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What is consciousness for?

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ABSTRACT

The answer to the title question is, in a word, volition. Our hypothesis is that the ultimate adaptive function of consciousness is to make volitional movement possible. All conscious processes exist to subserve that ultimate function. Thus, we believe that all conscious organisms possess at least some volitional capability. Consciousness makes volitional attention possible; volitional attention, in turn, makes volitional movement possible. There is, as far as we know, no valid theoretical argument or convincing empirical evidence that consciousness itself has any direct causal efficacy other than volition. Consciousness, via volitional action, increases the likelihood that an organism will direct its attention, and ultimately its movements, to whatever is most important for its survival and reproduction.

1. Introduction

Perhaps the greatest challenge faced by science today is to understand, in scientific terms, the nature of consciousness: what causes it (the "hard problem," so named by the philosopher David Chalmers) and what it causes (the "harder problem," so named by the cognitive scientist Stephen Harnad). We cannot at present solve the "hard problem" of how natural selection was able to produce consciousness, that is, answer the question of how consciousness emerged in the evolution of some animals. We can, however, go a considerable way toward solving the "harder problem" of why consciousness evolved, but, we believe, only through consideration of the adaptive value of volition (also known as "free will": non-deterministic, non-random choice).

So, our primary hypothesis is: **The ultimate adaptive function of consciousness is to make *volitional* movement possible.** Consciousness evolved as a platform for volitional attention; volitional attention, in turn, makes volitional movement possible. Volitional movement (including any automatized components) is the sole causal payoff, the "cash value" of volitional attention and thus of all conscious processes. There is no adaptive[1] benefit to being conscious unless it leads to volitional movement. With volition, the organism is better able to direct its attention, and ultimately its movements, to whatever is most important for its survival and reproduction. (Neural processes alone, as we shall see, cannot perform this function as effectively as can neural processes combined with consciousness.) Without the adaptive benefits of volitional movement, consciousness would probably never have evolved.

Since the *ultimate*[2] adaptive purpose of consciousness is to manage volitional motor movement,[3] consciousness is properly classified as part of an animal's motor control system. (Plants do not need consciousness because they are "planted.") There appear to be two fundamental types of animal movement: automatic and volitional. Although volitional and automatic movements are both implemented by non-conscious neural processes, volitional movements, unlike automatic movements, are *initiated* consciously. To elaborate on the meaning of our primary hypothesis: 1)Volitional action[4] (i.e., non-deterministic, non-algorithmic, non-automatic, non-random action that is freely-willed in the

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[1] By "adaptive" we mean "providing an organism with survival and reproductive benefits."

[2] "Ultimate" because in humans, at least, there may be a long chain of episodes of volitional attention and neural action, lasting months or even years, before any consequent motor movement occurs.

[3] By "motor movements" we are referring to all movements of an organism, not just locomotion. Other examples would include eating, mating, speaking, freezing in place, and moving the tongue, eyes, ears, nostrils, mouth, arms, head, torso, etc. Obviously, volitional movements require extensive neurophysiology in addition to consciousness.

[4] By "volitional action" we mean both mental and physical action, i.e., volitional attention and volitional movement. We include the volitional inhibition of attention and movement in the terms "volitional action," "volitional attention," and "volitional movement."

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"libertarian" sense) exists. 2) *All* conscious organisms, if unimpaired, are capable of some kind of volitional action. 3) Volitional action does not merely require consciousness; it is the *raison d'être* of consciousness. 4) Conscious organisms can volitionally override some of their neural processes. 5) Non-volitional movements do not require conscious involvement. 6) Consciousness is the top manager of the brain; it does not work on the neural assembly line.

We believe that ours is the only hypothesis about the function of consciousness that adequately answers what we call the "Key Question": "Is consciousness itself causally involved in this function, or is this function performed entirely by neural processes?" For example, the hypothesis that the function of consciousness is "detection" would not adequately answer the Key Question, because there is no evidence that anything other than a neural process is implicated in the actual performance (as opposed to any possible volitional initiating or sustaining of the performance) of detection (cf. Velmans, 1991a).

2. The two aspects of consciousness: volitional attention and conscious experience

In our view, consciousness consists of two integrated aspects, one active (i.e., that generates neural processes) and the other passive (i.e., that, presumably, is generated by neural processes).[5]) The active aspect is the effortful act of sustaining attention (henceforth referred to as "volitional attention" or "mental effort"), e.g., trying to identify an indistinct object in the distance, paying attention to a lecture when one is tired and hungry, or exerting mental effort to comprehend difficult reading material. Although many actions of a conscious organism can be considered indirectly volitional, only one action–volitional attention–is under *direct* conscious control. Volitional attention, or the exertion of mental effort, is the direct volitional act.

The passive aspect is conscious experience (i.e., "phenomenal consciousness" or "subjective experience"), e.g., feeling pain, feeling anger, feeling oneself exerting mental effort, seeing a red apple, or suddenly becoming aware that "I am late for work." Conscious experience typically has a focus of clarity surrounded by a less-clear fringe (e.g., in vision).

When we refer to "consciousness," we mean the functional unit of volitional attention and conscious experience. Conscious organisms (and *only* conscious organisms), informed by conscious experience, can volitionally direct their attention to control their movements.

The brain exerts "upward causation" by producing conscious experience. Consciousness, in turn, exerts "downward causation" on the brain via volitionally sustained attention. What goes up is very different from what comes down. Thus, there are really two "hard problems" of consciousness, whose solutions may be related: 1) how the brain produces conscious experience (Chalmers' (1995a) "hard problem"); and 2) how the act of volitionally sustaining attention affects the brain (but we are not solving these problems in this paper).

3. Volition as conscious effort of attention

"Effort of attention is … the essential phenomenon of will." —William James (1890, p. 562)

Volition has had a contentious history in philosophy and psychology. As Franklin (2002) states:

> "The issue of free will is perhaps the most oft debated single issue in the history of philosophy." In contemporary philosophy and psychology, volition is often dismissed as mystical, prescientific, and/or illusory (e.g., Wegner, 2002). This is unfortunate, since without an understanding of volition, the function of consciousness cannot properly be understood. A consciousness without volition, were that possible, would be epiphenomenal.

