

QUESTIONING FREE WILL

TEXT: HARALD RÖSCH

“Human beings can do what they will, but they cannot will what they will.” In the question of whether humans determine their own actions, philosopher Arthur Schopenhauer took a clear stance: free will does not exist! To this day, neither philosophy nor science have been able to definitively answer this question. For Herwig Baier of the Max Planck Institute for Biological Intelligence, this is primarily due to conflicting concepts of freedom.

Since you got up this morning, you've already made a lot of seemingly free decisions: gray or black pants, tea or coffee, work or go for a walk? As much as you're aware that you are subject to certain constraints, you would most likely describe your decisions as free. You could have also chosen the other option – if you'd wanted to! But why didn't you want to? Which takes us right back to Schopenhauer. "I've given a great deal of thought to this question, but I still haven't found a conclusive answer," replies Herwig Baier when asked whether he, as a neurobiologist, can say anything about free will. He's not alone in this – after all, the question even puzzled the ancient Greek philosophers, and the neurosciences have also been tackling it for several decades.

The neuroscientific study of free will is often traced back to an experiment conducted by physiologist Benjamin Libet in the 1980s. Libet asked test subjects to observe a dot of light moving in a circle and decide, at a position of their choosing, when to lift their hand. Libet's measurements showed that the decision had already been made before the participants raised their hands – 0.2 seconds beforehand. Libet was even able to measure an increase in electrical brain activity a second before the movement. This "readiness potential" always rises in advance of a movement. Apparently, the brain had made its decision before the test subject did so. Opponents and skeptics of free will alike still cite the Libet experiment today as evidence that the brain makes a decision and that the person only believes it to be a result of their will.

Since then, multiple research groups have confirmed Libet's measurements. Regardless, there is still disagreement about what they actually mean. Some critics argue, for example, that the readiness potential constantly rises and falls in a certain rhythm and therefore cannot be the cause of the decision to raise the hand. The readiness potential doesn't trigger the movement – instead, it simply makes it more likely during a specific phase of its wave-like motion. Others, however, argue that under the conditions of the experiment, raising the hand is not a true act of will.

And even to this day, there are still two opposing camps. Psychologist Robert M. Sapolsky is a prominent proponent of the deterministic view, which holds that human actions are the result of

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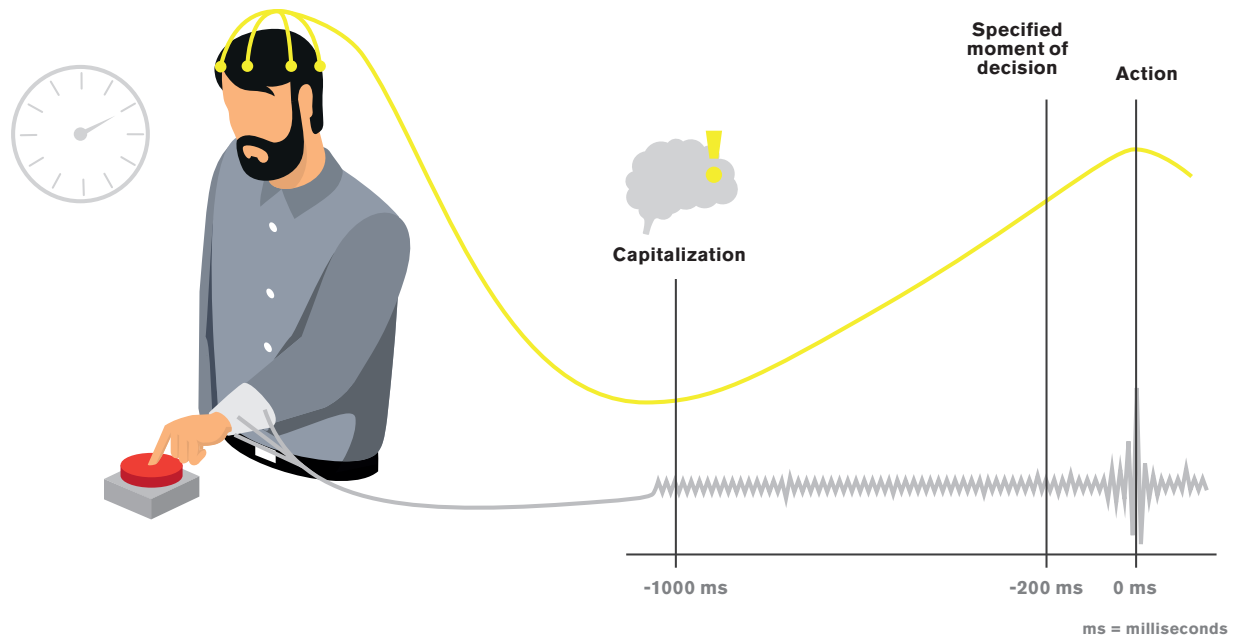
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molecular and cellular processes that cannot be consciously influenced. In his 2023 book *Determined*, he argues that our actions are solely the outcome of the activity of nerve cells, which in turn consist of molecular and electrochemical processes. Neurogeneticist Kevin J. Mitchell argues that free will exists despite all physical laws – and is even a product of evolution. According to this view, our actions are not predetermined.

