Embodied Freedom and the Escape from Uncertainty

Abstract

Behavioral actions can attain their intended result either when all possible details and intervening factors are controlled in advance by the action plan, or when only the final outcome is taken into account while the rest is left for on-line correction. Both ways have numerous advantages and disadvantages. The former can be applied only in very simple instances and therefore, puts very strong limits on the complexity of behavior. The latter can be used for action plans of practically unlimited complexity. Such movements are free because they are determined not by their environmental conditions but by their future result. To perform them, however, the executive system must admit its principal inability to predict and control everything in advance. This produces high emotional load, that is, the anxiety to meet uncertain and uncontrollable environments. Humans avoid this feeling of uncontrollability by developing doctrines like Divine Providence or the modern neuroscientific determinism. Such doctrines are based on intuitively plausible (but scientifically wrong) identification of causality with necessity and predictability. To claim the principal predictability of the world (and thus to remove anxiety), they invent arguments denying the freedom of voluntary actions.

Boris Kotchoubey[1]
Institute of Medical Psychology and Behavioral Neurobiology
University of Tübingen, Germany

The notion of free will presents a double interest for a psychologist. At the psychological level properly, the point is the behavioral and psychophysiological organization of voluntary actions. At a metapsychological level, we are interested in people's beliefs on this and related topics. As I hope to show here, the two levels are, albeit logically separable, less independent of each other than it might be assumed.

The Obstacle, Which Does Not Exist

Because free will is a mystery, and quantum mechanics is a mystery,
they should somehow be related to each other.
An unknown but frequently cited author

There is a long-lasting controversy between incompatibilists (who insist that we must choose between the two mutually excluding notions of free will and determinism), and compatibilists (who believe that freedom and determinism, if understood properly, are

[1] Boris.kotchoubey@uni-tuebingen.de

compatible) (Sappington, 1990). Although many philosophers are compatibilists, our intuition remains incompatibilist and Laplacean.

A recent attempt to solve the quantum indeterminacy using an appeal to causality in human choice (Rehmeyer, 2008) can illustrate the psychological incompatibility between freedom and determinism. Taking the Heisenberg principle as the most famous example, when we measure a certain variable of a quantum particle (e.g., its position), we cannot know its speed; and vice versa, when we measure its speed, we cannot know its position. The indeterminism disappears, however, if we assume that our very decision to first measure the speed (and not the position) is predestined.

I interviewed 78 respondents (47 women, aged 23-34 y), students of psychology and medicine and young scientists in psychology and neuroscience. From the long experience with this population, I know that the respondents have the full-scale IQ (WAIS) above 120, only exceptionally between 115 and 120. The respondents were presented with statements characterizing determinism (e.g., "Everything in the world is causally determined"), predictability (e.g., "Who knows all the facts in the present, must be able to predict everything in the future"), and free will (e.g., "Humans can act on the basis of free choice").

Most interesting is the pattern of correlations between the three domains, that is, determinism, predictability, and free will. The former two correlated with $r = .78$, whereas free will correlated with determinism with $r = -.92$ and with predictability with $r = -.69$ (all $p < .0001$). A factor analysis revealed that the data can be satisfactorily explained by one single factor with positive weights for determinism and predictability items, and negative weights for free will items. In other words, most people are incompatibilists, which is in accord with previous analyses (e.g., Roskies, 2006; Hodgson, 2005). Moreover, compatibilism versus incompatibilism is a running philosophical discussion whose outcome is presently open. In contrast, we already know that determinism does not guarantee predictability because many highly important processes from climate to heart rate to evolution are deterministic (and probably do not include any free will) but unpredictable. In people's beliefs, however, determinism and predictability are strongly directly related, and the belief in free will is inversely related with the belief in the predictable world.

Below I'll return to the question of why a seminal but very preliminary and methodologically naïve, thirty-year old experiment is still referred to by non-professionals as THE main empirical argument against the notion of free action. One poorly known quotation from an interview with Wolfgang Prinz, the Director of the Max Plank Institute for Psychological Research, may shed some light on the issue of why determinism and freedom are regarded as rivals, notwithstanding all the effort of clever philosophers inventing compatibilist theories.

> Question: Do the experiments of Libet prove that we are determined by our brain?
>
> Answer: Yes.[2] But to know that we are fully determined we *don't need these experiments* [italics added]. The idea of free human will is principally incompatible with scientific thought. Science *presumes* [italics added] that everything what happens is causally determined and that these causes can be found out… I'm unable to understand how somebody who works in empirical science can believe that free, that is, undetermined human activity might be possible. (Prinz, 2004, p. 22)

[2] Why did not Prinz simply stop after this "yes"? I don't know. He did not, however.