Like James (1890) and more recently Schwartz (1999), we believe that volition is fundamentally effort of attention.[6] Attention is the locus of volition. (In humans, effort of attention often takes the form of sustained conceptual thought.) Although many actions of a conscious organism can be considered indirectly volitional, only one action–volitional attention–is under *direct* conscious control. Volitional attention, or the exertion of mental effort, is the direct volitional act.

We grant that much of an organism's attention is controlled automatically. But as James (1899, p. 189) noted: "Our acts of voluntary attention, brief and fitful as they are, are nevertheless momentous and critical, determining us, as they do, to higher or lower destinies" (contra James, we believe that acts of voluntary attention are often more than "brief and fitful"). Furthermore, as Mangan (2003) states: "By far the most powerful impact conscious volition has on our organism is cumulative. Hardly anything new can be worked out in any detail at any given moment."

Overriding the neurophysiology of automatically-controlled attention requires the exertion of mental effort.[7] As Schwartz (1999, p. 127) notes in the context of treating obsessive-compulsive disorder (although the point applies in the context of normal functioning as well):

> "[to refocus your attention] … great effort is involved, not least because the brain, which very much has its own agenda, is bombarding consciousness with a series of distractions which must be overcome (i.e., not attended to) … the focus of attention must be shifted away from where the brain 'wants' to take it …"[8]

The mechanism by which volitional effort affects neural processes is currently unknown, but it is also not currently known how the brain produces conscious experience. Schwartz (1999, pp. 131–132) mentions several hypotheses about the nature of the causal interaction between volition and neural processes, such as Lindahl and Arhem's (1993) "mind as a force field," Libet's (1994, 1996) "conscious mental field" and Schwartz's "mental force." Whether or not such speculations are correct, our current ignorance about how volition interacts with the brain gives us no more grounds for doubting that it does so than scientists had in 1819 for doubting the similarly unexplained interaction between electricity and magnetism that had just been discovered by Oersted. As Schwartz (1999, pp. 131–132) notes: "While this newly proposed term, mental force, represents a still largely hypothetical entity, there does seem to be a theoretical need for a force of this kind in nature."

[5] Penrose (1996) makes a similar distinction between "active" and "passive" aspects of consciousness. An intriguing possibility is that the two aspects might ultimately be shown to be one, i.e., volitional attention may itself be a type of conscious experience rather than a separate aspect of consciousness.

[6] Our view on this topic is similar, but not identical to, that of James (1890), who viewed volitional attention as "sustain[ing] a representation" (p. 566). We prefer "sustaining a thought process"–or more generally, "sustaining attention"–which does not imply representationalism and emphasizes the *process* of cognition.

[7] Mental effort carries a slightly painful quale, perhaps because its indiscriminate exertion would result in diminishing returns and require too great a caloric cost.

[8] It may well be that all psychological disorders result from difficulties (some of which may be organically based) in volitionally sustaining or shifting attention.

Although the ultimate function of volitional attention is to make volitional movement possible, its proximate function is to override automatic attention that is not well-suited to the situation at hand. The capacity for volitional attention gives the conscious organism the flexibility to non-deterministically yet non-randomly sustain attention on a particular conscious content longer[9] than the default set by neural processes. This neural default can be overridden either by volitionally sustaining attention longer than it would have automatically continued on content already in the focus of awareness, or by volitionally sustaining attention on fringe content, thereby making that content focal ("shifting attention"). Here we can see the crucial importance of the "fringe" of consciousness to volitional action.[10] The fringe/focus distinction makes volitional selection (switching among objects of attention) possible. An organism cannot directly choose the contents of its consciousness from outside its consciousness. You cannot consciously, directly select from *outside* your consciousness the next mental content to focus on within consciousness. You cannot say to yourself "I will now think about this" unless you are already at least peripherally conscious of the "this." You *can* select content from *within* consciousness by moving content from the fringe to the focus of awareness, and you can bring in more information about a given subject by choosing to sustain a thought process about it. You can, therefore, consciously make fringe content focal, but non-conscious processes must first have placed that content within the fringe. If consciousness had no fringe–if it had "tunnel vision" limited to one object–volitional choice would be reduced to "stop or go," and thus would have much less functionality. Without a fringe, organisms could not consciously select among multiple alternatives.

Volitional attention itself is fundamentally a conscious action. As far as we know, volitional attention, unlike other causal factors, arises only in the presence of conscious experience. It is "fed" by conscious experience–unlike automatic attention, which is controlled directly by neural processes. Mental effort is a conscious act because it is exerted by a conscious organism on the basis of consciously experienced information; it is not simply a result of non-conscious causal factors. If the organism were not conscious of the object of its volitional attention, its volitional acts would be like the firing of laser blasts into dark space, and might well be random. The subsequent *feeling* of mental effort may have been tacked on by natural selection as a feedback mechanism to let the organism know when it is trying and, perhaps, to give the organism an awareness of "self." (Or it may be that the feeling of mental effort *is* the exertion of mental effort, i.e., they are one and the same.)

4. Arguments for the existence and adaptive value of volition in animals

Our hypothesis–that the function of consciousness is to make volitional movement possible– should apply to conscious non-human animals as well as to humans. The case for the existence of causally efficacious volition in non-human conscious animals may not be as compelling as the case for humans, but is nonetheless viable. In support of this point, we would note the following:

1) Darwin (1871/1998, p. 77) observed that "Animals may constantly be seen to pause, deliberate, and resolve." For example, a dog may occasionally appear to pause and ponder whether to chase a squirrel or to go to its master, who is calling it. Such behaviors in non-human animals appear, prima facie, to be volitional. This suggests that the burden of proof is on those who claim otherwise. We realize that it might be possible to program a robot to appear to be "pausing, deliberating, and resolving," but there is no apparent reason why natural selection would make a dog seem to be deliberating when it is merely executing a program.
2) The subjectivity and intentionality of conscious experience seem pointless outside the context of volitional action. Automatic actions do not require guidance by subjective, intentional information, because they can be accomplished by physical causation alone; they need not be consciously controlled.
3) It would seem likely from the principle of evolutionary continuity that other conscious animals have some form of volition. Like any sophisticated adaptation, such as the eye, volition would probably not have evolved in one sudden stroke. Non-human mammals, particularly primates, have many neural and behavioral similarities to humans, further suggesting that they may have some form of volition.
4) Why would the "Blind Watchmaker" of natural selection torture conscious organisms with pain if they could do nothing, beyond what they do automatically, to avoid the pain? The conscious experience of pain would have no function without the adaptive benefits of volitional action.

