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Consciousness and Action Control

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One of the key questions that guide and organise research on human consciousness is functional in nature: What is consciousness good for? Many answers to this question are possible, but the one that I shall be dealing with in this chapter is particularly popular. Although many laypeople and researchers would be willing to grant that many perceptual, to some degree even attentional processes occur outside of conscious awareness, the decision how to react to a given stimulus or situation is often assumed to be either necessarily or at least preferentially conscious. This idea is nicely captured by the blurb for the book *Better Than Conscious?* edited by Engel and Singer (2008): 'Conscious control enables human decision makers to override routines, to exercise willpower, to find innovative solutions, to learn by instruction, to decide collectively, and to justify their choices'. If correct, the implications of this characterisation are that decision making and action control are particularly promising targets of human consciousness, as they support and improve the quality of the way we deal with environmental challenges.

One of the origins of this widely held view is rooted in the psychoanalytic approach of Sigmund Freud. He claimed that both conscious and unconscious processes can contribute to the control of human action and considered control to emerge from the interplay between unconscious, automatic action tendencies generated by the pleasure-seeking Id and socially acceptable considerations provided by the rational Ego (Freud, 1923). Whereas processes initiated by the Id were assumed to be inaccessible to consciousness in principle, some, but not all, Ego operations were considered to be conscious. According to Freud, leaving action control to the Id would be problematic in modern societies, which calls for moderation by the Ego, whose task is to seek compromise between the Id's pleasure-driven urges and the strict requirements of the Superego, which represents societal norms, expectations, and principles.

More modern approaches still buy into this psychoanalytic scenario and the idea that socially responsible action requires conscious mediation. Indeed, so-called 'dual-route' or 'dual-process' models can be found in almost all psychological and cognitive-neuroscientific research areas (for an overview, see Evans & Stanovich, 2013), and even in the theoretical foundations and everyday practices of modern law (e.g., Günther, 2003). For instance, in

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their action-control model, Norman and Shallice (1986) distinguish between habitual, stimulus-driven actions on the one hand and actions that are assumed to be under 'deliberate conscious control'. It is interesting to note that this terminology implies (for no given reason) that unconscious deliberate control is inconceivable. In the same spirit, Libet (1985) has suggested that consciousness might have a 'veto' that prevents unwanted actions from execution. It is true that this veto idea puts consciousness somewhat later into the information-processing chain than other approaches would imply, but it still follows the tradition of (a) identifying responsible decision making with consciousness and (b) locating this process in between perception and action. The folk-psychological idea underlying these choices is that we, as conscious agents, may not be able to control what we perceive but we do control how we react to that.

The possible connection between consciousness, deliberate choice, and action control has many interesting and far-reaching implications, including questions regarding the freedom of choice, social responsibility, and legal accountability. None of these big questions will be addressed in this chapter, which instead will focus on the possible role of consciousness in the planning and selection of rather simple actions, which often consist in just a key-press. The hope is, of course, that insight into this role scales up to more complex and more important actions, but it should be kept in mind that this is just an assumption. Moreover, this chapter will focus on the technical aspects of action control, on the mechanisms underlying the selection and planning of voluntary actions given a particular goal, but not on the processes leading to the formation of a goal or intention. In other words, the chapter will focus on the volitional rather than on the motivational aspects of action control (cf., Heckhausen & Gollwitzer, 1987).

