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An Evolutionary Perspective on Free Will and Self-Consciousness

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The sense of *free will* is a consequence of having a brain with the capacity of rational thoughts and self-consciousness; that is, humans have the power of volition and agency. This sense of free will is underpinned by a true level of willfulness of behavior based on conscious (or cognitive) deliberation. Conscious deliberation is one of several strategies devised by evolution to execute behavior. Other strategies, such as reflexes and instincts, can be engaged simultaneously; our free will is therefore constrained by the relative dominance of the various strategies, as well as by the obvious limits of mental and physical abilities. The question of whether we have a free will may be answered by stating that we have a sufficient amount to choose "yes" or "no" as an answer; that is, we can set the arbitrary cutoff required to qualify either above or below the level of free will evolution happened to install. Our sense of free will is likely to exceed our actual capacity of willfulness. Conscious content needs to be generated by unconscious activity; but at the same time, conscious input is needed to make a cognitive decision. If the conscious input itself must be formed by the unconscious, which of the two comes first? The answer may reflect that of the chicken-or-egg-dilemma; conscious and unconscious activity develop gradually and interdependently culminating in the awareness of a willed decision.

Keywords: free will, self-consciousness, evolution, neurobiology, behavior

Although most people accept that we have a "sense of free will," in that we feel capable of making choices based on personal preferences, some people claim free will to be an illusion (Caruso, 2012). The question is whether the choices we make are predetermined by the design of the brain—either reflecting supernatural forces (a supreme power or God is pulling the strings) or a natural form of determinism (the laws of physics direct everything that happens in the universe). The stance taken here is that true free will, and thus predetermination, is not an either/or issue, but rather a question of degree.

In other words, we have a *sense* of free will in that we feel our actions to be willed, but this perception is based on the objective fact that the actions are to some extent decided on by the individual. That is, our sense of free will is underpinned by a true capacity to take action in that we use conscious input when making decisions.

Both our sense and level of free will are based on the way evolution shaped our brains. Investigating the evolutionary process leading to our current nervous system therefore helps us understand what free will is about. In the present terminology, most of the activity of any nervous system is unconscious. In certain advanced nervous system, possibly restricted to those belonging to the amniotes (Grinde, 2018), this activity can give rise to conscious experiences. The neurological circuits or structures responsible for this achievement are referred to as the conscious part of the brain. Typically, the decisions and actions

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This is a theoretical paper and as such does not rely on any unpublished data set, and there is no reference to unpublished studies.

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we make are based partly on conscious input and partly on unconscious processes in our brains.

As a phenomenon associated with humans (and perhaps other animals), free will can and should be investigated scientifically. Biology offers one possible line of investigation. I believe the old adage, "Nothing in biology makes sense except in the light of evolution" (Dobzhansky, 1973), to be true even when exploring something as philosophical in nature as free will.

I do not consider the phenomenon of free will to be a discrete entity of the brain, but rather to depend on at least four separate faculties:

1. *Self-consciousness:* This is about knowing that you are an autonomous individual; the capacity is also referred to as self-awareness or a sense of agency.
2. *Volition:* The wanting or intending for something to happen. In this faculty, I also include the capacity of expectancy; that is, a person creates a mental image of the likely consequence of a particular action.
3. *Attention:* Here it implies an ability to focus consciously on a task.
4. *Voluntary action:* The capacity to consciously activate muscles or instigate a line of thought.

I wish to address two questions: for one, what is the evolutionary history and rationale behind our capacity for free will? and two, what are the neurological correlates? There are data that allow for partial answers to both questions, and these answers form a coherent picture of what free will is about. I shall start with a brief evolutionary history of the brain components I believe are required for the phenomenon. Next, I shall consider how free will relates to the various strategies for behavioral control inherent in the human brain, and then consider experiments and observations made regarding the neurological correlate. Finally, I shall discuss the level of free will, both in humans and in other species, and the relevance for ethical and legal issues.

