in the F5 seems to code the meaning of action. This is also an indication that action understanding is not the only thing the mirror neuron system is involved in, but it might still be the highest amount of mirror neurons involved in one particular function. Lesion studies of the exclusive kind would give us evidence with causal claims. So far we are left with correlation. This is not

to say that there is *no* evidence of mirror neurons involved in action understanding, which is what Hickok claims (20: 1231). It is merely to say that there might be different ways to, and other areas involved in action understanding. This is Hickok's second objection.

Hickok argues that the existence of *other mechanisms for action understanding* suggests that it might be difficult to distinguish action understanding from object understanding (20: p. 1233). This is because cells in the superior temporal sulcus (STS) do not have motor properties, but have been found to be involved in action understanding. We might have a circuit coming from STS to F5 suggesting that action understanding is achieved primarily through perceptual object recognition and leaving mirror neurons to a mere executive motor command. That there are other areas involved in action understanding is perhaps not the greatest threat to the mirror neuron theory of action understanding. It is commonly accepted that neuronal activity is widely distributed in the brain (see e.g. 2), that areas work in parallel and loops (see e.g. 14; 15) and that this differs even at individual level (see e.g. 7). The mirror neuron theory simply implies that mirror neurons (perhaps amongst many) are indeed involved in action recognition, and at some level even primary (for mouth/hand grasping/gripping).

The third problem is that mirror neurons have been found in *other locations than F5*. That there are mirror neurons outside F5 does not in itself weaken the mirror neuron theory of action understanding. It is an empirical question if the functional properties of mirror neurons are to be found elsewhere. If so, fine. That might just be an indication that cells have different functions, properties or connections than scientists originally believed. We are perhaps beginning to see that the brain is not organized neatly, but is complex to the degree neuroscientist Edelman calls an ever changing, intricate jungle (14: p. 29).

The fourth problem confronts the grounds for *inferring from macaque to human*. We have to consider at least three possibilities concerning mirror neurons in monkeys and humans: 1) Mirror neurons do not exist in humans, 2) Mirror neurons are exactly the same in monkeys and humans, 3) Mirror neurons in humans have evolved to be involved in higher-order cognition (20: p. 1234). The first two possibilities have not been ruled out empirically and it is therefore a sound scientific attitude to hold one of these propositions, Hickok argues. This is not to say that the mirror neuron theory of action understanding regarding monkeys is false.

But if one adopts the third possibility, which according to Hickok (20: p. 1235) mirror neuron theorists most often do, it is not necessarily true regarding humans.

The fifth and sixth problem raises the question if *the mirror neuron system can be dissociated from action understanding* in humans (20: pp. 1235-36). Hickok argues that the mirror neuron system is not a *necessary* requirement for action understanding in humans, since other brain areas without mirror neuron properties are also involved in action understanding and that we are indeed capable of understanding actions we have never performed ourselves (without having motor knowledge). The mirror neuron theory implies that if one cannot produce types of actions, one will also have trouble understanding those actions. But this does not seem to be the case, since even people born with heavy movement deficits seem perfectly qualified to understand the actions of others. Hickok also points to the absurdity of mirroring in the literary sense: we would produce the same movement we observe *if* neuronal events were in fact truly mirrored. This would be counterproductive; meeting a lay-up with a lay-up and not a block. At some point then, action observation, understanding and production must come apart (20: pp. 1236-37). That would make the mirror neuron system's properties and functions appear meaningless. I believe this critique is not as devastating to the mirror neuron theory of action understanding as it seems.