At this point, there is no comprehensive approach that addresses the role of consciousness in action control. Rather, there are a number of research lines that tap into some aspects of this connection, often driven by little more than a working hypothesis or a general question. In the following, I shall try to organise some of the greater and/or more converging lines into what I consider four possible functions of consciousness (goal implementation, conflict resolution, agency, and task sharing) or, perhaps better, of functions that correlate with conscious experience. The reason why I emphasise the correlational aspect is that there is not yet any evidence that speaks to the causal role of consciousness for the functions that I shall address (Hommel, 2013). All that the available findings show is that some functions are often, perhaps always, associated with conscious experience—operationalised as the ability of individuals to report about it. This does not provide watertight evidence that the having of this experience is essential or required for the respective function to be effective. Hence, philosophically speaking, we have no evidence to rule out the zombie argument (Moody, 1994): it may well be possible to imagine a being that is exactly like a human being except for the ability to have conscious experience. Nevertheless, even if a zombie would be conceivable (which would imply that the addition of conscious experience is unnecessary), the observation that some functions are systematically related to conscious experience may tell us something about the characteristics of, and commonalities between, these functions—an implication that I shall discuss in the 'Conclusions' section. Moreover, I shall not follow the widespread custom of speaking of 'conscious processes'—which I consider a misnomer. There is no evidence that people can be conscious of any cognitive process: we have no idea about how we are retrieving a memory or how we attend to a particular stimulus. What people are conscious of are states *resulting* from such processes: We are conscious of the retrieved memory and the attended stimulus. It would be equally misleading to speak of conscious functions for the same reasons, which is why I shall stick with the less elegant but theoretically more transparent reference to cognitive functions that are associated with conscious experience.

Goal Implementation

When searching for the functionality of a phenomenon or process, its absence is often as informative as is its presence. With respect to consciousness, the motor aspects of human actions have been identified as an area of conspicuous absence from early on. Like his contemporaries, William James (1890, p. 499) observed that 'we are only conversant with the outward results of our volition, and not with the hidden inner machinery of nerves and muscles which are what it primarily sets it at work'. Take the example of tying your shoes or riding a bike: If you are to explain how you are doing that, all you can do is describe each single step from an outsider perspective that often does not reveal any 'privileged knowledge'. In other words, you basically describe your own action the same way as any observer might be able to do—except perhaps for occasional references to proprioceptive or affective impressions that are not accessible to an observer.

This kind of 'executive ignorance' (Turvey, 1977) suggests that people have very little insight into how they are performing a particular action. What they focus on instead are the events that their actions are meant to produce. Brunswik (1944) has tried to capture this aspect by distinguishing between the 'distal' goal event and the 'proximal' means to achieve it, which corresponds to the conscious representation of the outcome of an action and the peripheral muscle commands needed to produce that outcome, respectively. A possible reason why conscious representations refer to distal, but not to proximal, aspects of an action has been suggested by Prinz (1992). As he argues, action needs to be informed by perception, and vice versa, which raises the question how perception and action 'communicate' and which internal 'language' (i.e., code, reference frames, etc.) they may use. Proximal representations of perceived and produced events (i.e., early sensory codes and muscle commands, respectively) are not closely related to their central representations and to each other—they are coded in very different ways, which must make direct communication difficult. In contrast, distal representations (i.e., codes that refer to the external attributes of perceived and produced events) can be considered to be of the same format, which should facilitate informational transfer between perception and action. Accordingly, the theory of event coding (Hommel, Müsseler, Aschersleben, & Prinz, 2001) claims that human cognition is based on distal representations that are sensorimotor in nature. The discovery of so-called mirror neurons (Rizzolatti & Craighero, 2004) points to the same direction: If the same neuron responds to both the production of a particular action and the observation of the same action carried out by another person, it must code for the distal, but not the proximal, characteristics of the action. Distal coding, however, leaves the actual motor aspects of actions out of the picture.

It is interesting how we can afford to be so ignorant of the motor aspects. The answer of James (1890) and contemporaries (Lotze, 1852; Harless, 1861) has become known as ideomotor theory (Shin, Proctor, & Capaldi, 2010; Stock & Stock, 2004). The basic idea is that infants and novices first engage in more or less random movements (motor babbling), which generate movement-specific sensory consequences. Contingencies between motor patterns and sensory consequences are automatically picked up and stored. If then the agent wishes to produce one of the consequences voluntarily, he or she only needs to internally reactivate (i.e., imagine) the representation of these consequences, which will spread activation to the associated motor patterns. Hence, motor activities are controlled by operating on codes of their sensory consequences. This means that conscious access to the latter is sufficient to control the former, so that conscious access to motor activities is not necessary—executive ignorance.