The Evolutionary Perspective

Evolution of Brains

Some 600 million years ago, evolution introduced nervous systems for the purpose of managing behavior. Behavior entails making "decisions," which generally implies taking actions. In most animals, the decisions are (presumably) not based on conscious input but solely on unconscious processes, which means that their actions are what we may refer to as involuntary. Whether the decisions are based on conscious or unconscious processes in the nervous system, they typically result in muscular contraction and thus movement, initiated by the effector branch of the nervous system.

Most animals need mobility in order to care for the interest of the genes, which usually means moving *toward* what is beneficial and *away from* anything detrimental. All nervous systems are based on the same scheme: Sensory neurons send signals to a processing unit that pass on signals to effector neurons that again activate muscles. The main form of variance among species rests with how the processing units, or brains, facilitate behavioral decisions. Evolution has devised a range of strategies in an attempt to ensure optimal behavior in regard to survival and procreation.

Humans have, arguably, the most advanced brains. However, our brains do retain several "primitive" strategies for executing behavior, for example, in the form of reflexes. Then again, human brains have several additional features—compared to, for example, invertebrates—and these features allow for particularly complex and fine-tuned decisions.

One of these features is what we refer to as feelings. I use the term *feeling* for any form of experience with a positive or negative connotation. The reason why they come with these two attributes is because they are meant to help the individual either take advantage of options promoting the genes (moving toward) or to avoid (moving away from) an adverse outcome (Grinde, 2012). Feelings probably evolved some 300 million years ago in the early amniotes (Cabanac, 2009) and serve as a "common currency" allowing the brain to weigh advantages against detriments when making decisions (Cabanac, 2002). As feelings require the capacity to *feel*, they may have been the factor initiating the evolution of consciousness (Grinde, 2018).

The capacity for conscious experiences allowed for some further cognitive improvements in orchestrating behavior. That is, evolution introduced add-ons such as self-consciousness, deliberate thoughts, consciously directed attention, volition, and expectancy.

Evolution of Free Will

As suggested in the introduction, our aptitude for (and concomitant sense of) free will presumably depends on the evolution of particular brain faculties such as our capacity for self-consciousness, attention, volition, and voluntary action. The phenomenon we refer to as free will presumably came as a consequence of these added tools. It reflects the subjective experience of being the agent responsible for actions. As such, it should probably not be conceived as a distinct unit of evolutionary selection, but rather as either an exaptation or an indirect consequence of our cognitive tools.

The question of whether evolution also did select for free will per se is not obvious, as it may be argued that a free will have a distinct evolutionary advantage. A free will may, for example, empower the individual and thus enhance effort and persistence when performing a task (Gollwitzer, 1999). That is, the capacity to foresee consequences of our actions, and to realize that the outcome depends on our personal choice and initiative, is likely to motivate the individual toward fulfilling relevant goals. The contention that our sense of free will tends to exceed our true level of free will may reflect this form of selection. That said, I still believe that the faculties mentioned above were the ones that initiated our capacity for true free will.

Strategies for Executing Behavior

The Level of Conscious Involvement

Behavior has been defined as the internally coordinated responses (in the form of actions or inactions) of living organisms to internal and/or external stimuli (Levitis et al., 2009). The actions generally imply a neurological activation of muscles.

Reflexes, such as the knee-jerk (patellar reflex), represent the simplest form of a behavioral response or decision. This response does not require conscious engagement, when you activate proprioceptors associated with the patellar tendon by hitting them with a hammer, you tap into a system that helps retain balance. The response only requires minimal processing in the spinal cord. It involves voluntary muscles and is subject to free will in that you can choose to resist movement if warned ahead.

The knee-jerk is brought to conscious attention, while the continuous regulation of the muscle tone of voluntary (skeletal) muscles is not. Smooth muscles, such as those controlling gut movement and size of pupils, are generally outside of both voluntary control and conscious awareness. Yet, it is possible to "hack into" their control mechanisms by conscious effort, for example, thinking of something dark or light is sufficient to respectively slightly open or close the pupils (Laeng & Sulutvedt, 2014).

