Philosophische Analyse / Philosophical Analysis

Herausgegeben von/Edited by
Herbert Hochberg, Rafael Hüntelmann,
Christian Kanzian, Richard Schantz, Erwin Tegtmeier

Volume / Band 59

Morality in Times of Naturalising the Mind

Edited by
Christoph Lumer

DE GRUYTER

ISBN 978-1-61451-799-3
e-ISBN (PDF) 978-1-61451-801-3
e-ISBN (EPUB) 978-1-61451-939-3
ISSN 2198-2066

Library of Congress Cataloging-in-Publication Data
A CIP catalog record for this book has been applied for at the Library of Congress.

Bibliographic information published by the Deutsche Nationalbibliothek
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available on the Internet at http://dnb.dnb.de.

Printing: CPI books GmbH, Leck
♾ Printed on acid-free paper
Printed in Germany

www.degruyter.com

Contents

Libet's Experiments and the Possibility of Free Conscious Decision

CHRISTOPH LUMER

Abstract: (2) In a famous series of experiments Libet has proved, many believe, that the way for human action is physiologically paved already before the conscious intention is formed. (3) A causal interpretation of these experiments which follows Libet's lines implies that even a compatibilist freedom of action and decision, as well as actions in a narrow sense, do not exist. (4) A compilation of several critiques of the experiments' interpretation, however, questions the most important parts of these interpretations, e.g. the temporal order, the nature of the conscious intention. (5) In addition, a more sophisticated picture of the work of intentions makes clear that in Libet's experiments in most cases there were no proximal intentions to flex one's finger but that these actions are intentional in virtue of the distal general intention to follow the experimenter's requests. (6) Finally, an elaboration of the role of consciousness and deliberation in decisions shows how the latter intentions can be free despite being based on unconscious processes.

1. Introduction

Traditional conceptions of action, intentionality, reason, freedom and responsibility have come under attack as a consequence of (more or less) recent findings in behavioural, cognitive and neurosciences. The most fundamental challenge in this respect is still Benjamin Libet's experiments – and their followers – on spontaneous actions, which seem to show, and according to many have shown, that intentions do not play a decisive role in the production of actions. Though very much has been written about this challenge there is still a remarkable divide between those who think that Libet's findings have finally proven the obsoleteness and vacuity of those traditional conceptions of action, freedom etc. and those who think that they have proven nothing in this respect.

The aims of this chapter are threefold. The first is to systematise the many criticisms of Libet's experiments as well as his

Christoph Lumer (ed.): Morality in Times of Naturalising the Mind. Berlin; Boston: de Gruyter 2014.

interpretations of them and to filter out the remaining challenges to modernised, but still rather traditional, action theoretical conceptions. The second is to provide answers to these challenges by introducing adaptations of some of these conceptions to present-day empirical findings. And the third is to sketch a general theory of the role of consciousness and deliberation in intention formation, which fully restores freedom of action and decision.

2. Libet's Experiments

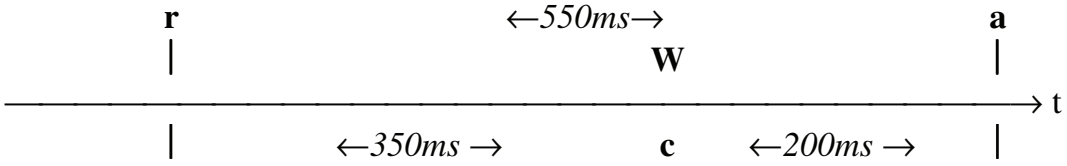
Libet conducted a series of experiments which purportedly show that the formation of a conscious intention may follow the proper physiological preparation for action:[1] As physiological indicators show, the action is already in the offing in such a way that in normal cases it will be executed; and only afterwards a conscious intention is formed, which is just the effect of a physiological preparation for action. At least this is Libet's interpretation.

What, somewhat more precisely, are Libet's findings? Voluntary actions are preceded by readiness potentials in the brain: Prior to the action the negative electric tension in the motor area and on the vertex of the brain rises continuously; and after the beginning of the action – i.e. the beginning of the innervation of the muscles (measured by electromyogram) – this negative potential declines sharply back to the baseline. Readiness potentials can be discriminated from the noise of electrical potentials in the brain mostly only by adding some dozens of single curves; Libet, in each case, added 40 curves (Libet 1985: 530; 535). These readiness potentials are usually interpreted as a preparation for action. The aim of Libet's experiments was to compare the beginning of the readiness potentials with the time of forming the intention. In his main experiment, the *spontaneous move plus timing experiment*, the subjects were instructed to quickly move a finger or hand in an arbitrary moment after the beginning of the experiment whenever they wanted to do so, without preplanning these movements (ibid. 530). In addition, they had to observe when the intention or urge to

[1] Libet's original experiments and his theory are reported in: Libet et al. 1982; 1983a; 1983b. They are recapitulated in full detail in: Libet 1985: 529-539. The latter paper was published together with 24 critical comments (ibid. 539-558) from peers and a reply by Libet (ibid. 558-564).

move developed by remembering and later indicating the concurrent position of a rotating light spot (i.e. the clock) (ibid. 532). The subjects reported that prior to each action an urge to act developed, which arose spontaneously and out of nothing (ibid.). Readiness potentials began to develop at -550 ms (i.e. 550 ms before the beginning of the action measured in terms of the innervation of the muscles). The urge to act, i.e. the "conscious volition" or "will", abbreviated by Libet as "W", instead took place only at -200 ms, i.e. much later (350 ms) than the beginning of the readiness potentials (ibid. 529; 532). This means Libet found the chronological order represented in figure 1.

Fig. 1. Libet's main experiment



r = onset of the readiness potential
a = action
W = willing, act of will or urge to move
c = position of the clock at the moment of the read time

The upper level of this diagram represents the physiological events: the readiness potential and the action; the intermediate level represents the mental events, in particular the willing; the lower level represents the events of the clock. The interval between *r* and *a* is measured physiologically; the time of *c* is calculated from the content of *c* itself.

Libet interprets this result as follows: The actions are initiated unconsciously; and the experience of a conscious intention is only a secondary result of the preparation for action already taking place (ibid. 536). This experiment has been replicated several times with similar results (Keller & Heckhausen 1990; Haggard & Eimer 1999; Trevena & Miller 2002).

In another experiment conducted by Libet, the *veto experiment*, the subjects were instructed to make up their mind to carry out the action at a certain time but when the urge to act developed they were to decide against this action by a conscious veto (Libet 1985: 529). Under these circumstances, the subjects could indeed prevent the action's execution. Readiness potentials at first developed normally

but then, 150-250 ms prior to the intended action, they decreased to the baseline (ibid. 538).

Haggard & Eimer (1999), apart from replicating Libet's main findings, have undertaken a variation of Libet's experiments. In their (second) experiment the subjects could not only choose the time but also which hand to move; meanwhile the subjects' readiness potentials were measured (by EEG) above the motor fields. Again, the subjects had to report the time of their intention or urge to move. The results were roughly the same as those obtained by Libet. In addition, the lateralised readiness potentials occurred on the side appertaining to (i.e. contralateral to) the hand which later executed the movement, and again, well before the beginning of the urge to move. (Ibid. 128; 130 f.) This means that in the lateralised readiness potentials, apart from the timing, even the content of the action, right vs. left hand, seems to be determined already.

Soon et al. (2008) repeated Haggard & Eimer's Experiment (spontaneous moves with free choice of hand and time) with important modifications: Instead of recording the brain processes with the help of EEG, they used fMRI with fine-grained voxels ($(3\ mm)^3$); and instead of searching for increased activities in rather big brain areas they analysed the recorded material for such activity patterns, altered with respect to the baseline, that might permit to predict which hand was finally moved; since fMRI has good spatial but poor temporal resolution of only 500 ms with about a 2 sec delay, the clock for measuring the time of the respective intentions could consist of letters on a screen that changed every 500 ms. The earliest predictive pattern with a predictive accuracy of around 60% (Soon et al. 2008: 544, fig. 2; Haynes 2011: 93) was found in the frontopolar cortex (Brodmann Area 10) already 9 sec (7 sec plus 2 sec reaction time of fMRI) before the conscious intention (Soon et al. 2008: 544; Haynes 2011: 89).