That action observation, understanding and production *can* come apart both intellectually and neuronally does not reject that mirror neurons have both visual and motor properties. It is just to say that many brain areas and circuits work together. This fact is appreciated by Rizzolatti (35; 36). Rizzolatti's claim is that mirror neurons might be a platform from which we can have other and maybe more sophisticated comprehensions of actions and intentions. Without the mirror neuron system, this more fine grained understanding might be impaired. Rizzolatti and colleagues have never argued that mirror neurons fire identically on a group level either. That would indeed be counterproductive. Mirror neurons are, as stated above, more or less congruent. We have activity in the motor cortex just by visualizing movements (and strongly congruent as well, see e.g. 23), but the neural activity is not strictly *identical*, because at some level we also have inhibition. If not, we could never visualize, fantasize, imagine without producing movements. When an action is understood; mirror neurons help us coming up with an appropriate response. The final (motor) response is the sum of many goings on, not only mirror neurons. In this way, action understanding and production both can and cannot come

apart. Without the mirror neuron system the goalie would not have the time to react appropriately when say a hockey shot is fired (see e.g. 27). This is in fact a problem for the serial information processing theorist, like Hickok seems to be. Knowing the time course of neuronal events, there simply isn't time for the brain to come up with responses if a puck or a tennis ball travels fast enough (see 27: pp. 44-47). The mirror neuron theory might explain how we are able to respond appropriately then (34: p. 73), contrary to Hickok's suggestion that mirror neurons would produce identical actions.

Hickok's seventh problem concerns the *location of F5 in humans*. If F5 is analogue to BA 44/6, then damage to this latter region should cause impaired action recognition. But that does not seem to be the case (20: pp. 1237-38). Since the exact location(s) of the mirror neuron system(s) in humans is not established, this is no broadside to the theory and I will leave it at that. We may summarize Hickok's important critique by urging ourselves not to jump to conclusions, especially when empirical evidence is (relatively) sparse, and that activity in the mirror neuron system *might* be a result from sensory-motor pairings. We must also, whether as philosophers of sport we like it or not, recognize the possibility that action understanding, abstract representation and thought seems to work quite well in humans without motor knowledge, ability or maybe even a mirror neuron system.

Neither must we forget that there *is* a huge pile of evidence (and more coming all the time (see e.g. 17: p. 105; 36)) supporting the mirror neuron theory of action understanding – and more.<sup>12</sup> Let us continue our discussion with the following attitude: suppose the mirror neuron theory of action understanding is true. What then? What would this mean to philosophy in general and philosophy of sport in particular?

### **Philosophical implications**

There are several important philosophical consequences put forward by the mirror neuron theory. One implication of mirror neurons is questioning the intuitive view held by many analytical philosophers that the causal chain of action goes from a desire/belief (in the brain) to the arm in a serial order. Single-cell recordings show that in reaching and grasping for food the arm moves without any *declarative* intention, and contractions in the hand may start before the shoulder. It is to say that motor actions are intentional in themselves, and that

information processing theories are undermined. This paves way for two consequences I will focus on here:

1) Motor actions are cognitive, and epistemology cannot any longer stick to the idea that knowing how (motor knowledge) is not proper knowledge.

2) Mirror neurons support a motor-theory of mind. A consequence for philosophy of mind should be an inclusion of body and motor action.

I will elaborate on these issues, before moving on to more specific concerns in the philosophy of sport.

### **Motor actions are cognitive at their most fundamental level**

The view that the motor system is simply an executive system without any perceptive- or cognitive element is being challenged by the discovery of mirror neurons. Mirror neurons in the motor system are much more complex than classical cognitivism and its modern version, constructivism, have recognized. Mirror neurons discriminate sensorial ‘information’ and code it on the basis of potential acts (gripping, reaching, bringing towards). To separate intention from bodily movement is in this light perhaps a mistake. It is quite seldom (if at all) that we merely move our limbs randomly like autumn leaves; instead we are goal-directed. Without falling into a discussion on the philosophy of action, we might say that we perform actions, not just movements.<sup>13</sup> As we have seen, some of the neurons in F5 discharge both when we do and when we observe: the motor and visual responses have the same functional meaning. The consequences are truly crucial to philosophy, sport science and philosophy of sport: hard evidence-based science now supports the notion of movement as cognition. The motor cortex of the brain is thus not merely executing movements, but actions. With the discovery of neurons with both visual and motor properties, the great distinctions between perception, cognition and movement are being more than bridged. They are being intertwined, perhaps even brought together as one. Rizzolatti claims that motor knowledge is necessary to understand the intention and meaning of actions. The whole idea that actions and intentions are guided by ultimately declarative beliefs or desires is seriously wounded. Perhaps we should abolish the distinction between knowing that and knowing how all together. This would truly change epistemology since analytic philosophers have hardly recognized knowing how (motor knowledge) as real knowledge at all, sticking to propositional knowledge that can be given truth values.

