Joseph Delboeuf on time as the mechanism of free will

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Abstract
In the early 1880s, Joseph Delboeuf proposed a little-known but ingenious solution to the problem the law of the conservation of energy poses for free will. When energy is transferred between two bodies, the law of energy conservation requires that the energy before and after the transfer be the same, but it says nothing of the time it must take. If we could delay this transfer, Delboeuf proposed, we could alter the course of matter without compromising the conservation of energy. This article begins by tracing the early history of the conflict between free will and the first law of thermodynamics and by recounting some initial attempts to resolve it. It next describes Delboeuf’s theory and the arguments that were made against it, before situating it with respect to some recent developments in the philosophy and psychology of free will.

Keywords
conservation of energy, Joseph Delboeuf, free will, inertia, time

One of the strongest scientific arguments against free will is the law of the conservation of energy. According to this law, the total energy of a closed system is always the same. Energy can be transformed from one form to another, but it can never be created nor destroyed. Suppose a freely chosen act required the initiation of a series of neuronal events that began with the motion of a stationary molecule. According to the law of the conservation of energy, that molecule will only be moved by another one colliding with it or by the influence of some other physical force. If the molecule should move in a freely chosen way through the force of one’s will, new energy would be introduced into the universe, thereby violating the conservation of energy.

Proponents of free will have puzzled over this problem ever since the principle of the conservation of energy, also known as the first law of thermodynamics, was formulated in the mid-19th century. The British astronomer, John Herschel, for example, felt the law

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was only approximately true, thus allowing human and animal volition the wiggle room
to exert a small but sufficient measure of force on the material world (Herschel, 1865).
The great Scottish physicist, James Clerk Maxwell, proposed volition might operate
through a force too small to detect (Maxwell, 1873/1995). Some of his contemporaries
suggested this force, or “directive principle,” could be infinitesimally small, or even
zero, thereby avoiding conflict with the law of energy conservation altogether (van
Strien, 2015).

More recently, some theorists have appealed to quantum indeterminacy to get around
the problem (e.g., Beck & Eccles, 1992; Lindahl & Århem, 2019). The law of energy
conservation would not be compromised, according to the predominant argument, so
long as the energy exerted by an act of will were within the range allowed by the uncer-
tainty principle. Kreinovich (2013) and Reason (2016), on the other hand, believe the
law of energy conservation can be violated by acts of will and call for quantum mechani-
cal approaches that allow for such violations. Others, such as Larmer (1986) and Collins
(2008), question the universality of the principle of energy conservation. Larmer (1986)
argues that the principle applies only to closed systems and not to what he describes as
the open systems of mind–body interaction, whereas Collins (2008) maintains that gen-
eral relativity and the Einstein–Podolsky–Rosen correlations of quantum mechanics are
not constrained by energy conservation, thereby suggesting we could perform acts of
will without breaking any physical laws. None of these approaches, however, has yet
been experimentally confirmed and, as Kane (2011) emphasizes, the free will versus
determinism debate remains far from settled.

This article presents a little-known but ingenious theory by the Belgian psychologist,
philosopher, and mathematician, Joseph Delboeuf (1831–1896). When energy is trans-
ferred from one object to another, the law of energy conservation requires only that the
amount of energy before and after the transfer be the same, but it says nothing about the
amount of time the transfer must take. If we could advance or temporarily suspend this
transfer, Delboeuf (1882a, 1882b, 1882c) proposed, we could alter the natural course of
matter without compromising the law of energy conservation.

Like many of his ideas, Delboeuf’s highly original theory went largely unnoticed in
his day and yet may still have much to teach us. As Nicolas et al. (1997) write regarding
some of his other contributions to psychology: “Delboeuf’s work is not only of historic
interest; his original ideas possess sufficient interest for present-day psychophysicists to
reexamine them” (p. 1297). Recent research has indeed drawn on Delboeuf in shedding
new light on the nature of hypnosis, the placebo effect, and related phenomena (Borch-
Jacobsen, 2009; Hacking, 2002; LeBlanc, 2004, 2014). Given this new enthusiasm for
Delboeuf’s work, it seems appropriate to examine what he felt to be his most important
intellectual achievement, namely his theory of the mechanism and character of free will.
It is of interest to theoretical psychologists, for example, to know that Delboeuf’s theory
anticipated the experimental findings of Benjamin Libet and others on the inhibitory
nature of free will (e.g., Libet et al., 1983; Schurger et al., 2012). It will be argued that
Delboeuf may well have provided the theory that explains their results. Most of all, we
have in Delboeuf a fresh perspective on the question of free will, one that has yet to have
a proper hearing among psychologists and philosophers. The goal of this paper,
therefore, is to reopen the case he made for free will and to invite intellectual and empirical inquiry into its possibilities.

I begin by tracing the early history of the conflict between free will and the first law of thermodynamics and by recounting some initial attempts to resolve it in the work of Maxwell and others. I next describe Delboeuf’s theory and the arguments that were made against it, before discussing it in relation to some recent developments in the philosophy and psychology of free will.