3. Causal Interpretation of Libet's Experiments

The basic traditional idea about *actions* is that by actions our self, i.e. the phenomenally experienced kernel of our personality, controls some parts of our bodily and mental behaviour and thereby, via anticipated causal chains, also controls further events in the outer world as well as our future experiences. And the dominant

traditional operationalising theory of this idea is *intentional causalism*: Intentions – or "volitions" in older diction – are the hinge between the inner self and controlled behaviour. On the one hand, they consciously represent some behaviour (and its consequences) and, if it is within the range of our action capacity, they cause this behaviour via a correspondence providing action generating mechanism. The set of options *a* for which it holds that if the subject intends to execute the option *a* then option *a* is realised (by the action generating mechanism) makes up the subject's *freedom of action*; the larger the set the more extended is our freedom of action.[2] On the other hand, for being ours and of value for us, intentions have to come into being in a certain way, which makes up free will or *freedom of decision*. The currently most broadly accepted compatibilist conception of freedom of decision is a rational or reasons approach: A free decision, which establishes the intention, reflects the various options, considers their relevant consequences, evaluates them according to the subject's preferences and integrates all these considerations into a comprehensive valuation, by which the action to be done is chosen. There is much room to consider more or fewer options and more or fewer consequences; the lower limit (= minimal deliberation) are two options, doing *a* or nothing, with only one relevant consequence of *a*. A *rational decision*, among other things, adjusts these quantities (of considered options and their consequences), i.e. the extent of the deliberation, to the decision's importance. For being expressions of our inner self, the deliberation and its result, i.e. the intention, have to be (mostly) conscious.[3]

This traditional conception of action is incompatible with physicalism and eliminativism. However, it is compatible with the presently most common philosophical approaches to the mind-body problem in general and to mental causation in particular: identity

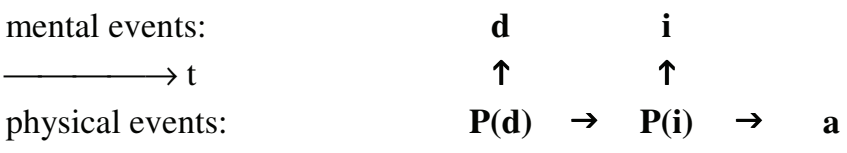
---

[2] This idea is present in many philosophers from Aristotle through Augustine, Ockham, Aquinas, Descartes, Locke, Leibniz, Hume, Kant to contemporary theorists like Fred Adams, Richard Brandt, Bratman, Davidson, Goldman and Mele – to name only a few. The conditional conception of 'freedom of action' can already be found in Locke, Leibniz and Hume.

[3] Elaborations of these ideas and references can be found in: Lumer 2013 (for the "hinge structure" of intentions), Lumer 2005 (for the content of intentions and decisions) and Lumer 2002 (for a rationalist and autonomy conception of free decision).

theory, (a broadly conceived) functionalism, emergentism, interactionism and epiphenomenalism – though in the case of epiphenomenalism the intention can only epiphenomenally "cause" the behaviour, i.e. actually the intention's physiological basis causes the behaviour but the conditional 'if the agent had not had the intention the action would not have been executed' holds. To distinguish this epiphenomenalism in philosophy of mind from other forms of epiphenomenalism I will call it also "*mental epiphenomenalism*". The following discussion of the challenges of Libet's results for the traditional conception of action presupposes that one of the mind-body theories compatible with it is true; here there is no need to determine which one. They all assume that the mental has a physiological basis. The causation of action according to the traditional, intentional-causalist conception of action can then be schematised as in figure 2. Figure 2 represents only the epiphenomenalist version. Similar figures (which might be called "figure 2.a", "figure 2.b" etc. respectively) could be drawn to represent the point of view of the other theories mentioned. The only changes would be that the causal relation between the physiological basis and the intention (i.e. "P(i) ➔ i" of figure 2) would have to be replaced by the identity relation (e.g. "P(i) $=_{pm}$ i" in the fictitious figure 2.a) or the functional relation (e.g. "P(i) $—_{f}$ i" in the fictitious figure 2.b) etc.; the same holds for the relation between the deliberation and its physiological basis. In the following figures, I will continue to draw the mind-body relations only in an epiphenomenalistic way. But these figures should be understood as representing the point of view of the other theories too. The

Fig. 2. Causation of actions, according to intentional causalism (epiphenomenalistically conceived)



→ or ↑= causation
d = (perhaps minimal) deliberation
P(d) = physiological basis of the deliberation
i = forming an intention
P(i) = physiological underpinning of the intention
a = action

problems raised by Libet's experiments remain the same – independently of which particular theory of mental causation is accepted.

Libet's experiments and his interpretation of them, however, suggest a different, though not entirely clear causal order. There are two main interpretations.

Causal interpretation 1: confirming intention: The first and seemingly straightforward interpretation of Libet's findings says that the readiness potential first causes the intention's physical basis (and thereby the intention itself), which then causes the action in the usually assumed way (cf. figure 3). Thus, the intention's physical basis ($P(i)$) may or (more probably) may not be identical to some advanced stage of the readiness potential. According to this interpretation, the impending action is already preselected with the occurrence of the readiness potential and the way to action seems to be (nearly perfectly) paved (Libet 1985: 536); nonetheless, the forming of (the physiological basis of) the intention is a necessary step in the action's causal history. The role of intention in this case probably would be to confirm the unconsciously preselected action (ibid. 538). Libet thinks confirming intention to be one possible interpretation of what he has found – besides the following interpretations (Libet 2004: 142; 145). – Even though in this interpretation the intention is still necessary for acting it no longer functions as a hinge between the inner self and the behaviour because the intention is not the result of a deliberation, which reflects and brings to bear the agent's concerns; freedom of decision is lost – at least if one does not assume the readiness potentials to be the result of some conscious deliberation. – Although the confirming intention interpretation is formally compatible with Libet's findings it is not very plausible. First, the same functional result would be obtained by the possibility of consciously *vetoing* the preselected action (Libet 1985: 538) – which is described below in interpretation 2.b. Vetoing would be more economical, though, which makes the veto theory (i.e. interpretation 2.b) more likely than the confirming intention interpretation. Second, without the observational task, agents probably would not even consciously feel the urge to act (Keller & Heckhausen 1990: 351-354) – what makes it unlikely that such an intention would be a necessary step to action.

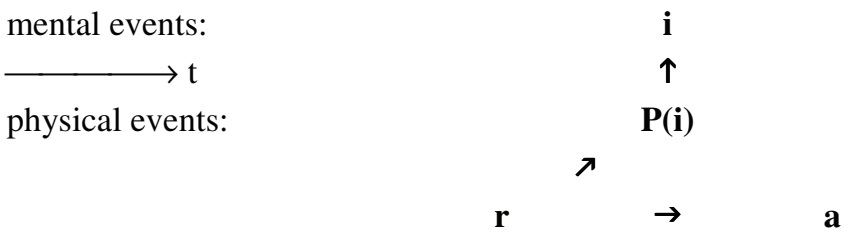
Fig. 3. Interpretation 1 of Libet's experiments: confirming intention

↑or → = causation
r = onset of the readiness potential
i = forming an intention
P(i) = physiological underpinning of the intention
a = action

Causal interpretation 2.a: physical epiphenomenalism: Another causal interpretation of Libet's observations is more likely: physical epiphenomenalism. With the occurrence of the readiness potential the way to action is paved so neatly that the intention has no essential function in causing the action. The intention is only a secondary result of the preparation for action already taking place. It is a by-product, an epiphenomenon of the essential causes for action, i.e. the readiness potential (cf. figure 4); its function may be to inform us about the impending action. Since with this interpretation even the intention's *physiological* basis is an epiphenomenon of the real cause (i.e. the readiness potential) for action this is a different kind of epiphenomenalism than the mental (philosophical) epiphenomenalism described above, i.e. the general theory of mind that mental events are causally infertile. The present form of epiphenomenalism may be called "*physical epiphenomenalism*". If mental epiphenomenalism turns out to be the true general theory of mental causation, physical epiphenomenalism would add a further epiphenomenal relation to the already existing one, thus leading to some sort of double epiphenomenalism; the intention would only be the (mental) epiphenomenon of the (physical) epiphenomenon (i.e. the physiological basis of the intention) of the real cause *r* of action. (In figure 4 "P(i) → i" represents mental epiphenomenalism, whereas "r → P(i)" represents physical epiphenomenalism.) Mental and physical epiphenomenalism are conceptually independent of each other. Libet's experiments may prove physical epiphenomenalism to be true (this remains to be discussed, however); but they say nothing about mental epiphenomenalism, their results are compatible with each of the mind-body theories taken into consideration above, from identity theory to mental epiphenomenalism. (Libet thinks the results of his experiments contribute to the philosophical, metaphysi-

cal discussion of the nature of mind, in particular that they falsify several metaphysical theories of mind, e.g. the identity theory (e.g. Libet 2004: 4-6; 11; 86-87; 158-159; 162-164; 167; 182; 184); but the respective claims rest on confusions, including a confusion of mental and physical epiphenomenalism.) – From the standpoint of intentional causalism, physical epiphenomenalism is still less attractive than the confirming intention interpretation because without the deliberative origin of the intention not only is freedom of decision missing but the causally interpreted freedom of action is missing as well; neither the intention nor its physiological basis play a causal role in bringing about the action.

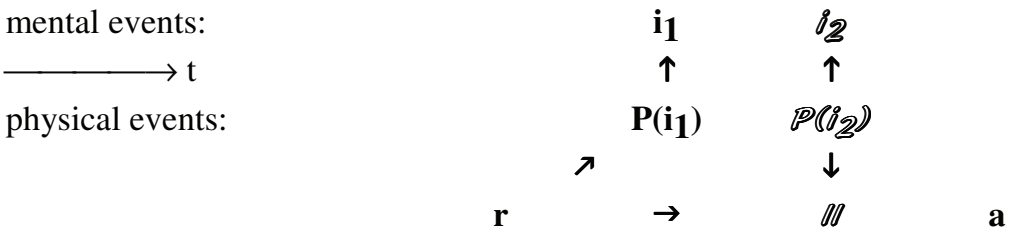
Fig. 4. Interpretation 2.a of Libet's experiments: physical epiphenomenalism



↑ or → or ↗ = causation; other symbols as in fig. 3

Causal interpretation 2.b: veto theory: A further interpretation of Libet's experiments is the "veto theory". The main part of this interpretation is identical to the physical epiphenomenalist interpretation. However, there is an amendment saying that, possibly, there is some *further* but this time negative intention, a veto, which can stop the preparation of action (cf. figure 5). Libet backs this interpretation with his veto experiment. – The veto theory seems to be Libet's causal interpretation of his experiments on spontaneous actions. – Whether the possibility of a veto, from the standpoint of the traditional conception of action, would be an improvement as compared to physical epiphenomenalism depends on the origin of such a veto, whether it is deliberative or not. This has to be seen in the following. But in any case even with the veto interpretation, the system of intentions (positive intention or veto) is deprived of its proposal function and freedom of action is reduced to two options, accepting or vetoing intentions which are unconsciously caused.