### **A motor theory of mind?**

Philosopher Alvin Goldman argues that mirror neurons might be the fundament for a simulation theory of mind (19). Goldman has collaborated with Vittorio Gallese, who is probably Rizzolatti's closest research partner. Like Rizzolatti (34: p. 131), Goldman attacks what he calls a theory-theory of mind. This also resembles Moe's (28) critique of classical cognitivism and information processing theory. Goldman argues that understanding low-level emotions (six basic emotions: disgust, fear, anger, surprise, sadness, happiness) is not something we do by reasoning (by theory, or like information processing). Instead, evolution has brought forward a faster and more direct way of recognizing emotions, namely simulation. Goldman uses evidence from cognitive neuroscience to argue that if you have not experienced a basic emotion yourself, your recognition of such an emotion is heavily impaired (19: ch. 6). In contrast to Hickok's arguments above, Goldman refers to massive amounts of lesion studies to show that persons with damage to brain areas (like amygdala) involved in experiencing a type of emotion (like fear) have problems detecting face expressions of that same type of emotion. This is an analogue to the work of Rizzolatti: if you cannot do, you cannot understand – if you cannot experience, you cannot recognize. Goldman uses the mirror neuron theory to support his claims (19: pp. 127-143). Goldman argues that the neurophysiological mechanism for understanding emotions is the same as understanding bodily actions.<sup>14</sup> And this is why Goldman's work is interesting also to philosophy of sport: emotion recognition and action recognition is essentially the same. And if so: knowledge of so called mental states and motor knowledge is also the same. Empirical investigations will probably revolve around questions concerning emotions and mirror neurons in the nearby future. But if Goldman is right (and Hickok wrong), it puts bodily knowledge on par with what has traditionally been called cognition and this insight may finally rid us of the Cartesian divide between body and mind. Such a motor theory of mind has consequences for the philosophy of mind. It raises questions to the notion that mind and the mental is something else than body and motor action – be it a difference in essence (Descartes) or place (physicalistic ideas of everything conscious going on in the brain alone). If you cannot reduce first-person experience to third-person description, this amounts to saying an experience cannot be known in any other way than by being there/doing it.<sup>15</sup> Rizzolatti insists that mirror neurons give an observer a first person grasp of the motor goals and intentions of others that we have yet to find elsewhere (34: p. 138; 36). This is also to say that we might actually have

a neurophysiological mechanism for what is known as phenomenal consciousness in analytic philosophy.<sup>16</sup> Our body and motor actions then, is the hub of our thoughts, our minds and consciousness.

### **Mirror neurons in the philosophy of sport**

Motor theories are not new to the philosophy of sport. What is new is the empirical foundation the discovery of mirror neurons provides (if Hickok's critiques can be met). How the body and brain work in conjunction with the world should be met with great interest by philosophers of sport. Neuroscientific discoveries have implications ranging from learning protocols to epistemological and metaphysical questions concerning the human body. In this article though, I will highlight a discussion recently brought up again by Peter Hopsicker (21). When Hopsicker extended the contributions made by Breivik (4) and Moe (28) on consciousness and knowledge in skilled motor behavior, he said it is those things we do not declare that deserves attention (21: p. 86). As we have seen, mirror neurons work in the interplay between the non-declarative, intentionality and prior knowledge. In this section I will try to relate the discussion above on mirror neurons to the contributions by Hopsicker, Moe and Breivik.