Free will and the conservation of energy: Historical background

During the first half of the 19th century, several theorists, most prominently Hermann von Helmholtz and William Thomson, had reached the conclusion that energy is neither gained nor lost in mechanical and chemical processes (Bowler & Morus, 2005). Helmholtz’s contribution stands out for our purposes, however, because he was the first to extend the conservation of energy to all processes, including those involved in life (Papineau, 2001). Helmholtz (1847/1853) affirmed that the chemical processes of biological organisms were no less subject to the conservation of energy than the thermodynamic processes of steam engines. Here then was a new challenge to the existence of free will. If all the energy exchanges and conversions in a living organism are conserved, freely choosing an action seems impossible. An act of free will requires influencing matter in some way, such as causing a molecule to go right when it naturally would have gone left. Were I to cause this molecule to go right by my own agency, I would violate the conservation of energy by introducing a new force into the existing balance of forces. I would have created something from nothing. Perhaps we could say force is conserved if the force I apply is derived from the release of chemical energy stored in my brain. The problem is that triggering that release still requires an addition of energy from nowhere. Thus it would seem that any force exerted by my will, if such a force exists, cannot be free.

There had of course been physical arguments against the existence of free will before the principle of energy conservation. Laplace (1814), for example, had famously argued that a mind powerful enough to know all the forces at play in the universe, as well as the state and motion of everything in it, would be able to predict the future as well as retrodict the past, assuming the world functioned as a giant machine. But the principle of energy conservation makes for a stronger deterministic argument. Against Laplace’s determinism, one could still appeal to the existence of spontaneous forces in living organisms, so called vital forces, for example, which were not by nature mechanistic (Papineau, 2001). After Helmholtz, however, the appeal to vital forces seemed much less plausible. As Papineau notes, the conservation of energy implied that all forces, even those yet to be discovered, were subject to the principle of energy conservation and were therefore deterministic. Within a generation, the comprehensive scope of the doctrine of energy conservation was a forgone conclusion, as Maxwell observed in 1878:

the principle of conservation of energy has acquired so much scientific weight during the last twenty years that no physiologist would feel any confidence in an experiment which showed a
considerable difference between the work done by an animal and the balance of the amount of energy received and spent. (p. 142)

One of the first attempts to reconcile free will and the law of energy conservation was by the Scottish engineer and polymath, Fleeming Jenkin, remembered chiefly today for opposing natural selection with the pre-Mendelian notion of blending inheritance (Bowler & Morus, 2005; Jenkin, 1867). Inspired by the Lucretian “swerve,” the Epicurean theory whereby atoms can occasionally deviate from their predetermined trajectories, Jenkin (1868) suggested we could employ our agency by deflecting the motion of atoms. Based on the fact “that a force acting at right angles to the direction in which a body is moving does no work,” (p. 223) Jenkin believed such a deflection would “neither add energy nor matter to the universe” (p. 225). While it is true no energy is added in such interactions, the same cannot be said for momentum (Collins, 2008). Jenkin’s mechanism is therefore unable to influence matter without violating the broader conservation of energy and momentum.

In a letter to Lewis Campbell in 1862, Maxwell (1990) speculated we might be able to avoid breaking the law of energy conservation by merely provoking the release of energy, like the trigger of a gun, or by directing the course of motion, like the shunting of trains from one rail to the next. The soul would not supply the force, as he put it, but would nonetheless control and direct it. As Maxwell (1873/1995) conjectured again in 1873,

the doctrine of the conservation of energy, when applied to living beings, leads to the conclusion that the soul of an animal is not, like the mainspring of a watch, the motive power of the body, but that its function is rather that of a steersman of a vessel—not to produce, but to regulate and direct the animal powers. (p. 817)

Maxwell went on to suggest the molecular action of this “directive principle” might even be too small to detect. Other physicists and mathematicians such as Stewart, Cournot, and Saint-Venant put forth similar ideas (van Strien, 2015). Saint-Venant suggested the triggering force could be infinitely small, but not zero. The problem of course is that such solutions still required a violation, however small, of the law of energy conservation.

One way around this problem was to assume the directive principle could be reduced to zero. The French mathematician Boussinesq (1879) believed this was possible in systems of Newtonian motion that contained singular points. A singular point is a point in the evolution of a system that admits of more than one mathematical solution. In one of his examples, Boussinesq described how a point particle that has come to rest at the top of a specially shaped dome could descend it at any time and along any slope. The particle’s future path is indeterminate. Unaware of Boussinesq’s work, Norton (2003) used a similar example (now known as the Norton dome) to argue for the possibility of non-deterministic systems in classical physics (van Strien, 2014). If such singularities exist in living beings, Boussinesq surmised, an organism could direct the motion of some of its molecules without applying force and, consequently, without infringing on the principle of energy conservation.
It soon became clear, however, that the singular-points solution simply could not work. Critics such as Bertrand (1878), Delboeuf (1882a), and Du Bois-Reymond (1882) pointed to its artificiality (Bordoni, 2015; Mueller, 2015). Although mathematically possible, it was by no means given that such indeterminate situations occurred in the real world. And even if singularities existed in living beings, they would be of little aid to free will. Consider the particle atop a Norton dome. Although the timing and path of the particle’s descent are indeterminate, they are also completely arbitrary. Singular solutions yield more than one possibility, Delboeuf (1882a) noted, but not necessarily the right one for the sentient being. To take advantage of such situations, we would need to choose when and where we wanted the particle to descend. We would need to direct the process, and the only way to do so would be to push the particle ever so slightly, thereby contravening the conservation law. However “ingenious and suggestive,” Delboeuf (1882a) concluded, Boussinesq’s idea, along with those of Cournot and Saint-Venant, should be abandoned “as artificial and inapplicable to reality” (p. 478). Or as Hacking (1983) more candidly put it a century later, “this idea is completely crazy: it tries to fit a square peg of human freedom into the round hole of singular solutions” (p. 465).