According to this ideomotor scenario, action goals are not given at birth, in contrast to what developmental nativists have suggested (e.g., Rochat, 2001), but emerge through sensorimotor experience (Verschoor, Weidema, Biro, & Hommel, 2010). Conscious

experience would then be tied to the implementation of a particular goal, which again would be coded in terms of the intended and expected action outcomes, the sensory action effects. Why would that be the case? It has been suggested that consciousness is related, perhaps even restricted, to the integration of knowledge (e.g., Baars, 1988; but see Morsella, 2005, for some limitations of the integration hypothesis). If so, consciousness would be more likely to be associated with processes and functions that consider multiple sources of information, and coding and implementing a goal is arguably meeting this criterion. Action effects are often highly context dependent, as the same movement can lead to many different sensory consequences in different situations—just think of pushing a button, which might create a letter on a monitor, switch on the light, or start a nuclear war. This means that identifying the action effect that is best suited to serve the current goal, or (if the goal is not going beyond producing that action effect) that satisfies current goal constraints, requires the integration of quite a number of informational sources. Once the correct action–effect code has been selected, the associated motor pattern could be more or less automatically primed, and the action could be executed without any further consideration about the context. If so, the hypothesised link between consciousness and information integration would indeed suggest that consciousness is more related to the selection of action–effect codes than to the activation of motor patterns.

The possibility that conscious experience is associated with the implementation of action goals rather than their online control is also consistent with an early observation of Exner (1879). He carried out various informal experiments on himself and noticed that his conscious activity was mainly concerned with setting up a particular task and preparing oneself for carrying it out. Once that was done, an external stimulus would be sufficient to trigger the further performance of the task without much conscious ado. Hence, implementing an action goal could be considered to turn the cognitive system into a 'prepared reflex' (Hommel, 2000; Woodworth, 1938). Later, more systematic experimental research has supported the idea that implementing a goal and a related action plan delegates control to internal and external stimuli, which may operate outside of consciousness (Bargh, 1989).

Among other things, this perspective tends to undermine dual-route theorising. Take, for instance, the notorious Stroop (1935) effect. The effect consists in the demonstration that naming the colour of a word is slower and less accurate if this word refers to an incongruent colour (e.g., the word RED written in green ink) than if it refers to a congruent colour (the word GREEN written in green ink). Dual-route models attribute this effect to a competition between the intentional route, which is responsible for translating word *colour* into the corresponding naming response, and an automatic, habitual route, which in this case represents the previously acquired reading skill (for a review, see MacLeod, 1991). As the automatic route is not under intentional control, the cognitive system needs to counteract the automatic activation of the reading response in incongruent trials, which takes time and effort—as reflected in delayed reaction time and reduced accuracy. While the resulting conflict scenario may be correct, the prepared-reflex view would suggest that the reading response is a result of the task goal to utter colour words in response to colour stimuli. This would fit with the observation that the Stroop effect is very small (less than 10% of its original size) or absent in task versions in which the verbal naming response is replaced by key-pressing responses (McClain, 1983), and even the small remainders disappear entirely if covert naming responses are prevented through concurrent articulation (Chmiel, 1984; Martin, 1978).

A similar scenario holds for the Simon effect (Simon & Rudell, 1967). The effect shows that spatially defined responses, such as pressing a left versus right key, are delayed and less accurate if the stimulus appears at a location that corresponds to an incorrect response. Dual-route models attribute this observation to competition between the intentional route, responsible for translating the relevant stimulus feature (e.g., shape) into the correct response,

and an automatic route that unintentionally translates stimulus location into response location (for reviews, see Hommel, 2011; Proctor, 2011). But, again, the prepared-reflex approach suggests another scenario: Preparing for a spatially defined response requires the emphasis on (i.e., the stronger weighting of) location features (Memelink & Hommel, 2013), with the side effect that the nominally irrelevant stimulus location now attracts attention (Wykowska, Schubö, & Hommel, 2009). If so, the Simon effect would be a necessary—and in a sense, artificial—consequence of preparing for a task with spatially defined responses. Indeed, Valle-Inclán and Redondo (1998) were able to show that behavioural and electrophysiological indicators of stimulus-induced response activation in a Simon task are obtained if the relevant S-R mapping appears before the stimulus (so that the goal could be implemented ahead of the stimulus), but disappear if the mapping appears after the stimulus.