Feelings evolved as a more advanced and adaptable strategy for orchestrating behavior, but their evolutionary rationale is to control (or sway) the individual, rather than the individual controlling them (Panksepp, 2004). That is, evolution did not install an ability to turn off, for example, fear or pain, by personal choice, as this could easily be disastrous for the genes, for example, as reflected in the high rate of injury in people with congenital insensitivity to pain (Young, 2008). In short, feelings are normally initiated in the unconscious part of the brain. As a rule of thumb, they are presented to conscious awareness, but you can be influenced by feelings without realizing that you actually have a feeling (Tamietto & de Gelder, 2010). On the other hand, it is possible to have a conscious impact on how feelings affect everyday experiences (Grinde, 2016).

Other strategies for behavioral control include fixed action patterns (where a sequence of activity is carried out in response to a stimulus) and instincts (or instinctive tendencies). Most forms of behavioral control are subject to learning in that the neuronal circuits responsible can be modulated by environmental input. The statement is true even for the simplest nervous systems such as those of nematodes (Zhang, 2008). Presumed unconscious processes can be responsible for advanced forms of behavior, such as the complex dance bees use to communicate (George & Brockmann, 2019). In humans, unconscious processes may affect conscious decisions without the person being aware of the input, for example, in the case of what we refer to as intuition (Sinclair, 2010).

Although the basic forms of behavior imply the activation of muscles, humans are endowed with the capacity to make purely cognitive decisions, for example, whom to marry. These decisions are clearly within the frame of our free will, yet they are typically swayed by unconsciously generated motivators such as feelings—we tend to marry the person we fall in love with.

The Importance of Response Time

In order to understand the evolution of our level of true free will, it is relevant to consider the time nervous systems require in order to elicit various forms of response.

Conscious processing is generally slow compared to unconscious processing and presumably costly in terms of required brain resources (Dehaene, 2014). Moreover, it can only focus on one task at the time (although it can jump rapidly between tasks). In contrast, unconscious processing can accommodate several tasks simultaneously, such as regulating heart rate and pupil size. We are consequently designed to engage our capacity for cognitive deliberation only when immediate action is not required and in situations that cannot be dealt with by more basic behavioral strategies such as reflexes.

The knee-jerk only takes some 20 ms (Vickery & Smith, 2012), reflecting the importance of continuous, rapid control of muscle tone in order to retain desired posture. A startle response, for example, the initiation of a fear reaction as measured by eyeblinks after a sudden sound, typically takes some 40 ms (Larson et al., 2000), reflecting a more elaborate (but unconscious) neurological processing compared to the knee-jerk. A voluntary reaction to sensory stimuli requires even more processing time. In general, the reaction to auditory signals tends to be faster than in the case of visual signals; in a task that requires the subject to push a button, the response can take, respectively, 280 ms and 330 ms (Jose & Gideon, 2010). Top athletes can start movement some 100 ms after hearing the start pistol, which is used to define a false start in sprint competitions and thus presumably reflects the minimum auditory reaction time (Pain & Hibbs, 2007).

In all the above cases, the response time includes the activation of sensory cells, signaling from these to the central nervous system (CNS), processing, signaling from CNS to muscle, and muscle activation. In the case of a knee-jerk, the processing time is close to zero. Thus, the response time reflects the time required for the signal to pass through axons, which in vertebrates is at the best (typically more) 12 cm/ms (Salzer & Zalc, 2016).

The responses described so far do not require actual deliberation after the stimuli are received. In this case, free will enters the picture by making a decision *prior* to the sensory stimuli, for example, by resisting a knee-jerk when observing that someone is about to hit your knee with a hammer. If, as may be the case in a startle response or a knee-jerk, there is no forewarning, the actual awareness of the situation occurs after the reaction.