Time and free will

While others saw the conservation of energy as a problem for free will, Delboeuf saw it as part of the solution. Imagine a molecule in the brain striking another and transferring all of its motion to it. The momentum before and after the collision must be the same. The only way, Delboeuf (1882a, 1882b, 1882c) reasoned, one can influence this interaction without creating or destroying energy is to influence its duration. The principle of energy conservation is not compromised, in other words, if we can advance or delay the transfer of energy between the two molecules. Time does not figure in the equations of the first law of thermodynamics. So long as the energy at the beginning is the same as that at the end, energy is conserved regardless of how long the process takes.

We make use of this mechanism, on this view, whenever we resist impulses, urges, or thoughts, such as the impulse to drink when thirsty, the urge to smoke when trying to quit, or the intrusion of distracting thoughts when concentrating on a task. We influence the course of matter, in other words, whenever we momentarily suspend, and thereby direct, the course of consciousness.

It should be noted that Delboeuf privileged our power to delay rather than quicken the transfer of motion between two bodies, although both are theoretically possible. In references to his theory in later publications (Delboeuf, 1887, pp. 167, 171; 1891a, 1891b, p. 411) and in a letter to William James (Delboeuf, 1885), he spoke always in terms of delaying rather than quickening the transfer of motion. I will therefore refer only to the delaying hypothesis in the rest of this paper, even if Delboeuf never explicitly ruled the quickening hypothesis out.

One might be willing to recognize, along with many of Delboeuf’s critics, the originality of his idea but not its plausibility (Couailhac, 1897; Fonsegrive, 1887; Fouillée, 1882; Piat, 1894–1895). The ability to affect time would indeed be an ingenious mechanism for producing physical effects without transgressing the conservation of energy, but how could we possibly influence time? Would we have the power to command time,
quipped the French philosopher Fouillée (1882), like Joshua stopping the sun over Gibeon? “Would this not be a miracle,” he continued, “as improbable as those in the Bible” (p. 609)? However improbable Delboeuf’s theory may at first seem, we should keep one important point in mind: he proposed a testable theory. Its veracity depends not on how plausible we think it is, but on whether its predicted consequences agree with the results of empirical investigation. The only contemporary of Delboeuf who seemed to have understood this was the American psychologist and philosopher, William James. In a letter to the French philosopher Renouvier dated 11 January 1883, James (1997) wrote:

Now, is the time when one molecule of the brain shall obey the impulse given by another so indeterminate, that such discontinuity may be found in the motions of these molecules and consequently in other motions of which they are remote effects? This does not seem to me an irrational question. Delboeuf himself admits the question is one of molecular happenings. (p. 387)

Nineteenth-century determinism predicted no discontinuities in the mechanical chain of events that make up the physical world. Discontinuities could be introduced, however, if we could influence the time it takes for one molecule to transfer its motion to another. The question is whether this occurs. It is a question of fact. James and Delboeuf knew that detecting such “molecular happenings,” if they exist, lay decades in the future. Whether we still have decades to go remains to be seen. In the meanwhile, Delboeuf’s conception of time lends a certain measure of plausibility to his theory, as we shall now see.

**Time, inertia, and free will**

Delboeuf began from the assumption that time is the measure of change. To take a classic example, a pendulum clock measures time by measuring the number of swings of its bob. All modern timekeeping devices function on the same principle, they measure change by keeping track of oscillations, whether it be the oscillations of a quartz crystal in a wristwatch or those of a Cesium atom in an atomic clock. Indeed, according to the International System of Units, our basic unit of time, the second is defined as 9,192,631,770 oscillations of a Cesium atom under specific conditions. Thus, still today, our fundamental standard of time is defined by change.