Taken together, these and other observations leave the possibility that conscious experience is associated with cognitive functions responsible for the implementation of goals and the preparation of related action plans. These functions are likely to affect both 'intentional' operations foreseen in the planning process and 'automatic' operations that result as a by-product of planning. As preparation can be considered to turn the cognitive system into a kind of prepared reflex, all processes that follow the planning phase (whether they are intended or a by-product) are likely to possess some or all characteristics of 'automaticity'. Nevertheless, as they were all enabled through goal implementation, they can just as well be considered 'intentional'—which basically undermines the common intentional/automatic dichotomy (cf., Hommel, 2000, 2007).

Conflict Resolution

In addition to a possible role related to the implementation of goals, conscious experience has been associated with the resolution of response conflicts (see also Chapter 4 by Egner in this volume). Support for this possibility has been derived from a seminal study of Libet, Wright, and Gleason (1982). In this study, participants carried out simple key-presses whenever they would feel an urge to do so, and made use of a clever self-report procedure to estimate the point in time when the urge would be experienced. The estimated time of experience preceded the actual movement, as one would expect. The more controversial observation was that physiological indicators of action preparation preceded the agent's conscious urge to act by hundreds of milliseconds. This finding has sparked widespread debates and encouraged authors to draw far-reaching conclusions, including the claim that acts of will 'cannot cause voluntary actions' and that the freedom of will 'is an illusion' (Roth, 2003). Although one can argue about the rationality of these and related arguments, the rather 'late' occurrence of conscious experience has been taken to suggest that it might be related to a 'veto' function (Libet, 1985). That is, the function of conscious experience might be related to the monitoring of ongoing action planning and performance, and the ability to prevent the eventual execution of actions that seem inappropriate or in conflict with current goals. Note how closely this view relates to the Freudian scenario of Id–Ego interactions.

Neuroscientific evidence and theorising provide support for the idea that consciousness-related cognitive functions are involved in handling response conflict. Botvinick, Braver, Carter, Barch, and Cohen (2001) have suggested that the anterior cingulate cortex (ACC) serves to monitor the cognitive system for the existence of response conflict (see Chapter 10 by Shenhav et al. in this volume). More specifically, the ACC would register the activation of multiple responses (an indicator of response conflict) and send an alert signal to frontal systems responsible for the maintenance of the action goal. This again would result in the reactivation and strengthening of the goal representation, which would increase the degree

of top-down control of information processing—so to prevent further conflict (van Veen & Carter, 2002). Although there is some debate about the details of this information-processing loop and the kind of signals being processed, the basic idea of a performance-monitoring function that informs goal representations in the face of conflict has found ample support from behavioural and neuroscientific studies (Botvinick, 2007). Moreover, the hypothesised neural conflict monitoring system (the ACC) has been implicated in various aspects of conscious experience, including conscious effort (Mulert, Menzinger, Leicht, Pogarell, & Hegerl, 2005) and self-conscious emotional reactivity (Sturm et al., 2013). Along the same lines, Posner and Rothbart (2007) have related conscious experience to the activation of a so-called executive-control network, in which the ACC plays a key role (see Chapter 15 by Brown in this volume). Converging theorising comes from Morsella (2005), who argues that consciousness should be particularly concerned with conflict between what he calls 'skeletal muscle plans'. Although all sorts of conflict may arise and be resolved through integration in the cognitive system, so Morsella argues, it is mainly the competition for the control over effectors (a particularly capacity-limited resource) that consciousness-related functions are concerned with.

Further support for a possible role of consciousness in conflict resolution comes from studies that related the experience of conflict or of conflict-inducing stimuli to the probability of conflict-resolution operations (for a review, see Desender, Van Lierde, & Van den Bussche, 2013). For instance, Kunde (2003) observed that the typical reduction of stimulus-induced response conflict after conflict trials (an effect that has been taken to reflect performance monitoring in the sense of Botvinick, 2007) only occurs if participants were able to consciously perceive the conflict-inducing stimulus. Along the same lines, Desender, van Opstal, and Van den Bussche (in press) found trial-to-trial adjustments only if participants consciously experienced conflict, which fits with the observation that the electrophysiological evidence of error processing (the so-called post-error slowing) only occurs if participants realise that they have made an error (Nieuwenhuis, Ridderinkhof, Blom, Band, & Kok, 2001). It is important to consider that these findings provide only correlational evidence, and thus leave the possibility that it is actually the intensity of conflict that determines the probability of both conscious experience and conflict-resolution operations. But even in this case, the presence of conscious experience would represent a diagnostic indicator for the presence of conflict-induced cognitive-control processes.