These few lines can give job to a whole host of psychoanalysts. For us, it is enough to notice that science is here presumed to presume the absence of free will. Science cannot, therefore, prove this absence. What is presumed at the beginning of an argument, cannot be proven at its end, otherwise it would be a simple peticio principii.

At least after Bertalanffy and Prigogine, we cannot believe anymore that the world is basically predictable, even if it based on causal laws. Likewise, it appears from the point of view of quantum physics that at the very end, it is indeterministic too. Both facts do not explain voluntary action, or at least we have no idea of what such an explanation might be like. They, however, make particularly odd the view that free will is impossible **because** it contradicts the ideals of determinism and general predictability of everything. Neither Science nor Western civilization broke down when physicists accepted the existence of essentially stochastic processes. The development of the mathematical theory of chaos and its applications did not make the research process more chaotic and unpredictable than it was before. Just for analogy, we may hope that our beautiful temples of reason will withstand even the assumption of voluntary actions.

The instrumental role of determinism does not prove its truth. Christianity (as measured both by subjective reports on faith and simple objective variables, e.g., visiting church) has consistently been shown to have positive effects on health, well-being, mental fitness and stress-resistance. While theologians may be glad to know this, none of them would take these findings as an index of truth of the Christian faith. We cannot assume that the positive psychological or medical effects of the belonging to Christian confessions proves that Jesus was really the son of God, crossed under Pontius Pilate, resurrected on the third day, and so forth.

The determinist faith has been proven a very useful tool in the development of the classical, mechanistic world view in $17^{th} – 19^{th}$ centuries, and one might reasonably argue that the progress of research at that time would have been impossible without this faith. Likewise, coal was necessary at a particular step in the development of industries. Nonetheless, would somebody really base an industry of the 21^{st} century on coal energy?

Embodied Freedom

> There are two qualitatively different ways of making a choice: first, to consider all the details of how a desired outcome is achieved, and second, to consider only the ultimate outcome.
> (Latash & Anson, 1996, p. 59)

All animal behavior is directed into the future. There is a profound misunderstanding that behaviorism regarded behavior as a chain of reactions to stimuli. In fact, the classical Skinnerian dogma $S^D – R – S^R$ (discriminative stimulus -> response -> reinforcing stimulus) clearly indicates that responses are controlled by their reinforcement. Not only behavior, but also all the most important physiological regulations are related to future stimulation: Sugar in the mouth switches on in advance insulin mechanisms of glucose reduction, and baroreceptors, in fact, respond to the future, not to the actual increase of blood pressure (Dworkin & Dworkin, 1995). It is the ABC of the behavioral therapist that if you want to change an undesirable behavior of a patient you must first change its consequences.

No predator in the animal world is so stupid to attack its prey at the site where the prey presently is. The attack is directed to the point where the prey will be at the next moment. A tiger that jumps for a gazelle where it is will die of starvation.

This future determination is not limited to higher animals but penetrates all levels of living organisms whenever there is something that can be called behavior. Escherichia coli, a simple prokaryote about 2 μm long, is able to both aerobically and anaerobically acquire energy. The bacterium can live in the intestine of large animals, including humans, but can also survive for a long time outside of a host. Aerobic respiration is useful for external life, but aerobic mechanisms themselves are energy-consuming. Therefore, the corresponding genes are switched off when the bacterium passes into the gut. More exactly, as recently shown (Tagkopoulos, Liu, & Tavazoie, 2008), they are switched off by increasing environmental temperature, which signals the transition into the gastrointestinal tract. As the authors state, this is like a "conditional reflex"[3] in which the temperature serves as a conditional stimulus signalling the upcoming lack of oxygen (unconditional stimulus) and releasing anaerobic life. Furthermore, when the authors created an artificial condition with the inverted order of things, that is, increasing temperature preceded a transition to the oxygen-rich environment; a population of E. coli needed "only" 600 generations to adjust in such a way as to switch off the aerobic machinery with decreasing temperature.

The future determination of behavior, however, is not the whole story. As the devil in M. Bulgakov's novel said, "That man is mortal would be only half of the trouble. The worst of it is that he's sometimes unexpectedly mortal" (Bulgakov, 1997, Ch. 1). Likewise, not only is behavior determined by future, it is determined by unexpected future. The hypothetical nature of behavior was emphasized by numerous philosophers and psychologists from Tolman to Popper. Eibl-Eibesfeld (1989) even indicated that each biological adaptation can be regarded as a hypothesis, which should be tested by the environment. This is because the adaptations have been selected during a time epoch different from that in which the organisms possessing these adaptations should survive. But if it is true even for morphological adaptations which are genetically fixed and remain stable during the life, the more true it is for those adaptations which are related to an organism's (or its parts') movement, that is, its behavior.