To this operational definition of time, Delboeuf added a small modification: time is the measure not only of change, but also of resistance to change. As Delboeuf (1882a, 1882b, 1882c) reminded his readers, all objects resist change because of a property called inertia, famously defined by Newton (1687/1999) as the “power of resisting by which every body, so far as it is able, perseveres in its state either of resting or of moving uniformly straight forward” (p. 50). When a billiard ball strikes and transfers its motion to another billiard ball, the transfer is not instantaneous. The transfer of motion from one ball to the other takes time. Upon impact, the second ball does not immediately begin to move. The first ball must push the second for a certain amount of time. “Indeed, if the first ball had stopped at the instant of contact,” Delboeuf (1882a) asked, “how could it have pushed the second” (p. 475)? Both objects resist change, the first tends to keep moving while the second tends to stay put. “All things . . . tend to stay as they are,”
Delboeuf (1882b) wrote. “To impart change, this tendency must be overcome, the struggle takes time” (pp. 621–622).

If we could alter not so much time as a body’s inherent resistance to change, therefore, we could then influence the course of matter without breaking the law of energy conservation. In the aforementioned letter to his friend William James, dated 27 August 1885, Delboeuf spoke of a force that was free “not to change its direction or strength, but its intensity per unit time, that is to say, that it can dispense its effort over a longer interval of time.”

Delboeuf was not saying that a body in motion could be stopped in midflight, like the sun over Gibeon. Rather, his mechanism would only operate at sites of energy transfer, as when one molecule transfers its motion to another. We would have the power of delaying not the motion of objects, but the transfer of motion between objects.

If we could prolong the resistance to change between two colliding molecules, would this not constitute a momentary violation of the principle of energy conservation? Even if the total energy before and after the transfer is conserved, one could argue energy is not conserved during the time the transfer is delayed. This objection to Delboeuf’s theory was first raised by Fouillée (1882), then repeated by Fonsegrive (1887), Piat (1894–1895), and Couailhac (1897). Delboeuf never gave a direct response. He planned to further develop his theory and to address the objections against it in a future publication but died of heart failure before he could do so, at the age of 64 in 1896. We do know, however, from a letter he wrote to James (Delboeuf, 1885) that he and some of his students had found a fair number of sophisms in Fouillée’s article, although he doesn’t specify what they are. Delboeuf also stated in another letter to James, dated 18 November 1890, that he felt the objections to his theory were not as strong as he had expected them to be. In fact, he seemed not the least troubled by Fouillée’s critique, and when we consider his theory carefully, it is easy to see why.

Fouillée and others believed Delboeuf’s theory is flawed because the suspensions of motion it requires would infringe upon the law of energy conservation. What these critics failed to realize, however, is that momentary suspensions occur not only when sentient beings exercise their will, hypothetically speaking, but whenever a body resists changes in its state of rest or motion. In other words, inertia imposes a delay on all transfers of motion between bodies, and virtually no one considers these delays to be violations of the principle of energy conservation. Such delays are natural (McLaughlin, 2008) and whether they are long or short makes no difference to the first law of thermodynamics. Again, the principle of energy conservation is concerned only with the quantity of energy at the beginning and at the end of thermodynamic processes, not with how long these processes take. It could be that Delboeuf’s mechanism violates some other principle of physics, but it does not violate that of energy conservation.

It is fair to ask whether Delboeuf’s mechanism contravenes the laws of physics discovered since the beginning of the 20th century. After all, Newtonian physics, upon which Delboeuf in part based his mechanism, has been overturned by Einstein’s theory of relativity and by quantum mechanics. A discussion of whether Delboeuf’s mechanism is compatible with the advances of 20th-century physics requires a study all its own, however, and will not be undertaken here. I would only note that the nature of time is the subject of lively debate and speculation among contemporary physicists and philosophers, from those who see it as a relational phenomenon of change, similar to how
Delboeuf saw it, to others who believe the whole history of the universe, its past, present, and future, is fused into a single, timeless reality, and our experience of the passing of time—and of free will—is consequently an illusion (Barbour, 1999, 2015; Callender, 2010; Carroll, 2010; Smolin, 2013, 2015). The same applies for inertia. Its origin remains a mystery. There have been theoretical attempts to attribute the source of inertia to other known forces, such as the total gravitational influence of all the mass in the universe, but no convincing evidence, experimental or otherwise, has yet been found for such theories (McLaughlin, 2008; Rothman, 2017). The number and diversity of theories about the nature of time and inertia, suggest, to my mind, that our grasp of these phenomena is not strong enough to either accept or dismiss Delboeuf’s theory outright. That day will come, as science marches on. In the meantime, let us explore, from the perspective of philosophical and theoretical psychology, the potential of Delboeuf’s theory for casting new light on the problem of free will.

Delboeuf’s theory in relation to philosophical psychology

In what follows, I situate Delboeuf’s theory with respect to some contemporary discussions in philosophy and psychology using Nichols’ (2008) categories of psychological inquiry into free will. Nichols organizes the contributions psychology can make to the free will debate into three categories: descriptive, substantive, and prescriptive. The descriptive category depicts the character of people’s beliefs regarding free will, the substantive considers the evidence for and against free will, and the prescriptive deals with the moral implications of the answer to the substantive question.