To summarise, cognitive functions associated with conscious experience might be particularly concerned with the avoidance of response conflict. As with goal implementation, this function can be considered rather information heavy. Which response is consistent or inconsistent with other responses is not self-evident but depends on the task and the action goal. For instance, moving the left and right index finger simultaneously is considered to constitute a conflict in most psychological experiments but can be perfectly functional in piano playing. This means that successful conflict monitoring cannot rely on simple information, such as the number of concurrently active responses (which would still raise the question what counts as a response). Rather, effective monitoring must integrate information about the current goal and stimulus-response mapping, currently available stimuli and other environmental information, and activated response tendencies.

Agency

Being able to perform a goal-directed action requires knowledge about the events that an action can produce. Without such knowledge being involved, moving one's body cannot be considered to have a particular purpose and to aim at a particular goal. This knowledge does

not need to be explicit and consciously represented. Many animals are able to carry out goal-directed actions without necessarily being able to represent their goal consciously, let alone communicating about it. The above-discussed ideomotor mechanism is thought to generate the action–effect knowledge that goal-directed actions need, but this knowledge does not have to be consciously accessible either. In fact, ideomotor theory aims to account for 'executive ignorance', which can be taken to reflect the lack of conscious knowledge about action–effect contingencies. And yet, if they are asked, people can commonly tell whether a particular event was caused by their own action and what their contribution to this event was. This ability and conscious experience has been called 'agency' or 'sense of agency', which, together with the 'sense of body ownership', has been claimed to represent an important constituent of the perceived 'self' (Gallagher, 2012).

Various studies have shown that people are sensitive to action–effect contingencies and can report them rather accurately (e.g., Shanks & Dickinson, 1987; Wasserman, 1990). For instance, if human participants are to judge the causal relationship between pressing a key and the flashing of a visual stimulus, the degree of perceived causality matches the actual contingency quite accurately, at least if the temporal gap between key-press and effect is no longer than 2 s (Shanks, Pearson, & Dickinson, 1989). Such findings may suggest that perceived agency is directly derived from implicit knowledge about action–effect contingencies, but the picture seems to be more complicated. For instance, Elsner and Hommel (2004) exposed participants to novel action–effect relations that varied in temporal continuity and in actual contingency. Participants were then tested for the spontaneous acquisition of action–effect associations (as usual in experiments on ideomotor action–effect acquisition: Elsner & Hommel, 2001), and they were to judge the causality between actions and effect explicitly. Both measures were sensitive to contiguity and contingency, and they were affected by these factors in comparable ways. However, the individual effects for the two measures did not correlate with each other at all, which means that how strongly an individual associated an action with its outcome did not predict his or her experience of causality between action and outcome.

This and other observations are consistent with the rather radical approach to personal agency suggested by Wegner (2003). According to Wegner's 'apparent mental causation model', human actions are always initiated by factors that are not directly accessible to consciousness: the unconscious cause of action, which may or may not be identical with the unconscious cause of thought (about the action). The (theoretically not further defined) unconscious cause of action triggers the overt action directly, without any intervention of processes related to conscious representation. However, initiating an action is commonly accompanied by the triggering of a thought about the action, which means that this thought commonly precedes the overt action in time. As humans often take correlations to imply causal relationships, the personal impression therefore is that it was the thought that produced the action, which, according to Wegner, is the reason why people believe in the causal power of their conscious intentions.

On the one hand, this scenario takes on board, and therefore perfectly fits with the claim of Libet and colleagues (1982), that the physiological causes of voluntary actions precede, and are thus not dependent on the conscious experience of the corresponding action intention. On the other hand, however, the approach does not necessarily exclude that what is being conscious is a relatively valid reflection of the actual cause (even though the approach is often interpreted as implying just that). If and to the degree that conscious thought is accurately informed by, and is thus a valid reflection of the unconscious cause, there would be nothing illusory about this thought's content. What is illusionary would only be the idea that the having of the conscious experience would be the actual causal factor. That this is a real possibility is suggested by findings of Wegner and Wheatley (1999). These authors demonstrated that humans experience more agency for the sudden appearance of an

(objectively unpredictable) object on a screen if they are presented with a word prime describing the object about half a second before the appearance. This implies that the conscious experience of agency relies on expectations and predictions.