Clear definitions and the ability to change perspectives – for Herwig Baier, these are prerequisites for understanding free will.



PHOTO: HERWIG BAIER, MPI FOR BIOLOGICAL INTELLIGENCE



The classic: in his famous experiment, Benjamin Libet measured the activity of the brain (yellow curve) and the muscles (gray) of test subjects while they lifted a hand at a time of their choosing on the “clock.” Between the moment the subjects indicated they had decided to do so and the movement of the hand, 0.2 seconds passed. However, the brain had already become active about one second before the movement – it had evidently already decided before the subjects became conscious of it.

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How is it possible that two renowned neuroscientists hold opposing views on such an important question? “Sapolsky and Mitchell mean different things when they talk about free will. That’s why, in my opinion, we first need to define what ‘will’ actually is and what we understand by ‘free,’” says Herwig Baier. “All living beings inevitably have a will because they have intentions: they solve tasks to stay alive and reproduce. This distinguishes living matter from dead matter. In order to fulfill this task, living beings must want something – such as taking in nutrients, finding mates, and generally: seeking favorable living conditions and avoiding unfavorable ones.”

So, there is a will – but is it free? And do non-human organisms also possess free will? These questions continue to divide opinions. For example, the Swiss philosopher Peter Bieri defined an action as free if it aligns with the agent’s higher goal or judgment. According to this, even mice and fish, perhaps even single-celled organisms, could be

“free.” Daniel Dennett saw this quite differently. The philosopher argued that among all living beings, only humans with language possess free will. Herwig Baier evaluates the diverging philosophical perspectives as follows: “Freedom is not a clearly defined concept. For one person, it is the ability to choose from several options. For the next, these would not be free decisions, but ultimately random ones. Additionally, many people – and this also applies to philosophers – feel uneasy at the thought that their subjectively perceived free will is limited by neural activity, hormones, metabolism, and their personal life history. It doesn’t initially matter whether free will is an illusion or a genuine product of evolution.”

The ability to make a choice

At this point, one could therefore answer the question of whether humans have free will like this: they have a →

will, just like any other living being does. Whether it is free is a matter of definition! Whatever philosophical concept is preferred, a will is expressed in the ability to choose one course of action from several options – i.e., to make a decision. How an organism decides in a particular situation and what influences that decision can then be studied in the laboratory. Herwig Baier and his team study the larvae of zebrafish, which are just a few millimeters in size. They provide the significant advantage that their bodies and relatively simple brains are mostly transparent. This makes it possible to observe the activity of the nerve cells from the outside. The researchers want to find out which nerve cells in the brain must be active for the fish larvae to exhibit certain behavior. To do this, they display black dots on a screen. The dots get progressively larger, simulating an object on a collision course. This kind of stimulus triggers escape behavior. The larvae must now decide which direction to swim in. “If a dot appears in front of one eye, most of the animals flee in the opposite direction. If the two eyes see dots of different intensities, the larvae swim away from the stronger stimulus toward the weaker one. But if both eyes are presented with a stimulus of equal strength, one of the dots usually ‘wins,’ seemingly at random. This means that the brain decides spontaneously and in a fraction of a second which of the two stimuli is more important,” explains Baier. These decisions are based on a circuit of nerve cells that Baier’s team has located in the midbrain. If the activity of the circuit is blocked, the animals can no longer select the stronger stimulus and often flee in the “wrong” direction.

A decision-making center in the fish brain

This network is, therefore, something like the fish’s decision-making center. If one were to attribute free will to the fish, this circuit would be its neural manifestation – though only for this particular behavioral decision. In other situations, different networks “make” the decision. “From a neurobiological perspective, there is not a single decision-making center or just one place in

which the will is located, but many,” Baier emphasizes. The behavioral strategies described above don’t follow the same pattern every time. In fact, the same fish can

make one decision on one occasion and a different one the next. In a minority of cases, the fish confronted with two equally strong stimuli will simply choose to swim through the middle. “The wiring in the brain allows for different behavioral responses to the same stimulus,” says Baier. Does that then mean free will? “It depends entirely on how you define ‘free’ – if you mean that the fish larva can behave completely independently of external and internal influences, then certainly not. Our studies show that physical states significantly influence the decision. Depending on whether an animal is hungry or full, stressed, or relaxed, it will generally make a different decision. For example, well-fed fish larvae are much more likely to flee from a mildly threatening stimulus, while hungry larvae tend to be bolder – after all, something edible could be at stake. Previous experiences definitely have an effect as well. So, if

SUMMARY

Every living being has a will – namely, to do what serves its survival. Whether this will is free depends on what one understands by “free.”

The will is not free in the sense that it is absolutely unrestricted, as decisions are influenced by a variety of internal and external factors. But it is free to choose from a limited number of options the one that most closely aligns with its intentions and goals.