The descriptive question

Delboeuf’s philosophical position on free will is libertarian, as opposed to determinist or compatibilist. In terms of Kane’s (2005) five fundamental notions of freedom, Delboeuf would subscribe not only to the compatibilist freedoms of self-realization, self-control, and self-perfection, but also to the libertarian freedoms of self-determination and self-formation. With respect to the latter two freedoms, for example, he spoke of how our past deliberations and decisions can become internalized as character-forming habits. In some people, he wrote, “the art of self-control has become a habit. They have made the noblest use of freedom; they have attained the human ideal of being able to fulfill one’s duty without effort” (Delboeuf, 1882c, p. 173). Thus, as with the freedoms of self-determination and self-formation, Delboeuf believed we can self-consciously influence our future decisions, and hence our innermost character, by the decisions we take in the present.

Delboeuf (1882c) saw acts of free will as proceeding in three stages: solicitation, deliberation, and decision. “In these,” he wrote, “are the beginning, the middle and the end of all free acts” (p. 164). But only the middle stage “is necessarily free,” he continued, “the first never is, and the third can, in some respects, not be free” (p. 164). Solicitation comes in the form of an impulse to undertake an action, such as the impulse to reach for a glass of water when thirsty. The impulse arises from the sensation of thirst, over which we have no control; it comes on its own, independently of our will. It is in
this sense that the first stage of a freely chosen act is never free. Deliberation, which lasts so long as we resist acting on an impulse, is essential for a free act. As a voluntary interruption of a physical process, via Delboeuf’s proposed mechanism, it would undoubtably be free. The third stage is that of decision, the decision to continue resisting or to follow through with the impulse to act. The decision that follows deliberation can in some respects not be free, as mentioned above. When we yield to an impulse, for example, our decision is obviously not entirely free. “That is why,” Delboeuf (1882c) wrote, “we don’t think of the drunkard as acting freely when he enters a tavern, nor the coward when he runs away, nor the loafer when he slacks off” (p. 172). We recognize someone as acting freely when they resist temptation, not when they give in to it. On this point, Delboeuf was fond of citing James (1880) who observed that we feel our freedom the most keenly when we take the path of most resistance.

Incidentally, readers of John Locke (1632–1704) will recognize parallels between Delboeuf’s three stages of free will and the British philosopher’s thinking on the subject. Locke (1689/1824) believed our impulses and desires governed our actions, but not completely. He insisted we still had the freedom to suspend our actions, as he made clear in the following passage:

For the mind having in most cases, as is evident in experience, a power to suspend the execution and satisfaction of any of its desires, and so all, one after another; is at liberty to consider the objects of them, examine them on all sides, and weigh them with others. In this lies the liberty man [sic] has. (pp. 249–250)

He continued, a few lines further: “we have a power to suspend the prosecution of this or that desire, as every one daily may experiment in [them]self. This seems to me the source of all liberty” (p. 250). We can discern in these passages Delboeuf’s stages of solicitation, deliberation, and decision, and, like his Belgian counterpart, Locke felt that our freedom lay in our ability to suspend rather than initiate action. For reasons too involved to go into here, Locke is generally assumed to be a compatibilist by contemporary philosophers (Rickless, 2020). Delboeuf, on the other hand, would have considered himself an incompatibilist; he would not have supported the thesis that free will is compatible with determinism in any way, shape, or form. And so, despite having similar ideas on how we exercise freedom, one is deemed a compatibilist and the other not. This apparent incongruity between our two philosophers is an interesting quandary, but one that lies outside the scope of the present study to explore or resolve.

Delboeuf’s incompatibilist account of free will offers an important metaphysical counterargument to scientific determinism, moreover. From the perspective of scientific determinism, when I perform an action, that action is determined in a two-step process: it is first governed by the past and it is next governed by the laws of nature at the moment my action is performed. On this view, I have no free will because I can only act according to what is entailed by the past and the laws of nature; whatever I do, I could not have done otherwise. Suppose I resisted the temptation to order fries with my mussels (with effort, I might add, the path-of-most-resistance kind of effort) in a Belgian restaurant. The urge to order the fries would not be free. Impulses and urges never are, as Delboeuf maintained, and on this point, he’d agree with the determinist: my desires are dictated by
the past. Where they’d disagree is over what happens once the urge is felt. The scientific determinist claims that what happens next depends not on my supposed free will, but on the laws of nature, in particular the law of energy conservation. According to Delboeuf, however, what happens next depends not only on the laws of nature, but also on whether or not I choose to refrain from acting on my urge to order fries. In this case, I chose to refrain, which is allowed by the conservation law, but I could have chosen not to refrain, and either choice would have been consistent with the past and the laws of nature. Hence, if Delboeuf is right about his mechanism for free will, scientific determinism is wrong.