This latter conclusion is also shared by comparator-model approaches to human agency (e.g., Blakemore, Wolpert, & Frith, 2002; Frith, Blakemore, & Wolpert, 2000). Although such models are not particularly articulate in telling implicit from explicit knowledge, they emphasise the idea that predictions about action outcomes play an important role in assessing the success of an action. There are two ways in which actions can be unsuccessful: the performed movement may produce outcomes that were not predicted, which would provide information about an error or mishap, and the movement can go as expected and yet not lead to a state that matches the desired goal state. It is this latter mismatch that according to comparator models informs about agency, or the lack of it. An interesting implication of comparator models is that they may help gain more insight into delusions of control, such as observed in schizophrenia. If, for instance, the agent fails to predict a particular outcome, producing an action that generates this outcome would lead to a mismatch, which might induce the experience of alien control (Blakemore et al., 2002).

To summarise, the conscious perception of personal agency relies on relating expectations about an action's contribution to an intended goal event to its actual outcome, but it does not seem to be a pure mirror image of this relationship. One reason for the observed discrepancy between implicit and explicit action–effect knowledge might be that the latter is integrating more (and more contextualised) information than the former (Hommel, 2015; Synofzik, Vosgerau, & Newen, 2008). For instance, people may have general expectations about differing degrees of causality in different situations, which may shape, and sometimes perhaps even overrule, registered mismatch between actual and expected effects. Given that conscious representations of agency are unlikely to be functionally involved in actual action control, there is indeed no reason why they should not be richer than the implicit representations that are driving the action machinery. Indeed, there does not seem to be any functional reason why questions of agency should keep an agent consciously busy—as long as his or her goals are achieved. Moreover, even estimates from rather simple tasks suggest that generating a conscious experience takes at least 300–500 ms (e.g., Dehaene, Changeux, Naccache, Sackur, & Sergent, 2006; Libet, 2004), which seems to be much too slow to assume that conscious agency considerations intervene between environmental events and appropriate actions on a daily basis (Hommel, 2013). Explicit representations of agency are therefore likely to fulfil other purposes.

What purposes that might be becomes clear if we consider the cultural relativity of the importance and meaning of the agency concept. It is interesting to consider that most publications on human agency uncritically restrict their analysis to an individualistic 'I-perspective' of a single agent and the way he or she is feeling about his or her causal power. Although that seems to be the obvious perspective for readers with a Western background, members of Eastern cultures tend to have a different, often more extended, perspective that includes family, peers, and colleagues in the perception of agency (Markus & Kitayama, 2003). A possible reason for this discrepancy is that the borders of the conscious 'self' (of which perceived agency is assumed to be an important part: Gallagher, 2012) implied in Western thinking coincide with a person's skin, whereas Eastern self-concepts are often more socially extended (Markus & Kitayama, 1991). For instance, whereas Western sportsmen tend to attribute their extraordinary performances to themselves, Eastern sportsmen tend to ascribe the achievement to entire teams including support staff, family members, and friends (Markus & Kitayama, 2003).

Applied to agency, this means that the Western concept is about individual agency, whereas the Eastern concept is about what Markus and Kitayama (2003, 2010) have called 'conjoint

agency'. This again implies that the experience of agency is unlikely to be hardwired and unlikely to be a mere mirror image of implicit action–effect knowledge, as that should be comparable for Eastern and Western agents. Rather, the conscious representation of agency seems to be penetrated by cultural experience and expectations, which again raises the possibility that the purpose of having such representations is to do with communication about agency—a possibility that I will develop further in the next section.