This is the most famous example of volition: Whenever I want to raise my arm, I can do it. The classical conception, therefore, is my muscles exactly fulfil the orders of my will.

The end result of an action, however, is a function of both internal (muscular) and external (environmental) forces. Therefore, if my muscles always exactly perform what my mind (my will, my brain, the central executive, whatever you like) orders them, the results of the action will not be the same: No, they will vary whenever the external forces vary, that is, almost always.

The miracle of free action is not that, whenever I want, my muscles do exactly what I want. The much greater miracle is that, whenever I want, they do something different. Depending on my posture (e.g., standing on one or two feet, bowing, sitting etc.) and external factors (e.g., wind or the physical resistance of an opponent trying to prove determinist views), entirely different patterns of muscle activity will yield the same outcome of raising the arm. The central executive that "wants" to raise the arm does not have any idea of this variability.

[3] Of course, it is not a real conditional response (CR) because it developed in evolution in contrast to the true CR developed in the individual life of an animal.

Bernstein (1967) was perhaps the first who indicated that the use of the term "degrees of freedom" in biomechanics is not simply a metaphor. When a novice (e.g., a first-grader) first tries a complex movement (e.g., writing), she must fix all irrelevant muscles, thus reducing the mechanical degree of freedom. Her movement is not free but frozen, as can be seen by the fact that even a slight but unexpected disturbance would suffice for the movement to fail. With experience, the movement becomes free, in both biomechanical and everyday sense of the word. The explosive increment of the degrees of freedom means that muscles are not strictly controlled but can now flexibly adjust on-line to any possible disturbance. The final result of the action now depends, not completely, but much more, on the organism's biological (in animals, mainly homeostasis-related) tasks than on the random environmental factors.

Perhaps the best illustration of the relatedness between mechanical and personal freedom can be found in the pictures of humans in advertisements, in official portraits of kings and other rulers, and particularly in totalitarian art. People are portrayed in cramped, inhibited postures and with gestures demonstrating the fatal lack of degrees of freedom. Not only must they smile, they must smile using one particular motor pattern. They have no choice but this particular smile.

What is at stake? Either a pre-programmed movement with very few degrees of freedom, with fixed muscles, no risk, no tolerance of unpredictable disturbances, high reliability for simple synergies and in simple conditions, or a skilled movement with many degrees of freedom, high risk, high flexibility and the ability of complex behavior in complex situations.

This view strongly opposes the conception of freedom as "inner determination." Tics and epileptic seizures are internally determined, but they are not voluntary movements. Pre-specified actions, which strictly follow the motor plan, are not free. They are typical for very simple animals (e.g., some, but not all, insects), for simple situations and, as already said, for the first steps of motor learning. A skilled action, to the contrary, leaves free resources to respond flexibly to environmental demands. It is created in the course of its performance (Turvey, 1990).

Therefore, notwithstanding unexpected and unforeseen disturbances, the movement that maximizes the chance to attain its intended final outcome is in turn determined by this outcome. Thus, we attain the following compatibilist definition of freedom of action: An action is free to the extent in which it is caused by environmental events ("stimuli") that do not exist at the time of the action's performance but will emerge as a result of this action.

The paradigm, on which the characteristics of a voluntary action can be seen in their most distinct form, is a scientific experiment (Dewey, 1925). It is based on an action plan that explicitly accepts its inability to predict all the possible environmental effects. It informs us about the world through its consequences, which are yet to be obtained. Finally, it can produce new effects and new results, which have never happened in the history of science (or the organism).

To make an action flexibly variable and yet attain its aim, the movement-control system must be able to distinguish between essential and non-essential variables of a movement synergy. Therefore, it must be able to set priorities. Maxwell (2001) rightly connects the determinism-versus-freedom problem with the value-versus-fact issue. Choice (i.e., the ability to make something different) is not the midpoint of freedom, but the means for self-realization. Whatever free human beings choose, their intended outcome is to be themselves. A skilled movement, that is, a movement possessing many biomechanical

degrees of freedom, is not only the source of freedom; it is also the first example of valuation. Bernstein's (1967) problem of the redundant degrees of freedom can only be solved by creating and realizing values.

To Choose or Not To Choose, Is Not a Question

"'twas ten to one; And yet we ventured for the gain proposed…"
Shakespeare, King Henry IV, Part II, Scene I

Postmodern philosophy[4] strongly reminds us of a Soviet grocery at the time of the socialist deficit economy: You can ask for cheese or fish, milk or sausage, but the seller's answer is all the same: "There is none!" There is neither subject nor object, neither truth nor objective world. Nobody is surprised that there is no free will either.