Fig. 5. Interpretation 2.b of Libet's experiments: veto theory



↑ or → or ↗or ↓ = causation
r = onset of the readiness potential
i_1 = forming of the first, positive intention
i_2 = forming the second, negative intention
P(i) = physiological underpinning of intention *i*
a = action
|| = interruption of a causal process
shaded signs = possible, not necessary actual process

Many incompatibilists think that because Libet's experiments show the action to be determined already before our conscious willing that this proves that freedom of decision does not exist. This thought, however, first, presupposes incompatibilism – which might be false – and, second and above all, in this general respect the experiments do not show anything radically new beyond what is already known about determinants of our behaviour before from psychology and physiology. On the other hand, several compatibilists argue that since compatibilism does not exclude determinacy and predictability of free decisions – on the contrary most forms of compatibilism even require them – Libet's experiments do not say anything about the existence of free will and responsibility (e.g. Roskies 2011: 15). However, this reaction overlooks the brisance of Libet's findings in the just given interpretation. Of course, in a compatibilist framework, predictability and determinacy of intentions or actions per se are no threat to free will; but certain forms of predictability and determinacy constitute such threats; and the above causal interpretations of Libet's results are among them – as has already been suggested.

According to the confirming intention interpretation (interpretation 1, fig. 3) and according to physical epiphenomenalism (interpretation 2.a, fig. 4), freedom of decision does not exist because the action is determined by the onset of the readiness potential, which also determines the intention, and because the onset of a readiness potential is not apt to procure freedom of decision. The readiness

potential is not apt to do that since, first, it is not a conscious state and hence cannot express the inner self and its concerns, and, second, it does not even represent anything like a rational *un*conscious decision, which integrates the agent's various concerns into his verdict. The (pre-)motor areas and the vertex regions, i.e. the seats of the observed readiness potentials, are not connected to all the other areas containing the already highly processed information necessary for making a rational decision; they are merely executive areas. The (dorsal) prefrontal cortex instead is such a highly connected area and, therefore, considered the most plausible candidate for the physiological place of intention formation (for references see: Passingham & Lau 2006: 61-64). Furthermore, according to physical epiphenomenalism and veto theory (interpretations 2.a and 2.b, fig. 4 and 5), not even freedom of action exists because the intention (or its physiological basis) does not cause or influence and hence does not control the behaviour. And the, perhaps formally existing, freedom of action in the confirming-intention interpretation (interpretation 1) is void because the intention is not free. Finally, the veto (in interpretation 2.b, fig. 5) could maximally provide a *negative* freedom of action. This freedom of action would be reduced to two options, either letting the behaviour (a) already in the offing pass or vetoing it ($\neg a$); and the vetoing instance would not have any influence on designing possible options. Whether or not this negative freedom of action were filled with some freedom of decision would depend on its deliberative basis, of which we have no trace so far. Libet, in later publications, simply assumes that vetoes, though perhaps being based on unconscious processes, are not specified by these processes and are hence free (in a presumed incompatibilist sense) (Libet 2004: 146-147). However, apart from being without any foundation and in contrast with his general theory of mind, this assumed spontaneity of the veto would not be sufficient for a compatibilist freedom of decision because it lacks a deliberative basis.

The preliminary question, however, is: Are these interpretations, in particular the veto interpretation, true? Are they sustained by the data?

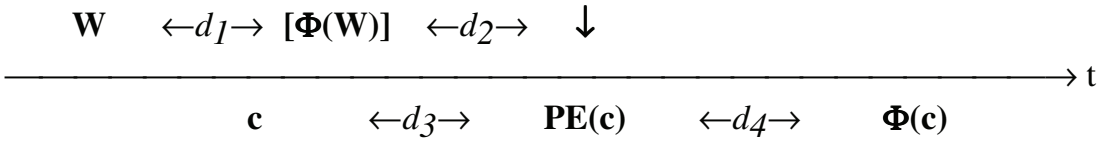
4. Critique of Libet's Experiments and Their Interpretation

There are many criticisms of Libet's experiments and their interpretation. In the following, a systematic overview of the most important of them will be given and some new ones will be added.

4.1. The Time of W – Still Unclear

Even after many years of discussion, the chronological order in Libet's experiments is still unclear.[4] Originally, Libet simply equated the read position of the clock with the time of the intention or urge *W*; this is represented above, in figure 1: "W" is exactly above "c", which means the time of *W* is identical to the time when the clock was in the read off position *c* ($T(W) = T(c)$). But this assumption is too simple and ignores four interfering time intervals and hence four sources of error (although only three of them are de facto relevant). Actually, the following intervals, represented in figure 6, have to be taken into account for calculating the time of *W* from the time read by the subjects (cf. also Dennett 2003: 231-236).

Fig. 6. Calculating the time of W



W = willing, act of will or urge to move
Φ(W) = awareness of the willing (i.e. recognising to have a volition)
c = position of the clock at the moment of the read time
PE(c) = perception of the clock position
Φ(c) = awareness of the clock position

$T(W) = T(c) - d_1 - d_2 + d_3$,
with $T(x)$ being the time of event *x*.

d_1: The first interval Libet neglected is the time between the (conscious) volition or urge *W* and the awareness of this volition

[4] The literature on the timing in Libet's experiments on spontaneous movements and his time-on theory is immense. A good collection which deals with many aspects is: Consciousness and Cognition (2002); the contributions by Bolbecker et al., Breitmeyer, Gomes, Joordens et al., Pockett et al., Trevena & Miller, and van de Grind are particularly interesting.

$\Phi(W)$. Some hold that this interval exists because the urge to move (= W) is different from the realization that one has this urge (=$\Phi(W)$) and because this realization takes some time (Breitmeyer in: Libet 1985: 540; Underwood & Niemi in: Libet 1985: 554; Roskies 2011: 20-21). Usually we are not aware of our conscious intentions; we have them but do not realise that we have them; awareness of the intention is an anomalous hyper-intention (ibid.). In order to calculate the time of the volition this interval has to be subtracted from the read position of the clock. – Now, an intention to move is indeed different from the awareness of this intention; both events are conscious mental states; but the first has the movement (or its valuation) as its content, whereas the second has the mental state of having formed this intention as its content; and the latter, introspective cognition takes time. However, e.g. in reaction time experiments, where subjects have to react as fast as possible to a certain signal, subjects react to the recognition of that signal and not to the meta-cognition of having recognised that signal; this meta-cognition is not requisite for the reaction and would unnecessarily defer it. This might hold for W as well. Roskies has claimed that there is a difference between perception, where the direct reaction is possible, and executive states, where instead first the meta-consciousness is required (Roskies 2011: 21). I see three reasons why this might be so. First, in deciding and in other cognitive operations the mind is actively engaged with another topic, e.g. inquiring which action is best, whereas in perception we can passively but attentively wait for the signal to appear. Second, 'to be the best action' is an abstract concept (in comparison e.g. to 'black dot on the screen'); the activation of such concepts takes place in brain areas which are not directly connected to the motor system; and this may be different from perceptual pattern recognition. Third, fast reactions depend on a learned pattern recognition; since the content of an intention is e.g.: '*a* is the best action', where we first have to find out for *which a* this holds, learning a pattern recognition is impossible here. Be that as it may, there seems to be a difference between reactions to intentions and reactions to perceptual stimuli. This difference comes into play in our case if W is really an intention; then $d_1>0$. If, however, W is an urge to move – and this is the topic of a discussion we will soon address – then to be aware of W (i.e. to recognise: 'I feel an urge to move') is not necessary for voluntarily reacting to W, "Φ(W)" should be deleted from figure 6

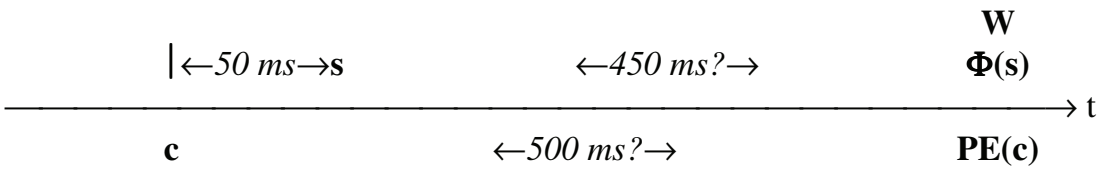
and hence d_1=0, because an urge to move, felt in the finger, is like an exogenous inner perception; we can directly react to the urge instead (recognising e.g. 'there is the urge').

d_2: The second interval to be considered is the interval between the moment of the awareness of *W*, i.e. $\Phi(W)$ (or in case $\Phi(W)$ is not necessary for reacting to *W*: between *W* itself), and the perception of the clock $PE(c)$ (Wasserman in: Libet 1985: 557; Roskies 2011: 20). This time is necessary for changing the object of our awareness (not the object we look at) even if one has stared at the clock the whole time (Underwood & Niemi in: Libet 1985: 555). For calculating the time of the volition from the observed time, this interval, too, has to be subtracted from the read time. (Libet incorrectly holds this interval to be equal to zero (Libet 1985: 560).)