One might be inclined to think Delboeuf a dualist because, for many, the idea of free will seems to imply that the mind must be independent and outside of the brain in order to influence it. Delboeuf did not see the mind as separate from matter, however. He believed in a kind of panpsychism whereby consciousness is an intrinsic feature of matter. He suspected so-called inanimate matter, which he preferred to call brute matter, is animated by attractions and repulsions in a manner reminiscent of the Greek philosopher Empedocles who saw in these forces the physical manifestations of love and strife (Delboeuf, 1887). Delboeuf acknowledged that his panpsychist belief was pure conjecture, but he also affirmed that to believe brute matter is devoid of consciousness was conjecture too, and he deemed panpsychism the more plausible of the two metaphysical beliefs in part because it avoided the problem of having to explain how something conscious could come from something that isn’t. “It is to want to build a great metaphysical work,” he admonished, “to believe there are no traces of thought and freedom in primitive matter . . . and to seek to extract them from that which is neither free nor sentient, like trying to extract gold from lead” (Delboeuf, 1891b, p. 411). Delving further into Delboeuf’s panpsychism would take us too far afield, but it is worth noting that panpsychism has been undergoing a revival among philosophers of mind (Goff et al., 2017) and one of the leading panpsychist philosophers has begun exploring the possibilities of pan-libertarianism, the view that subatomic particles possess free will, if only an incredibly limited form of it (Goff, 2019).

The substantive question

Sensations and free will. Delboeuf’s belief in free will was based not only on an inner sentiment of being free, but also on a deeply original psychological argument. Free will must exist, Delboeuf (1882b) argued, because sensations such as pain and pleasure would be inexplicable without it. “It is incomprehensible to think of the faculty of pleasure and pain,” he wrote, “as not connected to the power to pursue one and flee the other” (p. 624). And not only free will but the ability to reason must also exist, he added, because organisms that experience sensations cannot simply make random choices, they must try to figure out what their best choices may be. Although Delboeuf’s work was unknown to him, Hodgson (2012) makes a similar argument but begins by first establishing our “ability to engage in plausible reasoning,” and then derives free will as a necessary correlate of this ability (p. 5, see also pp. 37–54). And like Delboeuf, Hodgson maintains that consciousness (such as the subjective experience of pain) must play a role in making decisions because its existence would be superfluous otherwise. “That we have feelings like pain to motivate us,” Hodgson writes, only makes sense if such feelings “contribute to decision-making” (pp. 70–71).
To fully appreciate the force of Delboeuf’s argument, and by extension Hodgson’s, consider the nature of a sensation such as thirst. Thirst is an unpleasant, nagging sensation. The longer we wait to quench it, the more unpleasant it becomes. The feeling of thirst *encourages* us to take remedial action, but it does not *force* us to. Such is the character of pain and pleasure: they function not by automatically triggering responses, but by encouraging certain decisions over others. They coax rather than dictate. Sensations function largely as instruments of persuasion, in other words, and persuasion implies choice. What would be the point of having sensations that incite us to choose a course of action over another if we lacked the power to choose in the first place? Would sensations have evolved—or even exist—without this power? Sensations and free will go hand in hand; we can’t have one without the other.

Now is there an “essential difference,” Delboeuf (1882b) asked, “based, for example, on the nature of motives,” between this sensory freedom and the higher order psychological freedom we commonly associate with free will (p. 624)? It is a very interesting question, he continued, but it belongs to a completely different subject of study. Delboeuf’s subject is not, strictly speaking, a problem of philosophy, nor even one purely of psychology; it is a problem of psychophysics. The problem is this: how can sensate beings, able to exercise choice by virtue of their sensory capacities, influence the course of matter without violating the conservation of energy, one of the pillars of modern science? On the face of it, the dilemma seems intractable, and yet, as the history of science has repeatedly shown, deep problems have been solved by invoking radically new ideas. Delboeuf’s idea was to propose that we influence matter not by changing the speed or direction of its motion, which would violate the conservation of energy, but by prolonging the time it takes for transfers of motion to occur, which would violate no known law.

If Delboeuf is correct, at the level of molecular interactions in the brain and at the sites in the brain where an impulse is being resisted, we should see inertial delays that are longer than average. We should record a transfer of motion or energy that is momentarily suspended or taking longer than usual. How one might measure this effect would require a lengthy technical treatment and will therefore not be considered here. However, I do hope I have convinced my readers by this point that Delboeuf proposed a testable hypothesis: either his predicted delays exist, or they don’t. My aim in this paper is to make known Delboeuf’s theory to the scientific and broader academic community, not to design experimental protocols to test it. Generally speaking, any candidate for Delboeuf’s mechanism should fulfill two conditions: (a) it should be a molecular system that allows for a transfer of energy and (b) it should operate at the receiving end of that transfer. One should look for the mechanism of free will not in the key, where we’ve traditionally sought it, but in the lock. Postsynaptic neurotransmitter receptors satisfy these conditions in organisms so equipped. They are also the most likely mechanism for Benjamin Libet’s inhibitory theory of free will, to which we now turn.