From the point of view of what is said above, we can briefly state why the so-called empirical data fail to display any relevance to the target problem. On the one hand (as already shown by numerous authors, e.g., Bennett & Hacker, 2003; Dennett, 1991; Levy, 2005), this is because they are based on arbitrary and internally inconsistent definitions of voluntary action. Thus psychological experiments allegedly disproving the existence of voluntary actions (Wegner, 2002) usually presume such actions being determined by internal factors rather than external influences independent of the individual. Following this definition, a genetic disease is voluntary, but a decision to take an umbrella because of the rainy weather forecast is not. A few neurophysiological experiments presume that actions are only voluntary if they are caused by an immaterial, brain-independent conscious will, rather than the brain and the body. Both oppositions are wrong: the former, because both voluntary and involuntary actions are broadly controlled by both external and internal factors and the latter, because it is entirely based on the split between brain/body and mind/soul, which it hopes to overcome.

In contrast, our above definition suggests that a voluntary action is the one determined by the environment, which will emerge due to this same action. To do this, the action-controlling nervous system sets priorities and decides which few movement parameters should be controlled and which should be left free. The neurophysiological experiments used very simple finger movements whose voluntary nature is fully reducible to their biomechanical freedom (that is to the underspecification of low-level variables such as the exact direction and force). The Bereitschaftspotential (Libet, 1985) is generated by the supplementary motor area which is responsible mostly for the fact that a movement will take place and perhaps for the time of its onset. The lateral readiness potential (Haggard & Eimer, 1999; Trevena & Miller, 2002) reflects the specification of the hand and possibly the rough movement direction. All these parameters should be prespecified in very simple movements, in contrast to low-level variables (e.g., force) left for flexible adjustment. By complex movements, however (e.g., playing the Appassionata), the same parameters (hand, finger, and even onset time) can become non-essential and therefore left unspecified.

Importantly, Libet's own interpretation of his famous delay between the onset of brain activity and the time point of explicit volition radically differs from that of most philosophers. He maintains that the free will intervenes at a later stage in the natural course of

[4] In the broad literal sense "after modern," not in the narrow sense of Derrida & Co.

brain events to be able to say, "No, veto." They accuse him in dualism and claim that the time is too late; the brain preparatory activity has already done the entire job and does not need any voluntary power. The real difference between the two views, however, is minimal. Both ask for voluntary activity as some additional force besides the bodily organization of movement, but Libet asserts that this force is manifested in the experimental data, and his critics that it is not. This is equivalent, as indicated by Levy (2005), to the search for an additional decision making mechanism, which makes a decision to decide to act, a strategy leading into the infinite regress. This regress is avoided if we look for the source of freedom in the physiology of action itself, not outside it. For this sake, a physiological experiment should be based on an analysis of real priorities and values of the particular kind of movement realized in that experiment.

There is no space in the present text to discuss what the specificum humanum is: that complex of properties, which distinguishes the human mode of existence and human consciousness from those of subhuman animals (Kotchoubey, submitted). Very briefly, the combination of generative language, generative use of tools, and the unlimited facility to play creates the ability to covertly perform actions and evaluate their consequences. Whereas higher animals are simply free to the extent of the complexity of their behavior, humans possess a meta-complexity, which allows them to switch between different complexity levels. This unique ability, on the one hand, expands the freedom of action beyond the mechanical freedom of movement; on the other hand, freedom, which is nothing but natural (though restricted) for cats, bats and eagles becomes a problem in humans.

Usually, compatibilist theories of free will start with the appeal to higher-order, specifically human, language-related forms of reflexive awareness, which allows going beyond the purely physical necessity (e.g., Frankfurt, 1971; Pauen, 2004). These theories lack the biological basis of freedom in a living movement. Although they contain many important insights, they ignore the point that any high-level voluntary choice roots in the biomechanical design of a living movement.

It is not true, therefore, that only humans are free; to the contrary, only humans can be less free than they can. They can decrease the complexity of their actions below the level allowed by their biology. For the gain proposed by freedom is obvious: Free actions can attain the complexity never possible for fixed actions in which every detail is planned in advance. Nevertheless, the costs are very high too. First, there are cognitive costs, that is, there must be a multilevel "heterarchic" controlling system able to construe parameter classification and to set priorities. Second, these are costs in stability, because only pre-programmed movements can have a zero variance, whereas a result achieved through a flexible use of multiple feedback loops always contains some fluctuations.