d_3: The third interval to be considered is the time between the clock position *c* and the perception of this clock position $PE(c)$. In order to calculate the time of the volition, this interval has to be *added* to the read time. Originally Libet had ignored this interval; in more recent writings he takes it into consideration and equates it with 50 ms (Libet 2004: 128). He justifies this with an experiment in which a weak skin stimulus (at random times) was delivered to the hand and the subjects had to note and report the clock time of the skin sensation. The reported sensation times showed a (mean) difference of about -50 ms (i.e. slightly earlier) from the actual stimulus times. Libet then applied this difference to the results of his voluntary movement experiments, i.e. for readjusting he added the inverse of these -50 ms to the measured time of *W*, obtaining -200 ms + 50 ms = -150 ms as his final timing of *W* (ibid.). However, this correction is flawed. In the skin stimulus timing experiment the time of an *external* perceptible event has to be determined, and in order to be compared with the clock position it has to cause a signal in the perceptive cells, which is transferred to the brain and then processed to become conscious. In the spontaneous movement experiment instead, the event *W* to be timed is *internal*, i.e. already conscious; the long perception process does not exist or is already over. In timing the skin stimulus (in a way similar to the timing of *W*), the perception time of the skin stimulus has to be initially equated with the perceived position of the clock, where the latter perception process (from the stimulus on the retina to the conscious picture) may take roughly the same time as the stimulus perception process; actually, according to Libet's measurements, the difference is

-50 ms. In timing *W*, however, the *whole* interval of the perception process of the clock reading has to be added to the read time because when the subject becomes conscious of the clock position the indicated time is already delayed by this perception interval. The difference between the two measurements is illustrated in figure 7. The first and third line together represent the timing of *W*, whereas the second and third line together represent the timing of the skin stimulus *s*. The formula for calculating the time of the skin stimulus $T(s)$ ("$T(x)$" means: the time of x) from the read time 'c' (= $T(c)$) is: $T(s) = T(c) + [T(PE(c)) - T(c)] - [T(\Phi(s)) - T(s)]$; whereas the formula for calculating the time of *W* (leaving out the other intervals discussed here) is: $T(W) = T(c) + [T(PE(c)) - T(c)]$. Libet instead, incorrectly, used the first formula for calculating the time of *W*. Libet's general theory of consciousness says that roughly 500 ms are needed for events to become conscious (Libet 2004: 101-102). If this were true, the interval for perceiving the clock position ($T(PE(c)) - T(c)$, i.e. d_3) would last 500 ms. Given that the (mean) read clock time of *W* was -200 ms, this alone (without considering d_1, d_2 and d_4) would lead to timing *W* at +300 ms, i.e. *after* the beginning of the movement. But, given that after *W* a veto could still prevent the movement (and that backward causation is impossible), we run into a contradiction here. The whole theory of timing *W* and of conscious events seems to be fundamentally flawed.

Fig. 7. Timing of W compared to timing of a skin stimulus s



W = willing, urge to move
s = skin stiumulus
Φ(s) = awareness of the skin stimulus
c = position of the clock at the moment of the read time
PE(c) = perception of the clock position

d_4: The fourth interval lies between the perception of the clock $PE(c)$ and the conscious awareness of the clock's position $\Phi(c)$; this time is necessary for recognizing the exact position of the clock (Wasserman in: Libet 1985: 557). But Libet has argued correctly that this interval is irrelevant because in it the informational content (of

the clock's position) does not change, even if this information is consciously available only later on (Libet 1985: 560).

Summarising, we have a chronological order as shown in figure 8. The time of the volition *W* then can be calculated from the read time $T(c)$ via the following corrections: $T(W) = T(c)\text{-}d_1\text{-}d_2\text{+}d_3$ (cf. figure 8.1). For Libet's original simple equation of the read time and the time of *W* to be correct the following must hold: $d_1+d_2=d_3$. If d_1+d_2 were shorter than d_3, *W* would be later than originally assumed by Libet, i.e. later than -200 ms. But if d_1+d_2 were longer than d_3, *W* would be earlier than originally assumed by Libet, i.e. earlier than -200 ms (cf. figure 8.1). Finally, if d_1+d_2 were much longer than d_3, *W* could even occur before the onset of the readiness potential (cf. figure 8.2). This means that, since Libet's experiments do not include measurements of d_1, d_2 and d_3, they do not prove that the unconscious preparation for the action precedes *W*.

Fig. 8.1. Experiment 1, reinterpretation 1

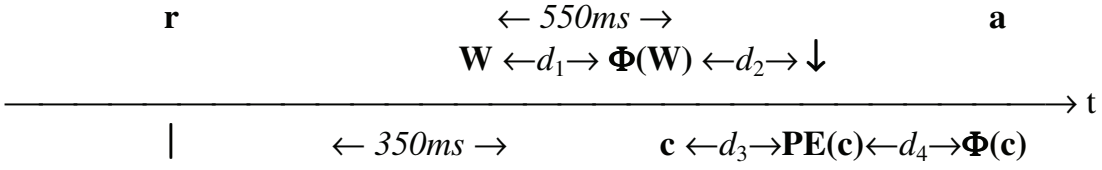
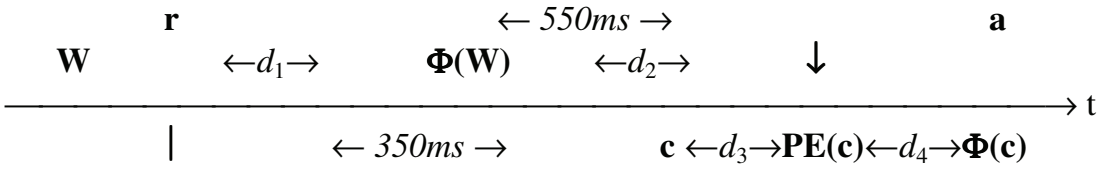


Fig. 8.2. Experiment 1, reinterpretation 2



r = onset of the readiness potential
a = action
W = willing, act of will or urge to move
Φ(W) = awareness of the willing (i.e. recognising to have a volition)
c = position of the clock at the moment of the read time
PE(c) = perception of the clock
Φ(c) = awareness of the clock position

Although Libet assures the accuracy and reliability of his subjects' readings of the time of *W*, reporting that the standard deviations of these times for each subject's 40 trials were close to 20 ms despite their interpersonally different means of *W* (Libet

2004: 128), critics have questioned this reliability, basing their doubts on replications of the experiments for which more detailed data have been published. Since reading the position of a rapidly revolving spot at a given time is a difficult task, as is relating such an event to the onset of one's conscious event *W* (Mele 2011: 29; Dennett 2003: 234-235), there is considerable variability in the reported times of *W*. Haggard and Eimer, e.g. have undertaken a median split of early and late reported times of *W* for each subject and then calculated the means of these two groups. In the *best* case the *means* of the early and the late times were -231 ms and -80 ms respectively (Δ=151 ms); in the worst case they were -940 ms and -4 ms respectively (Δ=936 ms) (Haggard & Eimer 1999: 132; also referred to by: Mele 2011: 29). Pockett & Purdy report similar difficulties for their own measurements (cf. their detailed data: Pockett & Purdy 2011: 40-43), which makes them doubt that it is possible to measure accurately the time of an urge to move (ibid. 38-39).

Another concern about the timing of *W* is that the observation task affects the occurrence and time of *W* itself. Part of the instruction is: observe a rapidly rotating light spot; execute a finger movement; observe your preceding urge or intention to move; then notice and remember the clock's position. These processes interact and prolong each other (Stamm in: Libet 1985: 554), so that – regardless of the measurement problems discussed so far – even a correctly measured and calculated time of *W* cannot represent the usual (without the observational tasks) time of *W*.

The preceding criticisms have at least heavily undermined Libet's hypothesis of the onset of the readiness potential preceding *W*. However, the considered foreruns amount to about maximally --1 sec. If, however, Soon's (Soon et al. 2008) and Haynes' (2011) results about physiologically made "decisions" at already -7 sec and interpretations analogous to those of Libet's experiments turn out to be true, questioning the timing helps little to eliminate the threat to free will. But let us consider further problems of Libet's experiments.[5]

[5] Although the experiments of Soon and Haynes and their co-workers may indeed resolve the timing problem of *W* in Libet's experiments in a very impressive way, they share all the other difficulties of Libet's experiments (see below, subsections 4.2-4.5).

4.2. The Interpretation of W – An Urge but not an Intention

A very critical point of Libet's experiments is the interpretation of *W*. During the experiments the subjects were asked to report "the time of appearance and conscious *awareness of 'wanting' to perform* a given self-initiated movement. The experience was also described as an 'urge' or 'intention' or 'decision' to move, though subjects usually settle for the words 'wanting' or 'urge'" (Libet et al. 1983b: 627). In his later descriptions, however, Libet first describes *W* neutrally, as an "urge, desire, or decision to perform each [...] act", "'urge' or desire" or "urge or intention to move", "urge to move", "urge or decision to move" (Libet 1985: 530; 532; 539), but later and in his final conclusion he interprets the mental event in question as an "intention" (ibid. 529, abstract; 532; 538; 539), "wanting" (ibid. 529, abstract; 532; 533; 534; 535; 539), "will" (ibid. 529, abstract) or "deciding" (ibid. 532) to act or to move, and his central short-cut for it is "W" = wanting to move (ibid. 529, abstract; 532; 533). (Analogous transformations e.g.: Libet 1999: 49.)