Of course, one could simply argue that conscious experience is epiphenomenal, but epiphenomenalism has serious problems that are discussed, e.g., in Locke (1966) and Rudd (2000). In addition, if conscious experience were epiphenomenal in an organism, one might expect at least some of its qualia to be "inverted," e.g., loud sounding soft, heavy feeling light, sex feeling painful and a bee sting feeling pleasurable. However, the qualitative character of a conscious experience generally reflects its functional role (Cole, 2002) The fact that almost all qualia point in the right direction would be a remarkable coincidence if conscious experience were epiphenomenal.

Volitionally sustained attention is slower, more energy-expensive, and less reliable than non-consciously controlled attention. What, then, is its adaptive benefit? In a word: flexibility. The flexibility of volitional attention provides benefits that range from conferring sexual selection advantages, to improving error detection, to facilitating perception, to enabling humans to engage in objective conceptual thought.

It has often been said that consciousness provides flexibility. This is true, but only because consciousness makes volitional action–action that can go beyond any programming–possible. The adaptive benefit of volition is that it gives the organism the flexibility needed to improve upon the automatic reactions of a non-conscious creature. This capacity to override its automatic reactions, i.e., its "programmed"[11] actions, enables the volitional organism to take adaptive actions that would not otherwise be possible and to avoid some maladaptive automatic actions as well.

One way that volitional attention adds flexibility to a conscious organism's action repertoire is by enabling the organism to exert mental effort to veto a suggested automatic action and prompt its neural machinery for another option. In this way, volition goes "beyond the automatic." Adding volitional consciousness to any creature (of any level of complexity) will make it capable of a *range* of actions, rather than the single action that its non-volitional

[9] We use the term "longer" for simplicity since we believe that volitionally shortening attention on some content entails lengthening attention on some other content.

[10] James (1890), Baars and McGovern (1996), and Mangan (1999, 2001) have also stressed the importance of the fringe or periphery of consciousness.

[11] We scare-quote "programmed" because we do not believe that the brain literally runs programs, but the term provides a handy way of referring to deterministic processes.

"zombie" twin would be "programmed" to take. Even in a very simple non-conscious creature that could make only one movement, such as locomoting forwards, volition would add the flexibility of choosing when to initiate and how long to sustain that movement. (Whether this flexibility could actually have evolved and been adaptive in a simple organism is another question.) Volition gives the organism an open-ended ability to add options to its repertoire of actions, an ability that would be particularly adaptive in a rapidly changing environment.

All programs, even neural net or other "learning" programs, lack the flexibility that volition can provide. Although such programs can be written to modify themselves in accordance with certain new conditions–to "learn" to adapt– they can adapt only to new conditions for which they are programmed. Adding self-modification algorithms to the original program merely pushes the problem up to a higher level. The modifications that can be made by a self-modifying program are always constrained by its original algorithm.

The flexibility of volition enables an organism to take a greater range of novel actions, and, as Miller (2000) suggests, potential mates may be attracted by novelty. Thus the possession of volition may confer sexual selection advantages. We would surmise, however, that only conscious organisms are "neophiliacs" (novelty-lovers). A purely automatic organism might tend to avoid novelty, since it probably would not have a program to handle it effectively. Sexual selection can magnify a trait that is already there for survival purposes, and this may have happened with volitional consciousness.

The flexibility of volition enables an organism to pick up more information about its environment than could a zombie twin with the same automatic processes; in fact, the full functioning of a perceptual system may well require the enacting of volitional attention. A conscious organism, compared to its zombie twin, is better able to attend to the important issues of a given situation. Neural processes do not always direct the organism's attention to the important issues. A conscious organism can volitionally redirect its attention when its "programming" has gone off the track. For example, by sustaining attention longer than it would have continued deterministically on a particular object, the volitional organism can pick up more relevant information than could its zombie counterpart. Volition, in concert with "frozen" volition (automatized processes resulting from previous volitional activity), is a powerful information-gathering combination.

As Gibson (1966, 1979) has pointed out, perception is an *active* seeking of information. An organism with only an automatic attention system might unavoidably miss important information. Information-seeking at the perceptual level may be enhanced by volitional probing of the environment. For example, a volitionally attentive predator could choose to snoop around more than its zombie twin would have, and thereby detect prey that would otherwise remain unseen. Also, volitional attention may help an animal to develop better perceptual abilities, as is perhaps the case in Held and Hein's (1963) kitten carousel experiment, in which kittens that actively controlled their own movements learned to perceive better than did passive kittens.

The flexibility of volition makes improved error correction possible. A volitional organism can still make errors, but it has a better chance of correcting them than would its zombie twin. Factors unforeseen by the zombie's program, or bugs in the program, could result in a pattern of error from which it could not escape. One might argue that the zombie could have algorithms modifying algorithms modifying algorithms, but this chain would have to end somewhere. At that point, the zombie would be stuck with its error. As with learning programs in general, adding more error-correction algorithms just pushes the problem back a step. In a changing environment, it will not be long before the zombie, lacking a non-algorithmic method of error detection, would make a mistake for which it had no error-correcting module. Furthermore, the error-correcting program itself could contain an error, and how, then, would that error be corrected? Even if a perfect "ultimate program" were possible–one that could adjust to any contingency and correct any error–it is clear that neither we humans nor any other known organisms have such a program, since we repeatedly make many mistakes that go uncorrected. Instead of such a program, conscious organisms have volition.