According to the *global neuronal workspace theory* of consciousness, a conscious experience is due to the ignition of a particular neuronal network that encodes a representation of the information experienced at that moment (Mashour et al., 2020). The process of bringing the information to conscious awareness, what may be referred to as "broadcasting," is expected to require at least 200–300 ms. Conscious deliberation as to how one ought to respond to a stimuli can only start at that point, meaning that decisions based on cognition and free will are only possible when one has at least a few seconds to make a choice.

The conclusion to be made from this section on strategies is that conscious, or free willed, decisions are intertwined with unconscious neurological processing. The sprinter cuts out conscious processing when he needs to react to the start pistol, in other cases, you may allow for minimal time to conscious deliberation, which means that the response is still likely to be heavily influenced by the unconscious processes. Even when you really give yourself the time to ponder on a task, the results are most likely swayed by processes in the brain that you are unaware of. In other words, even decisions assumed to be willed tend to be subject to forces beyond personal control. True free will is not an either/or question, but a feature that varies in level depending on a range of factors. The level reflects evolutionary constrains as to how a decision ought to be made.

The Neurobiology of Free Will

The Neuroanatomy

Studies based on neuroimaging (mostly functional magnetic resonance imaging [fMRI]) suggest that the exertion of free will primarily involves activity in select regions of the cortex, particularly in parts of the prefrontal cortex (PFC) such as the ventromedial PFC and the dorsolateral PFC (Haggard, 2019; Hauser et al., 2007). Finding a hotspot in the PFC is not surprising, as this region is associated with executive cognitive function, and because it went through exceptional expansion in our branch of the evolutionary tree, presumably in concordance with the need for a more cognitive form of decision-making (Smaers et al., 2017). The dorsolateral PFC seems to be of particular importance for planning, initiative, attention, and rational decisions, as damage to this region results in apathetic syndrome, a condition that causes loss of interest and initiative and in the more severe form can lead to a lethargic state (Chirchiglia et al., 2019).

I would not expect there to be dedicated brain regions, or neuronal circuits, for the explicit purpose of free will, thus the actual activity in the PFC may reflect a general deliberation on various options—including thoughts about moral issues and the future. That is, activity is directed to this part of the brain when a decision (or any topic) is considered worthy of further cognitive attention.

Although the PFC seems to take a key role in the cognitive part of making a decision, other regions are presumably also involved in regard to free will. As suggested in the introduction, free will depends on faculties such as attention, volition, self-consciousness, and voluntary activation of muscles. While attention may be primarily associated with the PFC, the other faculties are likely to engage other parts of the brain as well.

Patients with *akinetic mutism* have limited motor function, but they are not paralyzed; apparently, they lack the *will* to move, that is, volition; while patients with *alien limb syndrome* feel that their movements are generated by someone else, which suggests a disruption of agency or self-consciousness (Kranick & Hallett, 2013). The responsible lesions for these disorders occur in a variety of brain locations, but those causing akinetic mutism are typically related to a network defined by connectivity to the anterior cingulate cortex (situated in the interior, midline surface of cortex and considered a part of the limbic lobe). Those causing alien limb syndrome belong to a different network connected to the precuneus (in the parietal cortex; Darby et al., 2018). These networks also match with data on locations in the brain that when stimulated can disrupt the sense of having a free will, as well as with neuroimaging abnormalities in patients with psychiatric disorders related to the capacity of free will. Furthermore, the importance of the parietal cortex in self-consciousness is reflected in that patients with *anosognosia* (considered a deficit in self-consciousness) typically have lesions here (Vuilleumier, 2004) and in studies of "out-of-body experiences" using either electrodes or ketamine (Grinde & Stewart, 2020).

The brain's primary motor control system is spread out over the motor cortex in the posterior frontal cortex, but other regions of the brain—including the cerebellum, the supplementary motor area (SMA, in front of the motor cortex), and spinal cord—are required to fine-tune and pass on signals to the muscles.

The above discussion suggests that we can indicate regions or circuits that are particularly relevant in connection with free will, but that the phenomenon, in line with other complex functions of the brain, most likely engages a substantial part of the brain.