Most importantly, there are emotional costs due to the very fact that the executive simply leaves a lot of parameters unspecified and a lot of potential environmental factors unforeseen. To let environmental disturbances affect us and to correct these disturbances on-line, we first must admit the terrific unpredictability of the world we live in. With each complex movement and each act of volition, we venture toward this unpredictable world. The gain of the increasing ability to attain a desirable end is, therefore, counteracted by the cost of giving up means. Each voluntary movement is thus a gambling task, and even though we can win (and have won) a lot of such games we can never get a guarantee that we shall win the next one.

This is the point. All the theoretical constructions from the Divine Providence to the present-day restrictive neurodeterminism (which permits, for unknown reasons, only two of the four Aristotelian kinds of causes: the mechanical and the efficient) are means to escape

the unbearable uncertainty of life. Experiments and logical arguments are mainly pretences hiding the profound conflict between the enormous potential cognitive complexity of human behavior, and the need to find a firm, sure basis, "the unmoving mover," the last fundament of true stability and complete predictability among the storms of life and experience. The choice not to choose is also our choice. In the same way that the epoch of the American and French Revolutions, of the Bill of Rights, and of bourgeois liberalism chose Kantian philosophy of the autonomous subject, the contemporary attempts to expel voluntary actions from science and philosophy reflect the era of public video surveillance, state dirigisme, and anti-terror laws.

References

Bennett, M. R., & Hacker, P. M. S. (2003). *Philosophical Foundations of Neuroscience*. Oxford: Blackwell.

Bernstein, N. A. (1967). *The coordination and regulation of movements*. Oxford: Pergamon.

Bulgakov, M. (1997). *The master and margarita*. Retrieved August 20, 2009, from http://lib.ru/BULGAKOW/master97_engl.txt.

Dennett, D. (1991). *Consciousness explained*. Boston, MA: Little, Brown and Co.

Dewey, J. (1925). *Experience and nature.* Carbondale, IL: Southern Illinois University Press.

Dworkin, B. R., & Dworkin, S. (1995). Learning of physiological responses: II. Classical conditioning of the baroreflex. *Behavioral Neuroscience, 106*, 1119-1136.

Eibl-Eibesfeld, I. (1989). *Human ethology*. New York: de Gruyter.

Frankfurt, H. G. (1971). Freedom of the will and the concept of a person. *Journal of Philosophy, 68*, 5-20.

Haggard, P., & Eimer, M. (1999). On the relation between brain potentials and the awareness of voluntary movements. *Experimental Brain Research, 126*, 128-133.

Hodgson, D. (2005). A plain person's free will. *Journal of Consciousness Studies, 12*, 3-19.

Kotchoubey, B. (submitted). Human consciousness: Where is it from and what is it for?

Latash, M. L., & Anson, J. G. (1996). What are "normal movements" in atypical populations? *Behaviour and Brain Sciences,19*, 55-106.

Levy, N. (2005). Libet's impossible demand. *Journal of Consciousness Studies, 12*, 67-76.

Libet, B. (1985). Unconscious cerebral initiative and the role of conscious will in voluntary action. *Behavioral and Brain Sciences, 8*, 529-566.

Maxwell, N. (2001). *The human world in the physical universe*. Lanham, MD: Rowman & Littlefield.

Pauen, M. (2004). *Illusion Freiheit?* (4th ed.). Frankfurt-am Main, Germany: Fischer.

Prinz, W. (2004). Der Mensch ist nicht frei. In C. Geyer (Ed.), *Hirnforschung und Willensfreiheit: Zur Deutung der neuesten Experimente* (pp. 20-26). Frankfurt am Main, Germany: Suhrkamp.

Rehmeyer, J. (2008). *Do subatomic particles have free will?* Science News, August 15. Retrieved August 20, 2009, from www.sciencenews.org/view/generic/id/35391.

Roskies, A. (2006). Neuroscientific chanllenges to free will and responsibility. *Trends in Cognitive Sciences,* 10(*9*), 419-423.

Sappington, A. A. (1990). Recent psychological approaches to the free will versus determinism issue. *Psychologocal Bulletin,*108(*1*), 19-29.

Tagkopoulos, I., Liu, Y.-C., & Tavazoie, S. (2008). Predictive behavior within microbial genetic networks. *Science,* 320, 1313-1317.

Trevena, J. A., & Miller, J. (2002). Cortical movement preparation before and after a conscious decision to move. *Consciousness and Cognition, 11*, 162-190.

Turvey, M. T. (1990). Coordination. *American Psychologist, 45*, 938-953.

Wegner, D. (2002). *The Illusion of Conscious Will*. Cambridge, MA: MIT Press.