Consider a non-conscious zombie zebra whose sole response to the appearance of a lion is to run away. It might, as a result, run straight into a herd of elephants and be trampled. Its volitional twin, on the other hand, might have the ability to override its program, perhaps by volitionally sustaining attention on a fringe-of-consciousness goal image of, e.g., freezing in place. The volitional twin might then freeze instead of run –thereby gaining a chance, however small, of escaping death. A determinist might argue that the zombie zebra could also have been programmed to avoid herds of elephants. *After the fact*, a determinist could claim that almost any action could have been programmed in. But surely, neither the zebra nor any other organism has programming suitable for every possible scenario. Volition could save the zebra in scenarios for which its automatic programming is faulty or absent.

Algorithmic systems, such as the brain, are subject to many kinds of error, such as misapplied automatisms, infinite loops, and tendencies that were adaptive when they evolved but have outlived their usefulness. No algorithm can step back from itself and objectively self-correct its mistakes, but a volitional organism can, e.g., by waiting for a self-correcting program to run its course and then performing yet another error check. For example, computer trading programs are frequently used by quantitative investment managers. However, it is well known that these programs must be carefully monitored by a (conscious!) human; otherwise they can run amok, no matter how meticulously the program is debugged and how sophisticated its learning routines are. If the program is left to its own devices, unanticipated changes in the markets can wreak havoc. Such programs often seem to be one step behind new developments. Similar problems can be seen with chess programs.

Misapplied automatisms (automatic behaviors performed outside of their appropriate contexts) are a common cause of error. Automatisms are on average extremely helpful to organisms, but they can be harmful when applied out of context. For example, Hofstadter (1982) discusses a misapplied automatism in the insect world. The Sphex is a wasp who parks her paralyzed cricket prey at the door of her burrow while she makes sure everything is all right inside, and only then drags the prey inside. If the cricket is moved a few inches away from the entrance (perhaps by a mischievous experimenter) while the wasp is inside checking, the Sphex will, upon emerging, drag the cricket back to the entrance, then repeat the entire burrow-checking operation as many times as the prey is moved. In effect, the Sphex has an algorithm for storing prey that she relies on without regard to context. If the Sphex has any volitional control at all, such control is insufficient to break out of the burrow-checking loop. So as not to single out the poor wasp, we note that human stupidity is often a result of misapplied automatisms, e.g., sphexishly locking one's car door after leaving the keys in the car. Although a volitional organism will often enact maladaptive automatisms, it has an escape hatch: volitional override.

We believe that Hofstadter is on the right track when he says that "consciousness is simply the possession of antisphexishness to the highest possible degree." Hofstadter believes, however, that this "antisphexishness" must still be algorithmically constituted, which is where we part company with him. By making volitional, non-algorithmic action possible, consciousness enables its possessor to adapt flexibly to changing circumstances.

Without consciousness and its attendant power of volition, errors and ruts might cause a complex brain to break down, just as minor problems can cause a complex machine, such as a computer, to break down. The emergence of consciousness, and thus volition, would help remedy this problem by making the brain subject to conscious management. Volitional consciousness and the brain may have co-evolved: volition makes a more complex brain manageable; a more complex brain makes a greater degree of volitional consciousness possible, and so on. This co-evolution may have resulted in both the gigantic brain and powerful conceptual consciousness of *Homo sapiens*.

The flexibility of volitional action provides a shortcut to the evolutionary process. An organism capable of volitionally overriding its programming could handle new contingencies without evolving the extensive pre-programming that would otherwise be necessary. We suspect that to approximate human volitional flexibility using purely algorithmic processes would take the Blind Watchmaker considerably longer than the 4.8 billion years the earth has existed. It might also require vastly expanding the size of the human head to make room for the extra neural machinery necessary for handling so many contingencies.

Although every conscious experience may well be the result of deterministic neural processes,[12] (i.e., conscious experience may "supervene" on the brain), the act of volitional attention cannot have such a basis. If it did, it would not have the adaptive benefits discussed above. Volitional attention very likely has underlying neurophysiology from which it "radically emerges," but once it does emerge, volitional attention takes on a life of its own, not causally determined by its underlying neural processes.

Libet et al. (1983) finding–that specific neural activity (the "readiness potential") precedes the urge to make certain motor movements by about 350 ms–may at first seem inconsistent with the idea that volition has adaptive benefits. However, it appears that Libet did not actually investigate the *direct* act of volition. Libet's "wish or urge to act" is not the same as the experience of mental effort, the real signature of volition. One could argue that the actual volitional decision came at the point when the subjects decided to accept the terms of the experiment, and that once this decision was made, the movement of the finger was produced via delayed automatized action, i.e., the movement was free whim, not free will (cf. Zhu, 2003). Furthermore, there are other explanations of the Libet results that are consistent with volition having adaptive benefits, e.g., Libet himself has his "free won't" theory, according to which free will consists of the power to veto, not initiate, action.

If an adaptation is possible, natural selection has an uncanny ability to "find" it, given sufficient time. Natural selection somehow "found" consciousness, although it took much longer to do so than it did to find life. According to current estimates, natural selection happened upon life as a superior way to replicate molecules about 500 million years after the earth was formed. It took about another 3.5 billion years for natural selection to find consciousness (Hameroff, 1998),[13] but once consciousness was discovered, it offered a significant adaptive advantage to its possessors.

We realize that the adaptive advantage of libertarian free will entails the positing of either a new force of nature or of a radically new property of a known force such as electromagnetism. In either case, the notion of the "causal closure of the physical" (e.g., Kim, 1996) would be contradicted. However, this idea is an unproven assumption, so contradicting it is not fatal to our theory.

In regard to the oft-cited problem of how non-physical mind can act upon physical matter: if mind is an emergent property of matter, isn't that a sufficiently intimate connection to support a two-way causal interaction? But in any case, is the "interaction problem" a real issue beyond that of understanding causation in general? Why must causal agencies be of the same kind in order to interact? In addition, much of our early experience of causal interaction is of our own self-generated movements and other self-generated interactions with physical objects, such as pushing a ball. Thus, our very concept of causality may arise from our experience of volitional self-generated action, and, therefore, it may be that purely physical causation is more difficult for us to understand than volitional causation (though neither should be denied).