Neurological Activity Associated With the Execution of Willed Decisions

Activation of muscles typically involves activity in several parts of the brain. The SMA, with its projections to the spinal cord, is part of this system. It is presumably involved in the control of movements that are willed (rather than an unconscious response to a sensory event such as a knee-jerk). Willed movements are consistently preceded by a readiness potential (RP), which is considered to be a part of the preparatory activity for action. The RP entails a buildup of negative activity in the SMA that starts about 500 ms prior to movement (Kornhuber & Deecke, 1965; Libet et al., 1993) found that the RP also appear to precede, by some 300 ms, the subjective experience of making the decision to perform the action. That is, the decision was apparently made by unconscious processes in the brain, which subsequently created an illusion of a decision in the conscious brain. The observation suggests that true free will does not exist. We can still have a "sense of free will"; the question is whether the action is actually predetermined.

Later experiments appear to confirm that activity in the SMA is sufficient when performing a voluntary action (Sjöberg, 2021). That is, low intensity stimulation of the SMA (in connection with epilepsy evaluation) causes the patient to experience an urge to move contralateral body parts; while if the stimulation is more intense, movements are typically initiated, and they are perceived as voluntary. I shall discuss possible interpretations of the above observations in light of the evolutionary rationale behind this form of decision-making.

The apparent abolition of free will suggested by the Libet experiments has met with resistance (Guggisberg & Mottaz, 2013; Papanicolaou, 2017). For example, researchers have argued that the RP is not necessarily involved in the normal way of making a cognitive decision. In Libet-type experiments, subjects are asked to perform a specific task at a time of their personal choice (or to choose between two rather similar options such as the left or right arm) and then to record at what time they experienced the decision to start. In a normal situation, the person first needs to determine what to do. It is possible that the RP is not primarily about the decision to make a movement but is better described as a biomarker that reflects a preparation either to make a particular type of movement (lift a hand) or to do a voluntary task (Mele & William, 2009). Movements that are nonconsequential (the decision to lift the hand is already made) or are part of a list of actions required to reach a particular goal (such as putting one foot in front of the other when walking) are typically not monitored in any detail by consciousness (Horga & Maia, 2012). That is, the cognitive involvement is primarily about executing and monitoring the movements to see that they serve the larger purpose, not reevaluating the choice made. The RP could be part of this executive function. In short, neuronal events preceding an action does not necessarily imply that these events are the actual cause of the experience or decision made. As pointed out in the section on strategies, unconscious neuronal activity is part of any voluntary action.

In line with the above argument, resection of the SMA typically causes a transient inability to perform non-stimulus-driven, voluntary actions, but it does not appear to be associated with a loss of sense of volition or willpower—only with a profound disruption of executive function and/or cognitive control (Sjöberg, 2021). That is, the RP is not required for the subjective experience of free will. A related observation has been made with subjects being hypnotized (Schlegel et al., 2015). The researchers compared participants who performed a series of simple movement tasks either under hypnotic suggestion or upon normal instruction. The RP was present even when subjects made self-timed, endogenously initiated movements suggested to them by the hypnotist, in order words, without a conscious feeling of having willed those movements.

The point of having the capacity to make decisions based on conscious deliberation is to do a better job at evaluating the various factors that are relevant for the decision. Cognition, and thus free will, is an integral part of that strategy, as such it seems (at least semantically) more appropriate to state that there is an element of free will in connection with cognitive decisions. Then again, even if the RP can be accounted for by the above comments, the problem of preceding unconscious activity lingers, as discussed below.

The Chicken-or-Egg Dilemma

Most of the work on how an experience is broadcasted for conscious awareness is done in connection with sensory (visual or auditory) perception (Dehaene, 2014; Mashour et al., 2020). In these experiments, the broadcasting requires 200–300 ms or more, and it is assumed that other forms of conscious content, such as thoughts and memory retrieval, require a somewhat similar broadcasting process. The act of making a decision, or the awareness of that act, is in itself a conscious experience. That is, in order to have conscious awareness of the decision, you first need unconscious broadcasting activity. So how can consciousness initiate the unconscious broadcasting of its own conscious decisions or thoughts? The problem appears to be a variant of the philosophical question, "which came first: the chicken or the egg?"