### Delboeuf and Libet.

In 1965, Kornhuber and Deecke (1965/2016) discovered that certain voluntary acts, such as moving one’s hand, were preceded by a change of electrical activity, which came to be called the readiness potential (RP), in the motor cortex region of the brain. This RP could begin as early as one second before the voluntary muscle
movement took place. In 1983, Libet et al. published the results of an EEG experiment designed to determine precisely when participants became aware of their intention to act. Did this awareness occur before, during, or after the appearance of the RP? For each of 40 trials, they asked their participants to move their right wrist or fingers at any moment during a 30-second interval and to note the time at which they first felt the urge to do so. They were instructed to let the urge come on its own, without prior planning. Using electrodes on the surface of the scalp to monitor the motor cortex activity of their participants, Libet and his colleagues showed that the RP appeared on average 550 milliseconds before participants reported feeling the urge to move their hands. Many have taken this to be a refutation of free will because the “decision” came well before the participant was even aware of it. Yet this is not how Libet interpreted the results. Over the course of the experiment, the participants sometimes reported feeling the urge to move and deciding to veto or suppress the act instead. These reports led Libet (1999, 2004) to propose we might have “free won’t” instead of “free will.” And indeed, as he pointed out, acts of “free won’t” make up much of our daily experience, such as when we suppress the urge to say or do something we would later regret. Summing up his findings, Libet (1999) concluded that “the role of conscious free will would be, then, not to initiate a voluntary act, but rather to control whether the act takes place” (p. 54). If Libet had known of Delboeuf’s work, he might have added that the reason we exercise our wills in this unexpected way is because the first law of thermodynamics prevents us from initiating transfers of energy or motion but not from resisting them.

**Criticism of Libet.** Libet-like experiments have been successfully replicated (e.g., Schultze-Kraft et al., 2016), down to the level of single neurons (Fried et al., 2011). Yet several theorists have questioned Libet’s experimental results on empirical and philosophical grounds (e.g., Mele, 2009; Radder & Meynen, 2013). Bonicalzi and Haggard (2019) identify two main categories of criticism of Libet-style experiments, namely their methodology and their ecological validity, which I will now examine in relation to Delboeuf’s theory.

**Methodological criticism.** Perhaps the most widely cited methodological critique of Libet-like experiments is by Schurger et al. (2012). Libet-like experiments are controversial because the RP appears well before participants become aware of the urge to move. Schurger and his colleagues do not dispute this finding. What they do dispute is the claim that this RP represents the final stages of the brain’s planning and preparation for movement. There is neither planning nor preparation, on their view; instead, the process of deciding to move begins the moment one becomes aware of the urge to move, just as our ordinary notion of free will would lead us to expect. Their argument is based on the observation that there is always a backdrop of neural activity prior to motor action of this kind. True, they argue, the urge to move is preceded by an RP, as Libet found, but what Libet did not know is that the RP he recorded is preceded by other “spontaneous sub-threshold fluctuations in neuronal activity” that went unnoticed because his experiments, and others like it, were designed to only record the RP immediately before the movement occurred (p. E2904). In the Schurger model, when the spontaneous neural activity reaches a certain threshold, and not before, it activates the urge to carry out the assigned
action, such as moving one’s wrist. In other words, according to Schurger’s team, the RP recorded by Libet-like experiments is not evidence of unconscious preparation by the brain, but merely the RP that happens to exceed the decision threshold for triggering the movement. It’s a bit like a basketball bouncing in front of a window inside someone’s home. The observer outside only sees the ball if it bounces into view above the window-sill. When the observer outside sees the ball, if he happens to be Benjamin Libet, he will trace its trajectory back to the moment it left the floor and assume that is the moment the brain “decided” to throw the ball upwards. Meanwhile, Schurger and his all-star team, observing from within the house, witness no unconscious decision being made because the ball had already been bouncing for some time, in “spontaneous subthreshold fluctuations,” before it happened to bounce above the threshold of the window, which corresponds to the moment the participant first feels the urge to move. What seems to be the result of planning, therefore, is really just the result of chance.

Bonicalzi and Haggard (2019) and Khalighinejad et al. (2018) have proposed models that reconcile the classic understanding of Libet-like experiments with Schurger et al.’s findings, but even if we take these findings at face value, Libet’s original interpretation remains essentially intact. The RP that leads to the motion of the participant’s wrist may not be the result of unconscious preplanning, but it is not the result of unconscious choice either. In Delboeuf’s three-stage model of free will, it corresponds to the first stage of solicitation, which is never free. The urge still comes on its own, as far as the participants are concerned, and the role of conscious will is still to decide whether to follow through with the urge or not. Therefore, Libet’s and Delboeuf’s insight, along with Maxwell’s and perhaps Locke’s, that the role of conscious will is not to initiate but rather to control action remains fundamentally supported by Schurger et al. (2012). Schurger and his colleagues liken the process to a row of collapsing dominoes. The cascade of collapsing dominoes is not deterministic, as they put it, since “one could quickly remove the penultimate domino before the cascade reaches it” (p. E2905).

**Ecological validity.** Even if we grant the existence of Libet’s veto—and after all why not? We would all still be wearing diapers if we lacked the ability to resist our basic urges and impulses—his free-won’t model seems limited in its application. When we think of free will, we also think of initiating actions rather than of merely responding to them. Libet and Delboeuf proposed mechanisms of control and restraint that do not, on the surface at least, seem generalizable to all acts of free will.