5. Arguments for the existence and adaptive value of self-consciously deployed volition in humans

The two essential arguments validating the specifically *human* form of volition are:

1) We have introspective awareness of volitional action. As Schwartz (1999, p. 133), paraphrasing the 18th-century French philosopher Maine de Biran, states: "our inner experience of a causal relationship between the will to movement and bodily motions is so vivid and direct that it transcends the possibility of reasonable doubt." Almost everyone, including most determinists, will concede that we have an experience of volition; we do not experience ourselves as being passively pushed and pulled around. As Greenfield (2000, p. 184) puts it: "Despite all that we know about networks of nerve cells, neurotransmitters, and subconscious processes, it still *feels* as if there is a conscious inner self that is free to make choices." Many determinists (e.g. Wegner, 2002) claim that this experience of volition is an illusion. However, the burden of proof falls squarely on the illusionists, as Dennett (1991, p. 40) recognizes: "If I wish to deny the existence of some controversial feature of consciousness, the burden falls on me to *show* that it is somehow illusory." Although Wegner cites evidence (e.g., from hypnosis, electrical stimulation of the brain, and neurological disorders) that in certain unusual situations the feeling of volitional action may be illusory, it is a huge leap to infer from such cases that *none* of the many choices we make every day are volitional. That volition may have been shown to be an illusion in some cases does not mean it is an illusion in all (or even most) cases (cf. Nahmias, 2015).
2) There is an inherent contradiction in any deterministic theory of human nature, one that has been pointed out many times, e.g., in Joad (1957), Branden (1963), Locke (1966), Boyle, Grisez, & Tollefsen, (1972), Binswanger (1991), and Hodgson (1991, 2012). The determinists' predicament is that on the one hand, they want you to believe that determinism is true rather than false, but on the other hand, according to their various theories, factors such as your reinforcement history (behaviorism), the economic conditions of your social class (Marxism), your DNA (genetic determinism), or your innate drives (psychoanalysis) force you to believe (or not believe) in determinism regardless of whether it is true or false. Thus, determinists cannot legitimately claim that the theory of determinism is true, only that

[12] Although the creation of conscious experience is, in all likelihood, proximately deterministic, it is not ultimately deterministic because of the effects of volitional attention on future conscious experience.

[13] Hameroff hypothesized that the dawn of consciousness resulted in the Cambrian evolutionary explosion. If so, we would suggest that it was consciousness via volitional action that caused the "explosion."

they are determined to believe it. The determinists' own theories contradict any claim to truth.[14] Next, we show how volition enables its human possessors to escape the trap of determinism.

Human volition is the most flexible form yet evolved. It differs from volition in other animals in at least two major ways. First, humans, unlike other animals,[15] have the ability to be aware of their own conscious processes (i.e., they have "introspective awareness," "awareness of awareness," "second order consciousness," "recursive consciousness," or "self-consciousness"). Second, humans are able to sustain attention beyond the automatic for long periods of time. For example, while a dog may be able to sustain attention on a flower for a short time beyond what its neurophysiology would dictate, a human could keep volitionally shifting attention back to the flower for days or weeks or years. We suspect that human conceptual ability would be impossible without these two enhancements to animal volition. Volition that can be deployed in a self-conscious, reflective manner on one's own mental processes is a powerful capability that makes objective, conceptual thought possible. Unlike any other species, we humans can introspectively identify gaps in our own thinking/knowledge and volitionally direct our thinking to bridge them.

The flexibility of volition enables humans to escape the deterministic trap of being forced to hold a belief as true whether or not it is true. To attain objective conceptual knowledge, humans need a non-deterministic method of error correction. Physical brain processes alone cannot carry out this function, because brain processes, by themselves, are deterministic.[16] The volitional ability to sustain a cognitive process longer than it would have continued automatically gives humans a method of conceptual error correction that is not available to their zombie twins. Through volitional thought, humans can make conceptual judgments based on the available *relevant facts* rather than be forced to conclusions by *irrelevant factors* such as social class, upbringing, or genes. Self-consciously directed volition enables humans to correct conceptual errors over time, and thus to be objective.

Human thinking must inevitably go "off the track" on occasion. Notoriously, human judgment is fallible; "to err is human." "Intuitive" judgments, i.e., judgments resulting from non-conscious automatic processes, without volitionally sustained thinking, are often mistaken (Myers, 2002). We often let important issues slip by in our thinking without adequately considering them. No error-correction "program" could be sufficient to handle this problem, since any such program could also go off the track when it encounters situations outside the scope of its algorithm. Furthermore, as noted earlier, we do not have any sort of "ultimate program" that adjusts to all contingencies, since we make mistakes that are not due simply to a lack of relevant knowledge. Volition provides the ever-present potentiality for correcting errors that one could be trapped in if one's beliefs were determined. Error, were it to occur in a deterministic system (and we know errors do occur!), would be unavoidable unless there was an error-correction program – but then what about the fallibility of *that* program? One could still end up trapped in false belief. The exercise of volition–by impelling the thought process beyond the point it would have been terminated automatically – makes objective self-correction possible, even when one's "programming" would have led inevitably to an erroneous conclusion. The possession of volition means that no error is inevitable; you can always choose to act to correct the error.

Self-consciously directed volitional effort gives us the ability to make judgments that are based on the available evidence, rather than forced upon us by factors that may have no connection to the truth or falsity of the claim. We can choose to continue to activate relevant information, rather than passively hope that it will automatically come to us.

Space considerations permit only one small example of the self-consciously directed volitional process. Try to identify the steps you go through as you think about the following question: "Should a man be allowed to marry his widow's sister?"

Now, the correct response to this question may come immediately and without effort. Often, though, one's conscious reaction to this question may develop through as many as five introspectively discernible stages: 1) "Why not?" i.e., the belief that there is no problem with the man's marrying his widow's sister. 2) An awareness that feels like a mental "pebble in one's shoe," the annoying feeling that something is amiss. 3) A consciously sustained follow-up on the mental pebble by a specific thought process, culminating in posing and answering the question "What is a widow?" 4) A brief "tip of the tongue" experience, i.e., an awareness that the answer to the original question is on the way, but not yet conscious. 5) Finally, the aha! experience of "The man is dead!"