To get a better grasp of intentional movements in sport, Moe first raised critiques against information processing theories held by cognitivists. Moe's arguments came from Dreyfus' (12; 13) anti-representational/anti-rule account and Searle's (35) neurobiological theory of consciousness. Breivik criticized Dreyfus' view of absorbed coping. Breivik argues Dreyfus treats the athlete as mostly mindless, and hence underestimates conscious attention in (elite) performance. Hopsicker follows Moe and Breivik by analyzing the 'background' and 'attention'. Hopsicker turns to Polanyi to "examine kinds of knowing and how our intellect operates at the tacit and focal levels during the learning and performance of complex motor activities" (21: p. 76). It is here that I hope to contribute a little further by moving into the domain of contemporary neurophysiology.

In the information processing theories Moe criticizes, the motor system is regarded as an executive system without any perceptive or cognitive elements. Since recordings of mirror neurons suggest that there is a *direct* link between seeing and doing, there is no *processing* of information in the brain. Rizzolatti argues that we cannot any longer support the view that

perception, cognition and movement are distinct processes (34: pp. x- xi, 3, 17-21). The neuroscience of mirror neurons gives heavy empirical artillery to Moe's arguments against information processing theories and (classical) cognitivism.<sup>17</sup>

In the discussion of mirror neurons above, we have seen that having motor knowledge is what makes the mirror neuron system efficient. Having appropriate motor knowledge means that one can understand actions also if the observation is clouded by light, weather, objects etc. This is certainly a great benefit in evolutionary terms. It means a better prediction of what is going to happen, and a better possibility to make an efficient response. The link to sport is evident: having a good developed mirror neuron system and motor knowledge make us understand what the opponent is going to do next. We can even unmask tricks and supposedly concealed moves and techniques. As we have already seen, a grasp starts simultaneously as an arm reaches. When observing someone move, the mirror neurons in our brain coding for an *intentional act* – a goal-directed act - starts firing at the first minor twitches of the other animal. Mirror neurons combined with motor knowledge make us able to understand a motor act at an incredible early stage (34: pp. 110-114). Without mirror neurons, the tennis ball served by Federer would probably be way behind you (or Nadal) before your arm began to move. Thanks to the mirror neuron system, already in the throw up we begin to understand where the ball is coming and start a countermove. Motor knowledge is part of 'the background', which again makes us both understand and produce intentional actions. Rizzolatti also argues that human action understanding based on motor knowledge is done pre-reflectively and non-conceptually (34: pp. 124-125). The human mirror system might be interpreted as *tacit* knowledge. As we shall see below, there are several reasons to believe that the mirror neuron system is trainable and different at individual level. The mirror neuron system then, is what Polanyi calls 'personal knowledge' (33).

### **Nurturing a mirror neuron system**

The 'background' and the tacit knowledge discussed by Moe and Hopsicker are the result of experience. When contributing to skills, they are nurtured rather than the product of nature. When the mirror neuron system is considered the result of evolution it is perhaps easy to think of it as a static system rising from DNA structures which are not trainable.<sup>18</sup> But empirical evidence from sport related studies actually support another interpretation. In an fMRI study by Calvo-Merino (5) on expert ballet dancers, experts in capoeira and non-expert control



groups the following results emerged: the experts had stronger activation than non-experts in brain areas typically associated with the mirror neuron system when viewing videos of ballet and capoeira. But not only that: the expert dancers had stronger activation when watching ballet than capoeira, and the capoeira experts had stronger activation when watching capoeira than ballet. Both expert groups had stronger activation than the non-experts when watching actions from their non-expert domain. These findings suggest that a mirror neuron system is important for skillful motor behavior, and might be developed through training and experience. Similar results have been found in basketball players (1), where also decision making abilities have been linked to the mirror neuron system. This kind of research shows how neuroscientific studies on mirror neurons is directly influencing sport science.<sup>19</sup> The trainability of the mirror neuron system (e.g. the difference between experts and novices) is also an answer to the problem raised by Hickok against motor knowledge as a necessary requirement for action understanding: action understanding is a matter of degree, and Calvo-Merino shows us that more/better motor knowledge enables a more fine grained (better) action understanding.