Now an urge to do *a* and an intention to do *a* are quite different things. An *intention* to do *a* is a mental state, which is central (i.e. without any inner localisation), executive (i.e. with forming an intention to *a* one has made up one's mind to execute *a* and under certain conditions the intention causes the execution of *a* or a respective attempt), and which reflects the agent's desires, hopefully all desires and in an balanced way. Intentions have the hinge function, mentioned above (sect. 3), by stemming from and representing the agent's desires, on the one hand, and reaching into the outer world by causing the represented behaviour *a*. There are proximal intentions to do *a* right now; and there are distal intentions to do *a* at a given time or under certain conditions in the future; and there are further logical forms of intentions like conditional or general intentions. An *urge* to do *a*, on the other hand, can be felt in the respective effector organs, and often it represents only one (or few) of the agent's desires in a one-sided way and is not yet executive – think of an urge to shout at your boss. They are orientated on proximity and have no complex logical forms. We can take up an urge to do *a* in an intention and thus lend it executive power; but we can also refrain from doing so and reject the urge intentionally.

In order to render Libet's experiments "revolutionary" in action theory and for sustaining the above explained concerns about the inexistence of free will, the (allegedly) powerless event *W* has to be an *intention* and not only an urge to do *a* – because intentions are subject to requirements of freedom of decision but urges are not. Now *W* seems to be only an urge and not a (proximal) intention. Libet's subjects describe it as such; and when imitating Libet's experimental setting, what I felt was an urge to press sensed *in my hand*, hence not an intention but an urge.[6] Pockett & Purdy have confirmed the difference experimentally. Libet's experiment was repeated in an "urge setting", but with a reformulated question: subjects were asked when they felt the "urge" to press the key, the words "wanting" or "decision" were not mentioned. In a "decision setting", subjects had to press a right or left key depending on whether the sum of two figures displayed on a screen (in the center of the Libet clock) was odd or even. Since a different pair of numbers was presented for each trial subjects were forced to form a present intention – and not to rely on some distal intention. In this setting subjects were asked when they had "decided" to press which key. (Pockett & Purdy 2011: 39.) The urge setting roughly replicated what Libet had found. In the decision setting, however, readiness potentials began much later than in the urge setting and were much weaker – sometimes even missing; the individual means of the reported decision times were very close to (immediately after) the means of the onset of the readiness potentials. (Ibid. 39-43.) This means that while the decision setting roughly confirms a temporal order of physiological processes that one would expect for proximal intention formation, the urge / Libet setting was markedly different, thereby disconfirming the hypothesis of the presence of proximal intentions in the Libet setting.

4.3. The Prior Physiological "Determination" of the Action – Not Determining

A necessary premise in Libet's questioning free decision (by physical epiphenomenalism or by confirming intention) is that the readiness potentials – or more generally: circumscribed predictive

[6] Mele has stressed on several occasions that Libet's *W* is an urge and not an intention to act (Mele 2007: 259-260; 2009: 50-51).

physiological events – determine the later conscious decision. In order to be really critical for free will these physiological events (apart from not originating from conscious deliberation) have to determine the decision, if one leaves aside veto cases, by nearly 100%, and if one excludes external interruptions and limited ability, they must also determine the action by nearly 100%. This implies that the predictive accuracy of those physiological events with respect to the conscious decision and action, after excluding the just mentioned exceptions, should be close to 100%. This holds because with a lower accuracy the physiological indicators could represent action tendencies or information about relevant aspects of the action, whereas the real decision on them is taken later and possibly freely. (But keep in mind even a 100% predictability per se, in most compatibilist conceptions of free will, is not an obstacle to free will. A 100% predictable conscious decision is free if it is the result of a good conscious deliberation; and if this decision controls the action, this action is free as well. What is detrimental to free will is only that an unconscious "decision" is taken, which determines the conscious decision without ever passing through an effective conscious deliberation, i.e. the real "decision" is taken unconsciously before and perhaps on an insufficient informational basis.)

Now, we do not know the predictive accuracy of the readiness potentials at all for Libet's experiments. (Backward) recording of the EEGs was triggered only by the movement (more precisely by a positive EMG in the muscle), which means that readiness potentials that did not lead to an action were not registered at all (Libet 2004: 141 f.). Furthermore, finger flexings which were not preceded by a readiness potential could not be detected because the graphs of the readiness potentials were obtained by adding the records of 40 trials (Libet 1985: 530; 535). Hence the seemingly determining effect of the readiness potentials is only a methodical artefact; possible evidences which could disprove the determining power were simply ignored. And there seem to be disproving evidences. In an experiment conducted by Herrmann et al. (2008) subjects had to press a left or right button on an indication given at short notice; in this setting the readiness potentials appeared already earlier than the indication and hence before the action could have been determined. So the readiness potentials in this case may be part of a general preparation or expectation but do not determine the final action. Pockett & Purdy have provided further disproving evidence. In their

replication of Libet's experiment with 390 trials of each of their subjects they identified about 12% of these trials with little EEG noise and in which, nonetheless, no readiness potential is visible; even adding the graphs of this 12% (about 45 trials) did not reveal the typical ramp of a readiness potential, suggesting that at least in these cases there was no readiness potential preceding the urge (Pockett & Purdy 2011: 35-36). (Their hypothesis about this is that readiness potentials arise only with attention to the finger movements; and in the cases without readiness potentials there was simply not enough attention to the movement (ibid. 36).)

Soon et al., on the other hand, have assessed the predictive accuracy of the fMRI identified activation patterns preceding the conscious right-left choice by several seconds. It is nearly 60% in the most predictive area (59.1% at -8 sec and 59.4% at -2 sec in the lateral frontopolar cortex (Soon et al. 2008: 544, read from fig. 2)). Though this is significant at a P=0.05 level, it is not much above chance level, which is 50% in this case, but far from the nearly 100%, required for a determining event. This degree of accuracy leaves ample room for other factors influencing the decision and for the decisive role of the conscious intention itself.

4.4. The Action Type 'Flexing a Finger' – Not Revealing for "Real" Decisions

The paradigmatic action in Libet's and Haggard & Eimer's experiments and in the respective replications was to flex a finger or hand where this flexing had no further relevant effect (apart from the scientific elaboration). The open choice regarded only the time of this flexing and additionally – in the Haggard & Eimer experiment – the side. (Libet 1985: 530; Haggard & Eimer 1999: 129.) Now, these are very particular and insignificant actions. The fears regarding the defunctionalisation of intentions and loss of free will are much less dramatic if restricted to these and similar actions – because of their insignificance, because of the minimal freedom of action and because they already relied on a (possibly rational and free) general distal intention with a vast freedom of action, namely the intention to comply with the experimenter's requests. Although Libet initially admitted that his experiments do not exclude conscious initiation of voluntary actions based on conscious deliberation (Libet et al. 1983b: 641), he later tended to generalise his findings to a very

spectacular result, affirming that the defunctionalisation of intentions holds for *all* actions with proximal intentions (Libet 1985: 532; 1999: 54). Libet does not provide any supporting argument for this generalisation.

The kind of flexions studied are not an appropriate kind of action for experimentally disproving the existence of free will. This holds because freedom of decision – at least according to the prevalent compatibilist conception of freedom – depends on considering and weighing reasons for the identified options. However, in the experiments' paradigm cases there are only very few options, which are unimportant in themselves and without relevant differences between them. So there are no reasons to choose between them (or at least it is hard to identify one); and the respective "decision" is not free even for philosophical reasons. This "decision" instead is open to being "taken" randomly (from reason's perspective) as a consequence of fluctuations in our nervous system. Therefore, the experiments do not rule out that in situations where there are known reasons to choose one way or the other we consider these reasons and decide on this basis without irrational predetermination – as intentional causalism and the compatibilist rationalist model of free decision say (figure 2). (Cf. Roskies 2011: 17-18.)

4.5. The Theory – No Explanation of Decisions

Libet has become famous for his experimental results on spontaneous actions. In addition, he has developed a general theory of consciousness. However, this approach is essentially incomplete when it comes to explaining spontaneous or deliberate actions. It does not say whether the real "decision" is taken by forming the readiness potentials; it does not explain what the function of the readiness potentials is, where the readiness potentials and thereby a perhaps previously taken, real "decision" originate from; and finally, it does not say where and in which way intentions are formed. Even present (2013) day neuropsychology seems to be rather far from providing a comprehensive and confirmed theory about these processes, though, of course, there are many partial (and conflicting) hypotheses. Pockett & Purdy e.g. point out that ramp-like potentials have also been found in very different brain areas which are not connected to voluntary movements; the general function of ramp-

like potentials seems to be related to expectation and anticipation. Pockett & Purdy surmise that this could also be the function of the readiness potentials – and not to prepare or even decide on a movement. (Pockett & Purdy 2011: 37; 40.) In addition, there are many hypotheses on the physiological localisation of intentions or decisions; and the strongest among these, sustained by much experimental evidence, point to the dorsal or lateral prefrontal cortex (list of references: Passingham & Lau 2006: 61) – and not to the motor areas or the vertex.