Here, volitional action is most clearly evident in stage 3. At that juncture, one can consciously choose to follow up on the feeling, occurring in stage 2, that something was amiss. This feeling is an experience of the kind we call "inklings" ("stinklings," when tinged with negative affect): signals from the subconscious level of cognitive activity that function as an "early warning system" of the mind that tells one when there is a need to exert volitional effort. These affective states (which were first described in detail by the early-twentieth-century Würzburg psychologists, see Humphrey, 1951) are the form in which we become conscious of the progress of our thinking. They include awarenesses of: insight (the "aha!" experience), doubt, hesitation, knowing that you know something without knowing exactly what the something is, ease or difficulty of understanding, and being on the right or wrong track while solving a problem. These inklings are indicative of the progress of thinking, lying along a dimension extending from "Eureka!" to "I am totally confused." They are part of a penumbra of often subtle but introspectable affective states that apparently surround virtually all thought processes.

You cannot always decide *when* to think, by thinking; if you try you will trap yourself in an infinite regress of thinking about when to think about when to think, and so on. Inklings hint at a direction to follow up on by thinking. They signal the existence of gaps in our thinking, possibly important issues that have slipped by too quickly. In our example, one can follow up on the inkling in stage 2 by thinking further about the meaning of the question as a whole, and of its individual words, until one is able to formulate the required question: "What is a widow?"

Readers may generate their own further examples by reflecting upon their actions of sustained thinking, such as in reading comprehension and mathematical problem-solving. In all such cases, volition gives us the power to go beyond automatic processes.

In these last two sections we have discussed some of the adaptive benefits of non-deterministic, non-automatic, non-

[14] It has been pointed out that the existence of volition cannot actually be *proven*, since the concept of "proof" presupposes the existence of a volitional ability to judge the correctness of a proof. Volition can, however, be *validated* as an axiom, i.e., as an undeniable premise underlying all conceptual knowledge, since it is an introspectively self-evident phenomenon whose denial is self-refuting (see, e.g., Binswanger, 1991).

[15] with the possible exception, in a primitive form, of dolphins and certain primates (Smith, Shields, & Washburn, 2003).

[16] Or probabilistically deterministic, if quantum effects are significant in this context. However, since an ontologically non-deterministic quantum theory is far from proven, we are at present reluctant to make a quantum leap across the explanatory gap. Some theorists, such as Bohm (1952), describe quantum phenomena deterministically. In any case, there is general agreement that physical processes are effectively deterministic at the macro level.

algorithmic action in humans and other animals. Now let us apply our Key Question to our own hypothesis: Is consciousness itself causally involved in making volitional movement possible, or can this function be performed entirely by neural processes? As far as is known, neural processes are deterministic, or at least stochastically deterministic. Thus, neural processes alone cannot make volitional action possible; a "radically emergent" or "emergent2" (Searle, 1992) property is needed: volitional consciousness. If "volitional" action were completely reducible to neural processes, it would be deterministic and therefore incapable of providing benefits beyond those of automatic action. Neural processes are no substitute for consciousness. The "machine" is not the "ghost"![17]

6. Adaptive benefits of conscious experience

> "Conscious experience is at once the most familiar thing in the world and the most mysterious. … Why do we have any experience at all? Could not an unconscious automaton have performed the same tasks just as well?" –David Chalmers (1995b, pp. 1–3)
>
> Conscious experience is no substitute for neural processes. There is no reason to think that it can do what neurons do, and there is no evidence that conscious experience itself is performing any "processing" (see, e.g., Velmans, 1991a, 1991b). The "ghost" is not the "machine"!

However, it would be odd indeed if the very phenomenon that makes life worth living were epiphenomenal. What, then, is conscious experience for? If, for example, neural processes are able to non-consciously discriminate red from blue, why did natural selection add the conscious experience of red and blue? Our hypothesis provides a ready answer to this thorny question: the function of conscious experience is to inform–and sometimes to motivate or inhibit–volitional attention. Without volitional attention, conscious experience would have no function. Although an organism's automatic actions do not need to be guided by conscious information (these actions occur blindly by physical causation), its volitional actions require such guidance. Without conscious experience, mental effort would be of little value since it would be "flying blind." Volitional attention is only as good as the information that the organism uses to direct it. Conscious experience provides targets for volitional attention to aim at; neural processes take it from there.

Volitional attention apparently cannot directly access "data" in neural form. If one is peripherally conscious of a tree, one can choose to bring the tree into focal attention, but the tree first had to be in peripheral consciousness. Furthermore, it does not seem possible for neural processes to inform volitional action except by creating conscious experience. Purely physical phenomena lack "intentionality" (i.e., they are not "about" anything) (Brentano, 1874/1973). Therefore, physical phenomena, including neural processes as such, cannot constitute information in the sense of knowledge about the world. Physical "information" is not really information at all (cf. Searle, 1992, pp. 222–225).

Automatic movements are guided by physical causal sequences, not information. For example, the "information" that a robot possesses is nothing more than a high correlation between physical states inside the robot and physical states in its environment. This correlation may be used to guide the robot's movements, but such movements will be completely algorithmic, rather than volitional. Physical "information" can be helpful to a robot or an organism only if it is, at some point, wired to specific movements. On the one hand, physical "information" is of no use in the volitional control of movement, since the latter is not wired in. On the other hand, intentionality is of no use to the automatic control of movement. If there were no volition, intentionality would be epiphenomenal. What good is "aboutness" if you cannot choose, i.e., if you are stuck in a deterministic system? The property of "intentionality" may be a key to understanding why volitional attention needs information in conscious, as opposed to physical, form.

A volitional organism needs a way to motivate volitional action towards the ultimate goals of survival and reproduction. It also needs a way to inhibit volitional action when its exercise would run contrary to these ultimate goals. A special category of conscious experience evolved to solve these adaptive problems: pleasure/pain.