When we consider the brain’s peculiar balance between excitatory and inhibitory activity, however, it is by no means inconceivable that a refraining mechanism could account for self-initiated acts of will. Recent studies have shown that the brain’s excitatory neurons are constantly being turned on and off in a vast network of neural equilibrium (Isaacson & Scanziani, 2011). Excitation in the sensory cortex, for example, is kept in check by inhibitory neurons; when excitation increases, inhibition increases proportionally. The same is true of spontaneous cortical activity, where excitation and inhibition “wax and wane together” (Isaacson & Scanziani, 2011, p. 231). Every cortical system seems to work in this way, in a balance between excitation and inhibition, such that no excitatory neurons escape the influence of inhibitory neurons. This means that any decrease of inhibition will usually result in an increase of excitation. It is therefore
reasonable to suppose we could initiate action by inhibiting an inhibitor, that is, by employing a refraining mechanism of free will. Drawing on Fried et al. (2011), Haggard (2011) also proposes an “intrinsically inhibitory” model of volition. “Decreasing neurons,” he writes, “might withhold actions until they become appropriate through tonic inhibition and then help to trigger voluntary actions by gradually removing this tonic inhibition” (p. 405). And so, while an inhibitory volitional mechanism may conflict with our intuitive notion of free will, it does not conflict with the counterintuitive way neurons interact in the brain.

The prescriptive question

What should be done if we confirm the existence of Delboeuf’s mechanism? If we do, then little will need to change from an ethical or judicial point of view because, as Nichols (2008) reminds us, our society already functions on the assumption that we possess free will. From a scientific point of view, however, the discovery of Delboeuf’s mechanism would open new fields of investigation. One could explore the relationship between the mechanism, on the one hand, and the function, organization, and evolution of the brain on the other. What happens when the mechanism is impaired? What role does it play in mental pathologies? Libet (2004) suggested a relationship between the veto function of free will and disorders such as Tourette’s syndrome and obsessive-compulsive disorder, for example. Addiction might be another promising area of investigation because it consists of an inability to resist satisfying a strong desire or need. If Delboeuf is correct, we would also expect to find evidence of his mechanism in a wide variety of species. We may even observe the same general mechanism in our distant evolutionary cousins, such as insects, micro-organisms, or plants (Calvo, 2017). If we do, it will be an important step in ascertaining whether they possess consciousness because just as sensations imply free will, as we have seen, so free will also implies the capacity to experience sensations. Finally, the discovery of Delboeuf’s mechanism could help in identifying the physical correlates of consciousness. Since free will and consciousness go hand in hand, establishing the physical correlate of one would surely help in establishing that of the other.

Summary and conclusion

Soon after the law of energy conservation was formulated in the mid-19th century, several scientists and philosophers recognized the problem it posed for free will and proposed ways of solving it (Mueller, 2015; van Strien, 2013, 2014, 2015). Delboeuf (1882a, 1882b, 1882c) suggested we could influence the course of matter without compromising the conservation of energy by prolonging the time it takes for molecular interactions to occur. That we possess some form of free will is beyond doubt, moreover, on the grounds that sensations such as pain and pleasure function, in part, as instruments of persuasion, and persuasion implies choice (Delboeuf, 1882a, 1882b, 1882c; Hodgson, 2012). While it remains to be seen whether Delboeuf’s theory is compatible with the principles of modern physics, his theory is corroborated by the experimental findings of Libet et al. (1983) and others (e.g., Schurger et al., 2012) and is consistent with the inhibitory mechanism of volition proposed by Haggard (2011) and Libet (2004). The next step is to test
whether Delboeuf’s theory holds at deeper levels of biomolecular activity. If he is wrong, we will never detect the molecular delays his theory predicts. If he is right, such temporal anomalies are sure to be found, sooner or later. It is only a matter of time.

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Notes
1. This suggests Delboeuf believed we could slow, but not completely stop, transfers of motion or energy. If they were slowed sufficiently, they might give the appearance of having been stopped. In describing the effects of Delboeuf’s mechanism, therefore, I use terms such as “delay” and “suspend” interchangeably.
2. Here arises an interesting dilemma, first noted by an anonymous reviewer. The law of the conservation of energy allows us to suspend acting on an urge, but does it allow us to suspend this action indefinitely, or do we have to follow through on the urge at some point? I think it is possible to never act on the urge. These urges presumably correspond to molecular transfers of energy or motion in the brain. When we resist acting on an urge, we are therefore, according to Delboeuf, delaying one or more of these molecular transfers. It is conceivable, then, that other molecular forces (via enzymes, for example) could disrupt, breakdown, or otherwise halt these transfers as they are being delayed, and thus eliminate the urge to carry out the intended action.
3. I thank an anonymous reviewer for informing me that some of Delboeuf’s ideas could also be found in Locke, notably the idea that our freedom lies in our ability to resist impulses and desires.
4. An anonymous reviewer helpfully suggested the line of reasoning and the culinary example adopted in this paragraph.
5. Or, as Delboeuf more plainly put it, it is a problem of mechanics.

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