The answer to the chicken-and-egg question is that the two evolved gradually together, a similar answer seems reasonable in the case of the brain activity required to make a decision. That is, neurological activity associated with conscious deliberations interacts with the activity required for broadcasting, implying a gradual, interdependent process. The RP can be a part of this process, for example, by reflecting an element in the choice to make the movement or by representing intention (Lau et al., 2004).

Actually, the RP of the SMA is only one example of neural activity associated with the preparation for movement, other activity in both the SMA and the neighboring pre-SMA also seems to precede voluntary actions (Lau et al., 2004; Nachev et al., 2008). Moreover, it is possible to find correlated activity, not only in the pre-SMA and SMA but also in other parts of the prefrontal and parietal cortices starting several seconds before an awareness of the actual choice of behavior (Soon et al., 2008). The results are in line with the observation that unconscious changes in skin conductance can precede risky decisions (Bechara et al., 1997).

The first unconscious precursors of a motor decision seem to originate in the frontopolar cortex (the anterior part of the PFC) up to 10 s before action (Soon et al., 2008). This part of the brain has been associated with the storage of conscious action plans (Haynes et al., 2007; Koechlin et al., 1999). Other experiments suggest that an awareness of intention is accessible at early stages of motor preparation (Parés-Pujolràs et al., 2019).

A plausible interpretation of the combined data is that a motor decision is an ongoing process with input stemming from both unconscious and conscious brain activity. The final outcome may be what the person in a Libet-type experiment recognizes, or remembers, as the decision he/she made, even though the process was also informed by more subtle awareness prior to that. A similar picture may be the case for any form of cognitive deliberation. However, the subtle awareness is less obvious in a setup, such as that of Libet where the actual decision is predetermined, compared to a situation where deliberation is required.

Who Has Free Will?

In the introduction, I suggested that free will depends on at least four faculties: self-consciousness, volition, attention, and voluntary action. As to the latter two, any animal with a nervous system can focus its attention and take action. That is, motor control is a core function of nervous systems, and the combination of sensory input and goal-directed actions implies some form of attention. The question of free will depends on whether the animal is capable of *voluntary* action and *voluntary* directed attention.

Some form of consciousness, including the ability to direct attention, is presumably present in mammals and birds, and perhaps reptiles (Grinde, 2016), but self-consciousness appears to be restricted to a more select group of animals. Various experiments, most famously those involving mirror recognition, probe the presence of self-consciousness; it is generally agreed that the feature is present in apes, and possibly in monkeys, cetaceans, and certain birds (Chang et al., 2017; Leary & Tangney, 2011). It seems reasonable to assume that this list also reflects animals that can be said to have some form of free will.

When comparing humans with other species of animals, it should be noted that the terms we coin to describe features of living organisms are generally designed for us. Whether homologous (or analogous) features in animals deserve the same term is a question of semantics. The point is exemplified by asking whether dogs have a nose; some people will answer "yes," while others will claim "no, they have a snout." Homologs of the brain structures associated with free will are generally present in other mammals, and to some extent birds and reptiles, but the actual phenomenon presumably rests with the specific qualities of the neurological circuits, which we are unable to describe in sufficient detail to tell how they compare in different species. Presumably there are both quantitative (such as the power of directed attention) and qualitative (such as how agency and volition is perceived) differences between species; thus the answer depends on the cutoff chosen as to how different the feature is in an animal before the human term is inappropriate. Obviously, this issue is even more difficult to resolve in a trait that is invisible (such as self-consciousness) compared to, for example, the nose.

The present stance is that free will is not an either–or quality, but rather a question of level. I believe this point is relevant whether one compares species or individual humans. The point is perhaps best illustrated by considering attention. Attention varies on a continuous scale from the focus required in chess to being asleep. In my opinion, there is no sense in saying that moving the pieces in a chess match is not a question of exercising will power, while one may claim that a sleepwalker does not act out of free will. Moreover, the use of various types of drugs can have a drastic impact on our capacity for attention and the maintenance of free will (Grinde & Stewart, 2020). The level of free will also depends on age

(Kushnir et al., 2015) and on diseases affecting the brain.