Macphail (1998, p. 14, quoted in Blackmore (2004, p. 148–149)) raises what is, in effect, a version of our Key Question with specific reference to pleasure and pain: "there does not in fact seem to be any need for the experience of either pleasure or pain … What additional function does the pain serve that could not be served more simply by a direct link between signals from the classificatory system and the action systems?" Why does Mother Nature torment her creatures with pain and delight them with pleasure? After all, humans will even commit suicide under severe pain, an apparently rather maladaptive action. Our answer is that without volitional action, there would be no need for the phenomenal experience of pleasure/pain.

Like all conscious experiences, pleasure/pain informs volitional action. However, non-affective conscious experience could perform that function (e.g., by flooding awareness with the color white to signal benefit and black to signal harm). The unique function of pleasure/pain seems to be its inherent tendency to motivate and inhibit volitional action.

It is widely accepted that pleasure/pain motivates action. We believe, however, that the *conscious experience* of pleasure/pain motivates *volitional* action only. It does this by placing a conscious goal, or "action intention," or "goal image," of "approach/avoid me" into conscious awareness. If it were not for volitional action, the conscious experience of pleasure/pain would not have evolved, because purely neural processes would have been sufficient to control an organism's automatic responses. Physical processes do not require motivation; they just occur automatically by physical causation.

The aversiveness of pain and the attractiveness of pleasure set inherent goals for the organism that were, on average, conducive to the survival and reproduction of its ancestors. Volitional action in the absence of these goals might well be maladaptive, as illustrated by congenital analgesia, the rare condition of an inability to feel pain. A congenital analgesiac could volitionally decide to read a book while sitting on a red-hot stove. Similarly, without the conscious experience of hunger and its inherent goal of "avoid this feeling," an organism in desperate need of nourishment might volitionally decide to smell the flowers instead of to eat the fruit.

The valence of pleasure/pain increases the volitional effort necessary to pursue any goal other than that of approaching/avoiding the source of the pleasure/pain. It is more difficult to shift attention from pleasure or pain than from other conscious experiences. The inherent goals of pleasure/pain tend to crowd other goals out of consciousness, although pleasure/pain can probably be overridden by volitionally chosen goals in all but the most extreme cases, at least by humans. As the intensity of pleasure/pain increases, the inherent goal "approach/avoid me" becomes more

[17] Please note that our jocular use of the terms "machine" and "ghost" is not meant to imply that we embrace any form of Cartesian dualism or any other supernaturalism. Rather, we hold that consciousness is an emergent property of neural activity.

dominant and it becomes more difficult for the organism to volitionally attend to and enact other goals.

Unlike other conscious experiences, pleasure/pain has the power to inhibit volitional action. Despite its value, volitional action can be dangerous when exercised at the wrong time, such as when a rapid response is needed, as in emergency situations. If a tiger chases you, it is likely to be fatal to pause and volitionally decide whether to run or, perhaps, to examine the tiger's teeth. In such cases, your conscious experience of fear will inhibit volitional action, clearing the way for rapid automatic actions to take over.

The conscious experience of pleasure/pain "jams" volitional attention by flooding both the focus and fringe of consciousness. This flooding pushes other possible objects of volitional attention further away from the focus of consciousness, thereby increasing the effort needed to focally attend to them. Thus, the common fear of "losing control" when in the grip of a powerfully pleasurable/painful emotion, such as ecstasy or panic, is grounded in reality. In extreme pain, the fringe of consciousness is crowded out altogether and the capacity for volitional attention is effectively eliminated: there are no conscious experiences to attend to other than the pain. The feeling of panic when one is being chased by a tiger crowds out other objects of consciousness, making it exceedingly difficult to attend to anything but the goal of escaping the beast.

Pleasure/pain generally increases in intensity as the benefit/harm from a situation increases, and the more intense the pleasure/pain, the more it inhibits volitional attention. Pleasure/pain acts more like a dimmer dial than an on/off switch for volitional attention. It would be maladaptive either to switch off the volitional capacity completely in the face of slight pleasure/pain or to fail to severely inhibit volitional choice in the face of extreme pleasure/pain. There is a delicate balance between automatic action and volitional action; too much of either is maladaptive. If there were just one level of pleasure and pain, say of medium intensity, it would be too easy to override automatic actions in some cases and too difficult in others. The combination of volitional action motivated by pleasure/pain, and automatic action, is a more adaptive mix than would be an entirely non-conscious system of approach/avoidance. This combination allows for a range of potential responses to a novel situation, rather than the single possible response that would result from automatic processes alone.

Why did natural selection not rely solely on neural processes to inhibit volitional action? After all, the generation of conscious experience most likely costs calories. Why not have the brain "turn off the lights" when volitional attention is maladaptive, and later turn them back on? One possible reason is that the organism could benefit–immediately or subsequently–from conscious feedback about why its volitional powers are being ramped down. It would be confusing–and potentially deadly–for an organism to experience an inhibition of its volitional control without knowing why it was being inhibited, without knowing whether the precipitating situation was harmful or beneficial.

7. Some empirical evidence for our hypothesis

One line of empirical research that lends support to our hypothesis focuses on "implicit cognition." Information presented non-consciously seems to influence automatic action, but not volitional action. By contrast, the same information presented consciously influences both automatic and volitional action. Therefore, consciousness does not seem to be necessary for automatic action. Here are three examples:

1) "Blindsight" occurs when damage to the visual cortex (usually in V1) causes conscious blindness to the presence of stimuli in part of the visual field, yet blindsighters, when forced, can make above chance judgments about the presence of objects in the blind area. Velmans (2000, p. 202) notes that "blindsight patients make no attempt to grasp a glass of water in their blind field even when thirsty, suggesting that information about the input remains dissociated from systems subserving voluntary control." Blindsight patients apparently can use non-conscious visual information for forced- choice guessing, but not for volitional action.
2) An action that is normally involuntary and non-conscious can be brought under volitional control, but only if the subject is given *conscious* feedback of the process. Baars and McGovern (1996, p. 75) cite an extreme example of this: by being given conscious feedback of a single motor neuron (played back as a click through a loudspeaker), some subjects can learn to play drum rolls with that neuron through the loudspeaker after about 30 min of practice. However, if the biofeedback is not conscious (e.g., because it is presented subliminally, distracted from, masked or habituated), the subjects do not achieve voluntary control over the neuron.
3) Merikle (2000), in summing up research on subliminal "perception," observes: "The weight of the evidence indicates that people must be aware of perceiving stimuli before they *initiate* actions or change their habitual reactions to these stimuli [emphasis added]. Thus, although subliminal perception may allow us to make accurate guesses regarding the characteristics of stimuli, subliminal perception cannot lead a person to drink Coca-Cola or eat Ritz Crackers …" We would agree, because these latter two actions require either volition, "frozen" volition, or both.