Rizzolatti argues that motor knowledge is decisive in understanding the *meaning* of actions of others (34: pp. 136-138). Hence, we may suggest that motor knowledge is cognitive knowledge. For sport skills it may also suggest the following: action understanding in team sports like volleyball, ice hockey and baseball, and individual sports like tennis or boxing (where we respond to the actions of an opponent) is enhanced by the mirror neuron system. Our sensitivity to another's motor goals and intentions is better if we have expertise in the specific motor area. Mirror neurons have something to do with skillful motor behavior is the suggestion. The link to sport is appreciated also by Rizzolatti's philosophical right hand, Corrado Sinigaglia (38: p. 320): the mirror neuron system is trainable so that a wide platform of action production enables action understanding. Simply put: the more you can *do*, the more you *know*, making adequate (and creative) responses easier to come up with.<sup>20</sup> This might not come as a surprise to sporting people, but the mechanisms of the mirror neuron system gives us insight into *why* this is so. That is after all considerable scientific progress. The motor knowledge involved in action understanding is background knowledge, but it is also tacit knowledge: motor knowledge involved in action production and understanding does not have to be declared, or rise to the conscious attention Breivik (4) claims is important in skillful motor behaviour. That we do not have direct declarative conscious access to the

neurophysiological mechanism of mirror neurons is not to say that athletes are non-conscious as Dreyfus claims. It is merely to say that consciousness is directly evident in the actions, if we catch Rizzolatti's drift about motor actions being cognitive in them selves. Athletes do not have to make the background (Polanyi's subsidiary awareness) rise to conscious attention (Polanyi's focal awareness) because they *know* what they can *do*, and in this lies their ability also for action understanding and appropriate (or surprising) responses (34: p. 114). The mechanisms of the mirror neuron system enable us to understand how we can be intentional and conscious while knowledge remains tacit and in the background.

Whether the mirror neuron system is hardwired by nature or changeable through training and nurture is not to be decided here (of course). But a difference between mirror neurons in humans and monkeys may be reflected in a general difference between these species: neuroscientists working within evolutionary theory (see e.g. 18: ch. 14) agree that the neural networks and pathways in humans are somehow pruned (see 14; 15), epigenetic (see 7) and making new connections and synaptic growth at a completely different level than any other species, including chimpanzees, gorillas and macaques (25: ch. 3-4). This is evident in our relatively long (social) learning phase, compared to other primates and mammals. Even our gene expression changes to a great degree (24), and this is a necessary requirement for our fabulous ability to adapt and learn, both in daily life and sport. Our human nature is a nature of nurturing, and so is perhaps the mirror neuron system (5: pp. 1246-48; 34. p. 130). The obviously cognitive capacity of understanding intentional motor actions seems to be underpinned by trainable motor capacities which are tacit and in the background.

Let us sum up what all the hype is about, and what some consequences are. First and foremost, mirror neurons have visual *and* motor properties (34: ch. 2). This again implies that both visual and motor responses have the same functional meaning (34: p. 47). In other words, the discharging of the neuron is the same when an action is performed by you as when you just observe someone else doing the same action. This is also to say that the motor system is not solely a final stage in the brain for execution, but a cognitive system in itself. Rizzolatti describes this as "seeing with the hand" (34: pp. 50-51). If we relate this to the debate surrounding Hopsicker, Moe and Breivik, we see that the properties of the mirror neuron system provide the possibility of an extended mind where the hand or the hammer "sees the nail" (21: pp. 79-80) and gives us a neurophysiological explanation of why we do not have to

reflect on doing this or that: we do not need to have focal awareness (see 21) or conscious attention (see 4) on all the subsidiaries/background because there is a direct link between the object (the nail), the grasping of the hand, and the intention of hammering. The discovery that mirror neurons have visual and motor properties undermines the idea of distinct and serial processes in the brain. There is not a perceptual stage, then a cognitive stage and finally a motor stage. There are parallels, loops and sometimes perhaps only one thing. Recordings of mirror neurons suggest that there is a *direct* link between seeing and doing, there is no *processing* of information in the brain. Rizzolatti claims (34: pp. x- xi, 3, 17-21) that we should abandon the view that perception, cognition and movement are distinct processes lend strong empirical research to support Moe's rejection of information processing theories and (classical) cognitivism. The unity of vision and motor action in mirror neurons secure a fluid chain in our movements then. Understanding an action when in play helps us responding quickly and fluently. Also when we try to understand how to do, imitate and reproduce; mirror neurons seem to play a major part. Mirror neurons are perhaps some of the most important tacit components of our background knowledge in sport.