Complaining about the lack of a theory when faced with strong empirical results seems to be misplaced. But what has caused furore in the case of Libet's experiments was more their far reaching interpretation than the empirical results themselves. And if this interpretation includes an hypothesis on the defunctionalisation of conscious intentions then, to be able to accept this hypothesis, we need an explanation as to where and how the real decisions are formed, because in the end the real decisions may turn out to be still identical to forming an intention. This holds not only for Libet's theoretical hypotheses but also for other approaches which deny or reduce the function of conscious intentions.

A general problem for all these approaches is the *informed decision challenge*: Many of our actions react to rather complex situations with a wide variety of options, e.g. how to reply to a question or respond to a plea for help or to a boss's request to do some unwelcome or barely legal task or what to buy during one's weekly supermarket shopping; and often our actions take initiative independently of the present situation for realising long-term or short-term aims, e.g. buying an expensive consumer product, preparing a new project, newly or rearranging part of one's home. This is simply an empirical feature of our behaviour. Nowadays, naturalist free will deniers consider conscious intentions mostly as a physical epiphenomenon. However, even if we concede for a moment that all the just described actions are initiated unconsciously and not as the effect of conscious intentions, there has to be a kind of "decision" and a brain location where the "decision" takes place and where a great deal of complex information is processed and where, finally, one of the many possible controllable behaviours (or a sequence thereof) is selected. In addition, for arriving at solutions as smart as those we seem to produce by conscious deliberation, the unconscious processing has to make use (at least) of the same

information as the conscious deliberation does. If we can discard the possibility that the two information processing systems work in parallel as evolutionarily implausible, then they must be closely connected, with intentional causalism (including physically non-epiphenomenal mind body relations as they are conceived in the classical theories – identity theory, mental epiphenomenalism etc.) being one possibility for this kind of connection (i.e. the conscious deliberation or its physiological underpinning really makes the contribution to the effective decision it seems to make). In order to rule out this possibility and defend a physical epiphenomenalist conception of conscious decision with unconscious "decisions" as the real determiner of our actions, the naturalist free will denier has to provide a lot of empirical data and theory – which is lacking to date. Below I want to show that the classical, intentional-causalist connection is indeed the most plausible theory.

In any case, Libet's explanations do not master the informed decision challenge. First, the location of "decisions" cannot be that of the readiness potentials, i.e. the motor fields and the vertex of the brain, respectively, because, for one thing, the motor fields do not have sufficient associative connections to regions containing the respective information; hence they cannot integrate this information into a complex decision. For another thing, the single parts of the motor fields are associated with specific motor organs or movements and, therefore, cannot "decide" which of the many possible movements shall be executed. So, the "decision" has to be taken somewhere else, probably in the prefrontal cortex (cf. e.g. Passingham & Lau 2006; Goldberg 2009). Second, if, however, real "decisions" are taken in the frontal cortex the physiological basis of our intentions and mental decisions could be there too; and this reopens the possibility of a significant or even decisive role of conscious decisions and intentions for our actions. Third, given the enormously many options and the huge mass of possible consequences as well as their values which seem to be reflected in our complex actions, and given the high probability that because the wealth of respective information is distributed over various parts of the brain, an integration of all this information into one complex synthesising decision requires a global working place. Since such a global working place seems to be realisable in the best way via consciousness, it is rather likely that complex decisions are made

consciously. (Automatic actions, of course, are subject to quite different conditions and often are initiated unconsciously.)

5. The Power of Intentions – A Revision of Simplistic Versions of Intentional Causalism

One result of the previous discussion was that *W* is only an urge to move and not an intention. However, if there were no intention at all this would make the situation worse than it was depicted by Libet. So, do the actions in Libet's experiments rely on some intention, and if yes where is it? There are two main hypotheses on this question, both making recourse to intentions. *H1: General distal intention:* In Libet's spontaneous movement experiments there are no proximal intentions; there is only a general distal intention to comply with the experimenter's requirements; the single acts then are executed automatically (Keller & Heckhausen 1990; Mele mentions this as a "possibility", though he favours H2: Mele 2007: 269; 2009: 62). *H2: Individual proximal intentions after W:* The urge to move is only taken as an invitation to act; a proximal intention is formed after it; and this proximal intention accepts (or does not accept) this invitation and then activates the motor process. (Mele 2007: 264-265; 268-269; 2009: 57-58; 61-62.)

The main trouble with H2, however, is that there is no empirical evidence for the existence of the claimed proximal intentions. Empirical evidence supports another picture: Sometimes proximal intentions will be formed, but probably only sometimes; and if there is such an intention it is formed only as a response to perceiving the urge to move. In normal cases of spontaneous finger flexing, we neither feel an urge to move nor form a proximal intention. So, mostly H1 is true in Libet's experiments and perhaps sometimes H2.

Keller & Heckhausen confirm this picture by an experiment in which the subjects had again to flex their fingers spontaneously, as in Libet's experiment. However, instead of additionally having to observe wantings or urges they were distracted from finger movements by a backward counting task. When they had actually flexed their finger they were asked whether they had just moved and, if yes, about the respective intention. In most cases, the subjects could not even recall the movement itself and still less an intention, though the readiness potentials were qualitatively the same but

weaker than in Libet's experiments. (Keller & Heckhausen 1990: 351-353.) This makes it plausible that only Libet's observation and timing task induces the perception of an urge to move, which normally is not felt and which may be misinterpreted as present intention. As noticed by Breitmeyer (in: Libet 1985: 539) and as I could observe in myself, if one omits the time reporting task there is no further conscious formation of a proximal intention after having distally planned to spontaneously move one's finger. The resulting actions then feel much more like a tic, i.e. uncontrolled movements, even without a respective urge.

H2 seems to be inspired by a too simplistic common sense picture of actions, according to which actions are always triggered by individual proximal intentions; and intentional causalism may seem to imply this as well. However, we have to distinguish between an intention causing and an intention triggering the respective action. What intentional causalism only requires is that the intention cause the action in a match-ensuring way. And this is also possible, at least in principle, if distal, individual or general intentions cause the actions by structuring some controlling elements of the executive system, whereby the actions are triggered by the agent's perceiving a stimulus which indicates that the situation of execution has come. Now this possibility is an actuality for most of our actions, in particular for very many routines of everyday life like cooking or driving or the finger movements in typewriting. Intuitively this may be hard to accept. However, some experiments show that certain actions which rely on distal intentions cannot have been triggered by proximal intentions. An example familiar to common knowledge is *starting to sprint:* Sprinters perceive the starting shot and begin to run already 50-100 ms after the stimulus (i.e. the starting shot), probably long before being aware of the stimulus, which may occur only 300-500 ms after the stimulus (Libet 1985: 559). (Nonetheless sprinters report that they first heard the shot and then started to run. The explanation for this is: The sprinters were aware of their starting to run, too, only after having started to run.) In this case the agent has formed a distal individual intention to start running after the shot; however, the reaction time is so short that the sprinter did not consciously perceive the signal before starting to run; even less could he form the proximal conscious decision to start to sprint. This is possible because there are secondary, unconscious paths of

processing perceptual information which permit much faster reactions.[7]

However, one may doubt whether sprinters actually perceive the signal so late. There is another example, this time from the laboratory, which excludes this possibility, namely the *Fehrer-Raab effect*. First, a very short subliminal *test-stimulus* is presented to the subjects, e.g. a black disk on a computer screen. Then, with a delay of 10-80 ms after the onset of the test-stimulus, a *masking stimulus*, e.g. a black ring, is presented for a much longer time, e.g. for 126 ms. The delay between the onsets of these two stimuli is called "stimulus onset asynchrony". The chronological order and the durations are such that the subjects will not be aware of the test stimulus; afterwards they report having seen only the masking stimulus, i.e. the ring. Subjects have been instructed, and hence formed the general intention, to press a key as fast as they can after perceiving "the" stimulus. In the test experiment the reaction times were about 160-165 ms after the onset of the – not consciously perceived – test-stimulus, independently of the stimulus onset asynchrony. The reaction times were the same in a control experiment with only *one* stimulus. This means that the reaction times in the test experiment are the same as if the subjects had reacted only to the subliminal stimulus that was not consciously visible to them. (Neumann & Prinz 1987: 201-202 f.) Hence there was no possibility to form a present intention.

Starting to sprint and the Fehrer-Raab effect show that we can "program" ourselves, so to speak, with the help of conditional and individual or general distal intentions to *automatically* execute the intention later on. This makes intentions much more powerful than the simplistic picture of individual proximal intentions would permit because thereby we can react much faster and save the very limited resource of conscious awareness, and it extends the range of our intentions and intentionality considerably. Thus, the intentional-causalist concept of action does not have to be changed: The intention causes the act (in a match-ensuring way), but in a cleverer way than is assumed by common sense, namely by programming ourselves to execute the intention automatically later on.

---

[7] That such unconscious paths are effective is proved by phenomena like blindsight. For a general discussion of the effectiveness of unconscious information processing see e.g. Evans 2010; Libet 2004: 90-99.

This possibility of automaticity also explains the General Distal Intention hypothesis (H1) about Libet's experiments. The general distal intention to follow the experimenter's instruction to repeatedly and spontaneously flex one's finger was sufficient for performing the single flexions automatically without forming individual proximal intentions for each trial.