Another line of evidence supporting our hypothesis comes from the well-known covariance of conscious experience and volitional control. Where volitional action is not needed, conscious experience has no purpose and either never exists or fades away. Some examples of this covariance are: 1) In activities in which volitional control is usually not adaptive, such as in many internal bodily processes, conscious experience of the activity is not afforded to us. 2) Repetitive presentations, such as background noises, tend to fade from consciousness. 3) When control of an activity passes progressively from volitional to automatic, as in skill acquisition, conscious experience correspondingly recedes. 4) When volitional action is possible but undesirable, as in the cases of pleasure/pain, other conscious experiences that normally inform volitional action are "crowded out," as discussed in the previous section. Let us look at the first three examples in more detail.

1) We have no conscious experiences of many of our internal bodily processes, probably because volitional control of these internal processes was not adaptive, on average, for our ancestors. For example, volitional control of ph level of the blood would enable the organism to choose to bring its ph level outside its homeostatically established range, most likely with maladaptive consequences. The neural processes that control the workings of internal organs such as the kidneys were not tagged with conscious experience (except for the experience of pain, in some cases), because the routine processes of these organs is best controlled automatically. These neural processes do not require volitional guidance, which tends to be slower, less reliable, more limited in capacity, more likely to break down, and probably more costly in terms of calories.
2) Baars and McGovern (1996, p. 77) note that "Repetitive, predictable, 'old' stimuli tend to fade from consciousness …" We believe that this habituation occurs because "repetitive stimuli," such as the hum of the computer with which we are writing this

article, are of little use for informing volitional action, which is most useful in novel situations.

3) The process of skill acquisition provides evidence for our hypothesis. The more automatized a skill becomes, the less volitional, conscious management is required for its proper execution and the less awareness we have of the details of its execution (cf., e.g., Fitts & Posner, 1967). Whatever the mechanism may be,[18] as a skill develops and becomes more automatic, both the specificity and numerosity of intentions required for executing that skill decrease. With sufficient repetition in similar circumstances, orders to oneself become standing orders; memory replaces thought.

The conscious aspects of automatization are like macro-making (or like telephone speed-dialing, if you prefer). A macro is a small computer program that makes a sequence of operations accessible using a minimum of keystrokes. Change "keystrokes" to "conscious intentions" and you have a description of the volitional aspects of an automatized activity. An automatized activity can be executed via fewer, more general intentions than were needed to perform that same activity before it was automatized; i.e., the same result can now be obtained with fewer "keystrokes." Volitional attention is now freed up for another task.

Consider the classic example of the skill of driving. When one is first learning how to drive, one must pay attention to a great number of specific actions such as turning, braking, accelerating, watching the road, and so on. Eventually, with practice, these actions become in large part automatic and require only a few general conscious intentions to execute properly. The fact that volition and conscious experience co-vary so closely during skill acquisition is strong evidence that volition is integral to consciousness and its functioning. If consciousness either has no function or any function other than volitional control, why does it recede during automatization?

Future research should further explore the relationship between conscious experience and volitional attention, as well as the possible dissociation from consciousness of functions other than volitional attention, e.g., as has already been shown in blindsight research (cf. Weiskrantz, 1997). Research designed to identify the neural correlates of mental effort would also be of great value.

To sum up this section: there is empirical evidence indicating that, generally speaking, to whatever extent volitional action is possible in a given situation, to that extent there will be conscious experience of that situation. Conversely, to whatever extent conscious experience of a given situation is present, to that extent volitional action is possible in that situation. Conscious experience and the possibility of volitional action vary concomitantly.

8. Conclusion

Why did consciousness evolve? In a word: volition. We hypothesize that the ultimate function of consciousness is to make volitional movement possible. Consciousness, via volitional action, increases the likelihood that an organism will direct its attention, and ultimately its movements, to whatever is most important for its survival and reproduction.

A broad outline of the argument for our main hypothesis runs as follows: if consciousness has any biologically adaptive function, it must ultimately be for some type of movement. On the one hand, there are good theoretical arguments and empirical evidence that *volitional* movement requires consciousness. On the other hand, we know of no good theoretical arguments or empirical evidence that *automatic* movement requires consciousness. There is also empirical evidence that conscious experience varies concomitantly with volition. Volitional movement is adaptive because it adds a fundamental flexibility that is not possible with deterministic, automatic movements, which are controlled entirely by neural processes.

If our hypothesis is correct, it puts to rest a variety of assertions, including: 1) Claims by eliminative materialists/behaviorists/identity theorists that consciousness has no function, either because it does not exist or because it reduces to physical brain processes. 2) Epiphenomenalist claims that acknowledge the existence of consciousness, but deny that it has causal efficacy (e.g., claims that consciousness is a "causally impotent" "side-effect," "by-product," "dangler" or "spandrel"). 3) Assertions that acknowledge the existence and causal efficacy of consciousness by ascribing various functions to it but that fail to adequately answer the Key Question, i.e., claims that consciousness can somehow function as a substitute for neural processes. In addition to putting these assertions to rest, our hypothesis adds specificity to assertions that are true but vague, e.g., claims that consciousness provides flexibility, promotes survival and reproduction, perceives reality, obtains knowledge, guides movement, handles novel situations, or plans future actions.

Without an understanding of volition, the function of consciousness cannot properly be understood. If our basic hypothesis is correct, the failure to take volition seriously has been and still is the greatest impediment to progress in psychology and consciousness studies generally. However, since we humans are conscious and therefore volitional, there is hope for breaking out of this maladaptive automatism.

[18] One plausible mechanism is proposed by Logan (1988).

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