The debate as to who has a free will typically focuses on moral and legal issues (Ekstrom, 2018). A key question is whether a person can, and should, be held responsible for their actions. In this context, it is particularly important to note that free will is a question of level. The overall level can be partitioned into three somewhat independent levels: attention, competing decision strategies, and competence. The latter is a question of knowledge relevant to handle a situation.

Most countries have legal systems that take the level of free will into account. Although the legislation, and practice, varies, there seems to be a consensus that certain individuals should not be held responsible for their actions, such as the very young and those with severe mental handicaps. Even normal, adult individuals may behave as if their decisions are predictable and determined rather than being based on a free will (Kunzendorf et al., 2009), yet for legal purposes, it seems reasonable to consider their level sufficient to take responsibility for their actions.

Conclusion

Evolution has created and tailored a variety of strategies for executing behavior. One of these reflect the cognitive deliberation that we associate with a free will. The conscious reflection on complex issues requires considerable time and use of brain resources; consequently, evolution has restricted when this strategy is called for, restrictions that imply a limit to our free will. Certain decisions are almost completely outside of conscious control, such as the constriction of muscle around the pupil in response to an increase in light intensity; others are brought to conscious attention but may be considerably swayed by unconscious guidance, such as getting angry and retaliate when someone hits you. It seems likely that even our best efforts of making what we conceive as a willed decision are actually swayed by forces outside direct cognitive control, implying that our sense of free will tends to exceed our true free will. On the other hand, upon training the mind, some level of conscious control can be exerted over a range of features normally cared for by unconscious processes in the brain, such as physical pain (Bushnell et al., 2013) and heartbeat (Pokrovskii & Polischuk, 2012). In short, the willed input in regard to behavioral decisions is rarely either zero or a hundred percent but varies on a continuous scale.

The actual level of free will depend not only on the type of decision made (closing the pupil or hitting back) but also on the state of mind of the individual (focused or drowsy), the situation (speed chess or regular game), individual qualities (baby or adult), specific health problems (epilepsy and dementia), and species of animal (human or chimpanzee). The highest score is presumably obtained with a healthy adult human in an attentive state. It follows that the question of whether we have free will may be answered by stating that we have a sufficient amount to choose whether the answer is "yes" or "no," in that we can decide what level is required in order to qualify.

The point of being able to make conscious decisions is to find the optimal action in situation where preprogrammed solutions are less likely to work, for example, in situations where many factors ought to be weighed against each other and no immediate action is required. Evolution has attempted to fine-tune the tendency to incorporate free will according to the requirements of various situations.

Our evolutionary heritage is not necessarily optimal in a modern environment. For example, narcotics such as heroin and cocaine activate the reward mechanisms in the brain. The brain is designed with a tendency to let strong rewards supersede cognitive assessments, which means it is very difficult for a drug addict to refrain from taking an additional dose. If these narcotics had been widely available during our evolutionary history, evolution might have compensated by increasing the capacity for willed decisions when the rewards are artificially activated.

I hold that the will is free to the extent that conscious deliberation is included as an input to decision-making. While I can see arguments in favor of the whole universe being deterministic, I see no reason to abolish the use of the term "free will" in relation to human behavior. There are noticeable qualities of how our brain functions that leave room for this term. Moreover, the concept may serve a purpose. A belief in free will seems to bring advantages such as a higher level of self-control, a meaning of life, and fostering a propensity for prosocial behavior (Moynihan et al., 2017; Vohs & Schooler, 2008). Even if these outcomes have been questioned (Crone & Levy, 2019; Ewusi-Boisvert &

Racine, 2018), it seems best to stick to a definition of free will that bestow us with this quality—given that quality of life should be a guiding principle for human endeavor (Grinde, 2012).

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