However, there may be a problem in this explanation. Apart from the various differentiations of types of intentions (individual vs. general, proximal vs. distal etc.), we have to distinguish between fine and coarse intentions. *Fine intentions* describe the intended action as exactly – i.e. fixing the main parameters of the action – as is necessary for that action to be identified and executed by the executive system without conscious specification of further parameters. *Coarse intentions*, on the other hand, do not specify some parameters of the action sufficiently for being identifiable by the executive system. E.g. the time of the action may remain undetermined but likewise the type of movement, e.g. when I intend to buy a certain book and still have not yet established whether I will buy it in a bookstore, online or by phone etc. Goal intentions are usually coarse-grained, implementation intentions often are fine-grained. Now in Libet's experiments the subjects had to move their hands or fingers whenever they felt an urge to do so. This could mean that the time of action in the general distal intentions was not yet specified so that these intentions were only coarse intentions with the parameter "time of execution" left open, which then had to be determined by individual proximal intentions. But in Libet's setting the time is so arbitrary that no kind of rationally justified decision can be taken in this respect. The parameter open at the time of the prior intention is so irrelevant that its specification by means of a (conscious) intention can be renounced. This arbitrariness opens two possibilities. The first is: *E1:* The subject forms the intention to flex her finger when she feels an urge to do so; this is a general distal *fine* intention, which uses the urge as the go signal. (*E1.1:* A variant of this possibility is that the subject initially, after the instruction, forms only a coarse intention, which is specified to an individual proximal fine intention after the first urges; however, when after a few trials, the subject has learned about the urge and the course of events, only then does she form the general distal and fine intention to flex after an urge.) The other possibility is: *E2:* The subject already in the general distal intention leaves the timing to the

executive system, i.e. to unconscious happenings, which here function as a sort of random device (cf. Pockett 2006: 16). If this possibility exists, as seems to be the case, then the executive system is able to carry out this general distal intention without receiving a further parameter specification, which means that the distal intention is already a *fine* intention. Perhaps the first possibility (E1) is more likely in situations with the additional task of observing the beginning of an urge to move and the instruction to flex when one feels this urge to move – as in Libet's experiment –, whereas the second possibility (E2) is more likely with a task to flex spontaneously without observing instructions – as in experiment 1 of Keller & Heckhausen (1990: 351-355). That in such situations our executive system is able to determine the time of action, which from the perspective of the intentional system works like a random device, is a further very powerful extension of the possibilities of our intentional system because it relieves us from the labour of conscious decision in cases where the decision would be (rather) arbitrary and superfluous anyway.

The second experiment of Haggard & Eimer leaves open a further parameter: for each trial, the subjects had to choose (rather) freely which hand to move (Haggard & Eimer 1999: 129). This task however was specified by the instruction to produce roughly equal numbers of left and right hand movements over the entire block and to avoid using obvious patterns such as left, right, left, right (ibid.). As already mentioned above, in qualitative terms the results of this experiment were the same as those of Libet's experiments (ibid. 130 f.). Where are the fine intentions in Haggard & Eimer's experiment? In this case it seems to be less plausible that, in addition to the time of action, the choice of the hand could also be delegated to the executive system, which again would work like a random device. Nonetheless some observations of my own trials confirm this interpretation. It is true that these observations are not representative and their interpretation is somewhat speculative. But on the whole they represent at least a possible interpretation, which is not ruled out by the experiments in question:

1. Choice of the hand by the executive system: Without the task of observing the time of the preparations for the movements these movements again felt like a *tic*, i.e. an uncontrolled spasm not preceded by a singular present intention. This means that in this case there is no proximal intention but at best an urge to act. And it seems

as if the general prior intention could even delegate the choice of the hand to the executive system – in addition to the timing – thus revealing itself as a general fine intention.

2. Causing an urge to move by directing the attention: With the observational task I realized that I directed my attention long before the movement and before a respective urge to one finger. Then an urge arose in the respective finger, subsequently this finger flexed. It looks as if directing the attention was equal to or caused the urge and probably, before that, caused the readiness potential as the physiological basis of this urge. (Often the urge to move the finger was felt for a rather short and constant interval after the singular intention; and this interval might be roughly equal to the interval between the onset of the readiness potential and feeling the urge to move.) However, focusing my attention is not identical to forming an individual distal and fine intention. So I did not form an individual (minimally) distal fine intention. The fine intention in this case was like that in explanation E1: a general distal (at the beginning of the trials) and fine intention to flex after feeling an urge.

3. Additional individual intention for respecting the pattern instruction: The instruction to avoid obvious patterns sometimes led to considered choices of the hand to use. ('Several times consecutively I have used the right finger; now it's time for a change.'; 'in order not to approach the pattern rrrlll I must take the right hand now.' etc.) These choices, again, took place long before observing the urge to move, they led to focussing my attention on the chosen finger, where the urge to move developed (again, probably as the conscious companion of the later phase of the readiness potential), which, finally, led to the flexing. This means, in these cases there is first an individual distal and fine intention to flex a specific finger after an urge to do so. While the side is chosen deliberately, the timing is again left to the executive system.[8]

So, only in the third scenario are there *individual* (minimally) distal fine intentions. In the first and second scenario instead there are general distal fine intentions which leave the timing and the choice of the side to the executive system, although in the second scenario the executive system's "random" choice of the side is again determined by focusing one's attention.

---

[8] Pauen proposes this explanation too (Pauen 2014).

All this means, in Libet's as well as in Haggard & Eimer's experiments the actions are caused by the respective intentions via the match-ensuring mechanism of the executive system. Some peculiarities are only that these intentions were mostly general distal and fine intentions, and additionally left some parameter specification (timing and choice of the side) to the executive system. Because these peculiarities are not included in the folk-psychology of action, several researchers may have been misled to search for and misidentify (individual proximal and fine) intentions where, in fact, they do not exist.

6. Free Decisions – Despite Unconscious Preparation

The explanation just given reduces the processes in Libet's experiment to complete normalcy in terms of intentional causalism – in addition providing some instructive technical amendments to this theory. The whole burden of sustaining the intentional-causalist explanation now rests on the general distal (and fine) intentions, which in order to answer to Libet's challenges have to be free and conscious. Libet does not discuss the freedom of these intentions, but he has developed a general theory of consciousness, the time-on theory (Libet 2004: chs. 2-3; in particular 101-102), whose truth, unfortunately, would again imply the unfreedom of all of our decisions.

The *time-on theory* says: T1: "Conscious and unconscious mental functions differ most importantly in the presence of awareness for the former and the absence of awareness in the latter" (Libet 2004: 101), which implies that the real information processing is done unconsciously; consciousness is only an addition. T2: To produce conscious experience, appropriate brain activities must proceed for a minimum duration of about 500 ms. An unconscious function might be transformed into a conscious one simply by increasing the duration of the appropriate brain activities. Libet formulated hypothesis T2 first for sensory experience only (ibid. 101-102), but then he extended it to all instances of awareness (ibid. 89; 198; 199-200). The exact version of Libet's time-on theory is not very plausible in the light of the results of Libet's own experiments on conscious perception of direct electrical stimulation of the brain: The summarising function of the stimulus train durations shows that

stronger (than threshold) stimuli need less time for reaching awareness and that there is a clear (roughly inversely proportional) functional relation between stimulus strength and duration until awareness (ibid. 41, fig. 2.2.B). So a more plausible interpretation of these brain stimulation experiments seems to be that what is decisive are stimulus strength and duration together which lead to increasing some signal strength or electrical potential etc. until an awareness threshold is exceeded. For the following this correction is irrelevant; what is important is the general idea of consciousness as a process in which the signal strength of an information already present is amplified in some, time consuming, way until the awareness threshold is exceeded. I call this general theory of the physiological production of consciousness the *crescendo theory*, thereby underlining the idea of amplifying the strength of a signal with an already present information. The crescendo theory is a generalisation of the time-on theory, which captures its philosophical gist.

If the crescendo theory of consciousness were true for conscious intentions and if the unconscious signal whose amplification leads to the conscious intention were not already the result of a conscious deliberation, there would not be freedom of decision (according to the rationalist conception of freedom of decision sketched in sect. 3). This holds because the conscious decision would not be an expression of our inner self and an integration of the agent's preferences. The intention would even not be free if the signal at its basis were the result of a kind of unconscious deliberation because still the active participation and control of the inner self would be missing. However, we can see already from these descriptions that not the delay during the process of getting the intention conscious is per se detrimental for freedom, but the lack of a conscious deliberation. And this could be a resort for freedom. With the crescendo theory and without a respective deliberation a (possible) veto would not be free either, and it could not confer some freedom upon the complex of conscious intention and possible veto. Libet assumes that the conscious veto might not require preceding unconscious processes (2004: 146). This, of course, contradicts the crescendo theory; and since Libet does not offer good reasons for this exception I will ignore it. It would not help anyway in a compatibilist framework, though perhaps it could in an incompatibilist picture.