### **Mirrors so far and in the future**

Let's say we take Goldman's simulation theory of mind to mean that understanding *emotion* is an understanding of bodily *action*. If read this way, understanding the mind is understanding the body, and vice versa. It is a view of an *extended* mind (see 8) – extending the mind beyond brain to body and world. We understand both low level emotions and bodily actions through bodily observation. Recognizing and understanding emotions and bodily actions seem to presuppose the ability to experience the emotion/action. There is a link in the mirror neuron theory then, to the popular discussion of phenomenal consciousness (the experience) and psychological consciousness (understanding and cognitive awareness) (3; 6). We might wonder if in biological creatures like humans, one could really have the one without the other. This is important, since if not, the neat distinction between phenomenal- and psychological consciousness would be heavily undermined and a study of *biological* consciousness should/could not be continued without including the first person perspective of phenomenal consciousness, even when studying cognitive tasks like memory or visual attention. What Hopsicker calls 'dwelling' must be brought into the picture when studying human cognition, skill and intentionality. To study mere attention (Breivik's 'conscious

attention' or Polanyi's focal awareness) then, without what Hopsicker and Polanyi have called tacit knowledge, and Moe and Searle 'background', simply does not make much sense. Why? There just wouldn't be any focal/conscious attention without any background/tacit knowledge. There would be no starting point, no idea what to focus on, no shoulders there for the eye's spotlight to rest upon. This philosophical point, brought forward again by Hopsicker has drastic consequences for research methodology and goals in for example (sport) psychology.

If the interpretive and empirical challenges concerning the mirror neuron theory can be met, then it might be true that mirror neurons will eventually do for psychology what DNA has done for biology. The consequences for sport science are perhaps just as big. We have seen that the discovery of mirror neurons have implications for imitation, learning, emotions, space-orientation and anticipation. Moreover, we might say that mirror neurons present us with a fundament for a philosophical theory with at least the following suggestions and intriguing ideas suited for further research:<sup>21</sup>

Mirror neurons present us with a solid empirical ground for rejecting both a dualistic and an information processing view of the mind. Instead, mirror neurons provide us with the view that the body and motor action is cognitive in itself. This popular view in the philosophy of sport now suddenly has support from the most advanced neuroscience. The mirror neuron theory of action understanding is a theory of understanding intentions and the mind of others. It is a theory of both how the mind and the body works, although the distinction between body and mind might be about to be deleted. This theory also makes us see that cognitive skills and motor skills are at heart (or at neuron if you will) the same. It supports Breivik's claim that consciousness and skill are intertwined, and that skillful motor behaviour is not mindless, like Dreyfus argues. If mirror neurons are also important in social cognition, we might also have a neurotheory of ethics (see 34: Ch. 7). Perhaps we have a neural mechanism underpinning Levinas' notion of 'the other' (26). This has implications for lots of ethical themes in the philosophy of sport: violence, sportsmanship, ethos and cheating. It is a long leap from the mechanism of mirror neurons to doping behaviour, but without recognizing emotions or reactions in the other it is perhaps difficult to establish a personal morality. Combining Jeffrey Frey's work on emotions in playing (16) and Goldman's simulation theory (19) with Rizzolatti's work on mirror neurons (34) and LeDoux's work on the amygdala (25) might be a start in such a direction.

The mirror neuron theory has far reaching consequences worth taking seriously in the philosophy of sport. From the fundamental theory of the body not as a serial organized unit but as a direct matching organism, to understanding and doing intentional motor behaviour and sharing emotions on the field, mirror neurons are evident in most aspects of sport. With mirror neurons, Polanyi's and Searle's philosophy might also have found a neurophysiological fundament not easily swept under the carpet.