Task Sharing

Up to this point, I have discussed evidence suggesting that a few main functions of action control are systematically related to conscious experience. All of them are characterised by their integrative nature. Even though this is consistent with current theorising about consciousness (see the section titled 'Conclusions'), one may ask what the having of conscious experiences may add to the operation of the associated functions. For instance, there is no reason why an entirely unconscious process should be unable to check for the consistency of an ongoing action with the current action goal and to suppress the action if the discrepancy is above some threshold. In fact, this is what each cybernetic system, such as central heating, is doing (Wiener, 1948).

A philosophical way out would be to grant each cybernetic system consciousness, as suggested by McCarthy (in Searle, 1987). A more pragmatic approach could consider how the presence of conscious experience is typically diagnosed (Hommel, 2013). Arguably, the least controversial method to assess the conscious experience of others is to have them communicate about it—which is why verbal report is so popular in consciousness research. This might be taken as a rather arbitrary methodological convenience but it may also have a deeper meaning. If the conscious representation of some state of affairs allows us to communicate it to others, it may be that it is exactly this purpose that explains why some action control functions are associated with consciousness. Indeed, Baumeister and Masicampo (2010; cf., Dennett, 1991) have claimed that communication might represent a crucial function of human conscious thought, and Baumeister and Bargh (in press) suggest that the ability to communicate may be the main purpose underlying the connection between consciousness and action control.

Agency is a good example in case: Although the having of an agency experience does not seem to be particularly useful for the agent herself, it does allow her to comment on her degree of agenthood for a given action, which among other things relates to the action's social responsibility and acceptability (cf., Freud's Ego function). As these functions are to be interpreted within an existing cultural framework, it makes sense that perceived agency is sensitive to cultural factors—as discussed above. Implementing a goal and preparing for an action is also something useful to communicate to others, be it in an attempt to explain one's own behaviour or in order to instruct others to do the same. This is exactly what happens at the beginning of each psychological experiment: the experimenter explains to the subject what to do, how to do it, and when to do it, and this is the only information that a participant needs to produce the data all psychological studies are based on. How participants translate that information into a functional action goal and task set still remains a mystery (see also Chapter 2 by Monsell in this volume), but it is clear that they do and that their ability to do so requires conscious experience. Verbal communication seems to be particularly suitable, presumably because verbal descriptions provide the easiest way to refer to possible, but currently absent, events, like stimuli and responses.

Although the utility of verbal communication for interpersonal task sharing seems obvious, the verbal coding of task-related information may also have benefits for the individual.

In agreement with earlier considerations of Russian activity theorists (Vygotsky, 1962), researchers have assumed that self-control might be mediated by, or at least benefit from, inner speech and verbal self-instruction. Indeed, there is evidence that people tend to instruct themselves verbally at the beginning of a new task (Miyake, Emerson, Padilla, & Ahn, 2004), which, given the strong connection between inner speech and working memory (Baddeley, 1986), may help to maintain a new, still fragile task set (Goschke, 2003). Instructing another person may thus not only provide the information that this person needs to implement a new and unfamiliar task set, but also the (verbal) means to keep this set active. If so, it would make sense that consciousness is found under conditions that induce uncertainty about how to achieve a particular goal and about which actions are best suited to reach it: goal implementation and conflict resolution.

Conclusion

The evidence discussed in this chapter converges on three points. First, cognitive functions that are systematically accompanied by conscious experiences seem to be more integrative in nature than cognitive functions that are not. This observation does not come as a surprise but corresponds to what Morsella (2005) has called the 'integration consensus'—the widely shared view that conscious experience is related to information integration. Second, and to some degree even because of the higher temporal demands of broader integration, conscious representations seem to take too long to emerge to play a systematic, modulating role between perception and action. Hence, the contribution of consciousness to action control does not seem to be well captured by the folk-psychological idea that we perceive, think, and then act. If anything, we rather think, act, and then perceive or, perhaps even more appropriately, we occasionally think about acting/perceiving. And, third, there are reasons to assume that the main function of consciousness in action control is actually for communication with both others and oneself. Having conscious insight into aspects of action control allows us to verbalise what we are doing, how we are doing, and why we are doing it, which provides the opportunity to share tasks and strategies how to implement and control a task with others, and to use this information for self-control. Hence, although conscious experience does not seem to play a role in ongoing action control, it is likely to provide the basis for interpersonal learning and cultural transmission (Hommel, 2013; Masicampo & Baumeister, 2013).

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