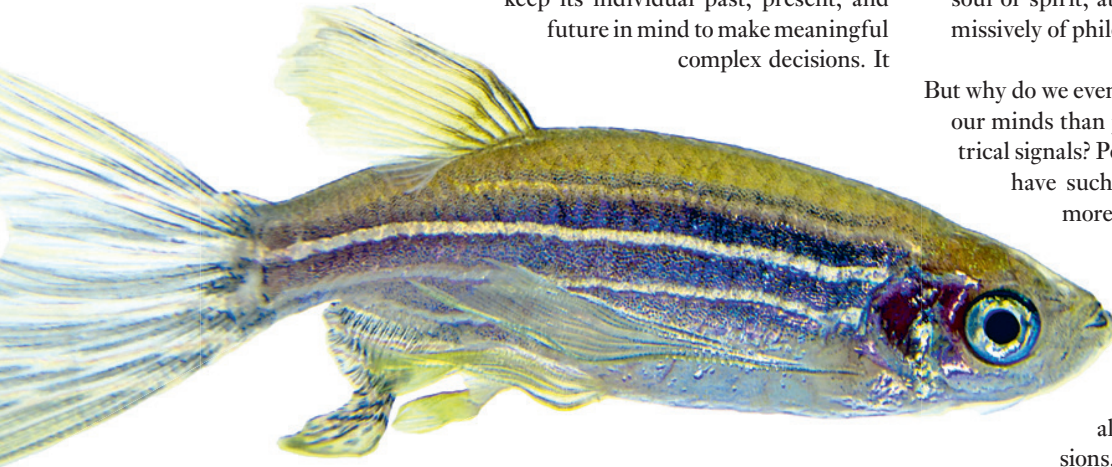
The concept of free will may be an illusion created by the brain. But whether this illusion is merely a byproduct of a highly complex neural network or a product of evolution that promotes survival remains a matter of debate.

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‘free’ means that internal and external factors trigger customized behaviors that don’t just follow a simple stimulus-response pattern, then yes.”

In the most literal sense, an organism must keep its individual past, present, and future in mind to make meaningful complex decisions. It



Zebrafish can remember the past, focus on what matters, and anticipate the consequences of their actions – everything needed for intentional behavior. But can they also pick the best option from several alternatives?

must remember past events, focus on current demands, and anticipate the consequences of its actions. “We now know that our fish larvae are capable of all these tasks,” says Baier. However, it remains unclear whether the animals also have the ability of mental navigation – whether they can envision in their mind a path they will take in the future. To answer this question, Baier proposes an experiment in which zebrafish are rewarded for approaching various feeding stations in a specific sequence. If place cells in the brain – those that are active at specific locations in a space for vertebrates – fire before the animal reaches the next reward station, it would indicate that the fish can plan their own future actions. And anything that plans must be able to envision different options. Yet even though zebrafish, fruit flies, and nematodes are proven to make decisions, it’s difficult to describe this ability as free will. This is perhaps due to a conflation of two concepts: that of free will, and that of consciousness. According to Herwig Baier, this confusion also leads to a misinterpretation of the Libet experiment. “The moment participants reportedly decided to lift their arms might not actually be the moment of decision but rather the point at which the previously made decision became conscious to them. It takes some time before the decision – whether free or unfree – is perceived as such by us.”

One consequence of this conceptual confusion is that it feels absurd to speak of free will in flies and worms. After all, humans often attribute consciousness only to themselves, great apes, and a few other cognitively advanced species. The conflation complicates matters, as determining what consciousness actually is, how it can be measured, and which animal species possess it

is just as complex as the question of whether free will exists. A commonality between the two concepts is that humans also perceive their consciousness as something separate from the brain. “The majority of my colleagues would likely reject the existence of a soul or spirit, at least professionally,” says Baier dismissively of philosophical dualism.

But why do we even feel as though there must be more to our minds than just interconnected neurons and electrical signals? Perhaps it proved useful in evolution to have such an illusion: an organism might be more likely to survive if it perceives itself as an individual that makes its own decisions and acts independently. It could, however, simply be a by-product of a highly complex and dynamic neural network, without purpose, without benefit, and above all, without any influence on our decisions.

Complications for culpability and punishment

Were it not for its practical consequences, the discussion about free will could easily be dismissed as a research dispute and an intellectual exercise of philosophy. How free we are when we choose a gray pair of pants and tea in the morning may not have big consequences – however, whether we are free in the decision to either buy or steal a watch certainly does: if an individual’s behavior were predetermined by evolution, biography, and neurophysiological processes, then they would have no free choice at all. Robert Sapolsky, who refutes the existence of free will, concludes that this should have consequences for jurisprudence. If a person cannot be held responsible for their actions, the legal system, according to Sapolsky’s view, must take this into account when determining the sentence – a court ruling cannot establish personal guilt, as such a thing does not exist. Conversely, morally good behavior and professional performance should be rewarded much less, or not at all. Herwig Baier holds a different opinion. In his view, it certainly makes sense to hold people accountable for their actions: “Punishing transgressions primarily serves as a deterrent. A legal system must assume the autonomy of the individual, even if it is an illusion.” Because this very effect of deterrence works like one of the external factors that influence a person’s decision in the watch store and prevents them from stealing. At least for the watch industry, it would certainly cause significant problems if one could plead “insanity due to lack of free will” in court. ←