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<sup>1</sup> [http://www.edge.org/3rd\\_culture/ramachandran/ramachandran\\_p1.html](http://www.edge.org/3rd_culture/ramachandran/ramachandran_p1.html).

<sup>2</sup> Single cell recordings measure neural events (action potentials) in the brain by inserting electrodes into axons and/or dendrites.

<sup>3</sup> Primary motor cortex is often referred to as M1. Rizzolatti uses F1.

<sup>4</sup> fMRI measure changes in metabolism or blood flow in the active brain. With fMRI, imaging is focused on the magnetic properties of haemoglobin. The fMRI detectors measure the ratio of oxygenated to deoxygenated haemoglobin – called the blood oxygenation level dependent effect (BOLD). For a more extensive treatment of the methods of (cognitive) neuroscience, see (18: ch. 4).

<sup>5</sup> As I have already stated, there is a problem of attaching mirror neurons in the strict sense to humans due to lack of single-cell recordings.

<sup>6</sup> EEG provides a continuous recording of overall brain activity through electrodes placed on the scalp, which measures large, active populations of neurons producing electric potentials (see 18: ch. 4).

<sup>7</sup> Brain imaging cannot distinguish between inhibitory and excitatory activity in neurons. This means that we can only see similar activation, not type. Although spatial and temporal resolution in fMRI is increasing all the time, neither localization nor firing rate can be established at identical level by this technique.

<sup>8</sup> Other suggestions have been BA 6 (29).

<sup>9</sup> Since the mirror neuron system is a biological system, we might consider it an explanation for a suggested beneficial difference between observing humans and non-biological models (see e.g. 25: p. 48).

<sup>10</sup> Other objections have been raised by De Jaegher and Di Paolo (11) and Hutto (22). Sinigaglia has tried to conciliate these, see (38: pp. 322-325). See also (9).

<sup>11</sup> Hickok also objects to the lack of empirical support for a generalization of a mirror neuron system to speech recognition (problem number eight). This does not seem to be the most crucial issue for philosophy of sport, and will not be discussed here.

<sup>12</sup> A recent single-cell recording suggests mirror neurons across several brain regions in the human brain (30).

<sup>13</sup> In discussing fine grained vs coarse grained individuation of actions, mirror neurons support a coarse grained approach, but a lot more coarse grained than say Davidson's account (see e.g. 10).

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<sup>14</sup> The same claim is raised by Rizzolatti (34: p. 130, ch. 7).

<sup>15</sup> An example: analytic philosophers have tried to resolve Jackson's 'knowledge argument' by claiming what Mary learns is a knowing how which is not considered knowledge, and hence Mary does not know anything new when seeing colors. This escape is perhaps excluded by the mirror neuron theory.

<sup>16</sup> See (6). For a discussion on phenomenal consciousness in sport, see (3).

<sup>17</sup> I state 'classical' in parenthesis because connectionism might also be undermined by these discoveries. Evan Thompson holds that connectionism is a contemporary neuroscientific information processing theory (40: ch. 1).

<sup>18</sup> Evidence has suggested a mirror mechanism in infants as young as 6 months (38: p. 327).

<sup>19</sup> An excellent review of neuroscientific research on sporting skills is provided by Yarrow (43). The writers urge "neuroscientists to consider how their basic research might help to explain sporting skill" (43: p. 585). I believe we are only beginning to see the impact neuroscience is going to have on sport science, including philosophy of sport.

<sup>20</sup> The neurophysiological explanation is: if you do not have the motor knowledge x, you will not have the neural network z necessary for producing motor action y, so when observing someone capable of y and having x and z, your brain cannot have strict congruent neural activity. You may have broad congruence, but of course the similarity will widen with the difference in x and z, which are (some of) the reasons you cannot do y.

<sup>21</sup> The mirror neuron theory is a philosophical theory, both of body and action. The theory argues for the body as the 'great reason' as Nietzsche calls it (31: "Of the Despisers of the Body").

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