Is the crescendo theory, or more precisely that part of the crescendo theory which speaks of conscious *intentions*, true? First, for intentions it does not seem very likely that the unconscious decision is made rather fast and that the main part of the information processing is dedicated to amplifying the decision's content. If there is such a process of an increase of the electrical potential in the case of intention forming – and not only in perception processes –, given the architecture of our brain and the role of intentions, it seems more likely that the increase of the electrical potential is due to processing various incoming signals and elaborating their content, thereby making "inferences" and the like so that the decision results only at the end.[9] Second, the general crescendo theory is a generalisation of results from experiments with sensory perception, but especially its extension to endogenous mental events is problematic. Philosophers distinguish two directions of fit of mental events, where the content of perceptions should fit to the world, whereas the content of intentions is meant to make the world fit to it. In the case of perception the sensory stimuli are already there and often for a longer time. There is a signal with a given information, which has to be filtered, e.g. in terms of relevance, processed and perhaps brought to consciousness in an elaborated form, fitting to the external facts. The crescendo theory seems exactly to capture this process. For intentions, however, the situation is different. In the studies discussed here, the really "fitting-making" part of the process, i.e. the executive part, which translates the intention's content into efferent signals, movements and, finally, effects in the external world, is more or less neglected. What is studied instead is the formation of the intention itself, i.e. the constitution of the starting point of the process, the determination of the design to which the world should fit. There is no plausible explanation why this determination should have a crescendo form; there is no unconscious ideal decision or the like which has to be depicted or represented in the conscious decision. Instead a new, endogenous decision has to be

[9] A further observation supports this conjecture. The ramp-like 500 ms readiness potentials are present before conscious as well as unconscious actions; hence they cannot serve to make unconscious information conscious. Only the quantitative increase of the readiness potentials seems to make the difference for conscious awareness. (Keller & Heckhausen 1990: 351; 354-356.)

"constructed" by choosing among possible options according to a valuation of these options.

If the intention-regarding part of the crescendo theory is not very plausible, what sense can we make of the various empirical results obtained so far, and in particular what is the role of consciousness in intention forming? Is there room for free intentions? When answering these questions we have to regard the following somewhat generalised empirical findings of Libet. Often intentions or action plans to do some *a* "pop up" in our minds; and these plans are already so elaborated or adapted to the situation that they certainly are the result of a sophisticated unconscious processing but without relying on a preceding conscious deliberation; and very often they are executed rather immediately, though we can veto them, i.e. form an effective negative intention about them. The problems with this constellation were (cf. sect. 3) that freedom of action seems to be reduced to two possibilities (doing or not doing *a*), that the intention or plan does not result from a conscious deliberation and hence is not free; and this verdict may even be extended to the veto. However, I think we can amend this picture by further empirical considerations (not contained in Libet's theory) which restore complete freedom of action and (compatibilist) freedom of decision.

1. Action plan as proposal: The appearing action plan probably is not yet an intention (as urges are not yet intentions); it is a plan, a proposal or, in epistemological terms, an hypothesis, which has to be examined and only eventually, after critical scrutiny, is turned into an intention.

2. Immediate knowledge of the proposal's sense: When such a proposal appears, the agent usually knows its sense – if it has one – immediately, i.e. that with some probability it has a certain positively valued consequence. Accordingly she can consider or immediately discard the action proposal.

3. Universal search for validating an optimality judgement by deliberation: The fact that this proposal is rendered conscious has precisely the function of enabling critical scrutiny. Of course, some unconscious critical scrutiny probably begins already when the proposal is still unconsciously assembled (Dennett 2003: 237); but it will be rather limited. Consciousness, according to a by now widely accepted hypothesis, is the general workplace of the mind which makes information that otherwise would be encapsulated in one

module only universally available (e.g. Baars 1997). And this opens the possibility that the action proposal evokes associative reactions in all interesting parts of the brain, where these reactions may be positive or negative or, what is more important, provide more specific information about the action under consideration.[10] That such a universal information search is necessary for possible intentions, instead of simply making some algorithmic and locally limited steps (like adding 2+2), has to do with the specific content of possibly rational decisions.[11] The result of a rational deliberation can be condensed in an *optimality judgement*: 'Action *a* is the best among the available options', where the 'degree of desirability of an action *a*' is defined in terms of the intrinsic desirability of *a*'s consequences. Such an optimality judgement contains three (somewhat hidden) kinds of generalisations, which cannot positively be demonstrated to be true. (1) The chosen action is better than *all* its (relevant) alternatives. (2) For each option considered *all* the relevant consequences have been taken into account. (3) With respect to the uncertain assumptions about the actions' consequences, the agent does *not* dispose of *any* information which implies a better justified cognition about the same topic. (This negative existential proposition expresses an epistemological requirement for uncertain cognitions, namely that where our database implies contradictory propositions about a topic we should doxastically adopt the one which is better justified on that database.) Since these three generalisations prevent a positive, e.g. deductive proof of the optimality judgement, the open associative search for relevant information regarding these generalisations – i.e. the search for perhaps better alternatives, for (further) relevant consequences, for stronger information regarding the relevant consequences – in all interesting parts of the brain is the best individually available and

[10] Passingham and Lau see the peculiarity of the prefrontal cortex – which is often considered to be the place of intention formation – in combining two features, i.e. being part of the global workplace (it is e.g. the only region that receives inputs from all posterior regions of association cortex) and being the central executive. And because decisions require the integration of all relevant information, which requires the global workplace, they think at least nontrivial intentions are formed there. (Passingham & Lau 2006: 65-68; further literature can be found there too.)

[11] For the following empirical sketch of deliberation see: Lumer 2005: 241-254.

fast substitute for a positive proof, which can improve and validate optimality judgements.[12]

4. Flexible extents of deliberations; the simple cases: Now, the loss resulting from not finding the really best option, or the possible improvement engendered by finding a better option can be dramatic or minor; this depends in part on the importance of the decision to be taken. And because improving an optimality judgement costs time and effort there is a wide array of more or less extended deliberations or considerations of possible actions, where the actually invested effort often (and rationally so) reflects the importance of the decision. Therefore, in the most simple case, when an action proposal "pops" into consciousness this initiates the associative search for relevant information. If no possible negative consequence is found, the mere proposal, on the basis of knowing its positive sense, is transformed into an intention and then executed. The next, a bit more complex, cases are that a further positive consequence is found and, again, the intention and execution follow quite immediately or that a serious negative consequence appears and the proposal is blocked. So the latter kind of "veto" has the form of not proceeding to an intention.

5. More extensive cases: active conscious deliberation: Still more complex cases include a third possibility, apart from execution or vetoing, which was not visible in Libet's experiments, namely to open an active conscious deliberation. This possibility is seized e.g. if the process of open association produces a negative and a positive consequence or only a mildly negative consequence of the action under consideration or if it produces a possibly better alternative. The conscious deliberation then consists of extending the search for consequences or extending the search for better alternatives and evaluating the options found in a more explicit and formal way: How good or bad are the single consequences of an option? What is their

[12] Dennett has made important contributions to explaining the possibility of free decision in the face of Libet's results, which share many features of the present proposal (Dennett 2003: 236-242). The present proposal, however, goes beyond Dennett's explanation e.g. in the following respects. 1. It includes a clear account of the cognitive and freedom as well as autonomy providing function of consciousness. 2. This is based on an explanation of why good decisions need a universal workplace. 3. The proposal provides an explanation of the variability of deliberations, 4. which also permits minimal conscious deliberations for spontaneous actions.

total value? How does this total value compare to that of a given alternative? Of course, deliberation can be extended to any known degree of complexity. Complex deliberation can itself be intentionally driven. A big part of complex deliberation consists in letting one's free associations work to produce further consequences, better options or corrective knowledge regarding the basis of a prediction; intentional deliberation can sustain this process by purposefully imagining the question or relevant concepts. The ideas which eventually emerge are, of course, the fruit of extensive unconscious processing. But they are always only suggestions, again brought to consciousness for being subject to conscious critical scrutiny with the help of criteria for their truth – e.g. propositions about consequences should be implied by information about the circumstances, the envisaged action and empirical laws – and for initiating a free associative search for possible objections. These objections and corrections may include also parts of the decision criteria themselves (Lumer 2009: 241-427; 521-529).

6. Acquiring intentions by deliberation without a decisional act: The transition from an idea of an action to the respective intention does not seem to require an explicit mental act of approving an intention. It seems as if when at the end of the deliberation the necessary information has been collected and approved, the last step to the intention is taken in the form of simply acquiring a *dispositional* intention, so that at a point certain the agent has the background knowledge to have the intention without mentally representing it. This explains why agents can form an intention after deliberation without an explicit act of decision. This makes the possibility of an individual proximal intention after *W* in Libet's experiment on spontaneous acts (H2) somewhat more probable.

This outline of the process of intention formation leaves ample room for freedom of decision and action although most of its conscious steps are based on massive unconscious information processing. So this is a way out of the impasse preordained by the – erroneous – idea that an unconsciously predetermined intention is necessarily unfree. What is decisive for freedom of decision is (1) that the unconsciously generated ideas are subsequently subject to conscious critical scrutiny, (2) that the whole process of intention formation takes the form of a conscious deliberation in search of the best action, i.e. where the pros and cons of the various options are considered and evaluated, and (3) where the agent consciously gives

weight to her concerns. (That an intention is formed as the result of a deliberation in which the single steps are conscious but always preceded by unconscious processing is in itself not detrimental to freedom of decision.) A conscious deliberation takes place even in the most simple forms of decisions, where an action proposal is accompanied by knowledge of the sense of this action, by negative knowledge about negative consequences – despite a respective search – and where at least one alternative, doing nothing, is considered. The complexity of the deliberation can then be increased. Consciousness has three important roles in these processes. It helps to recruit relevant information – new hypotheses about consequences, possible alternatives, other critical aspects etc. – by exposing ideas and questions to the general workplace. It scrutinises hypotheses (of all kinds) by checking them against primary and secondary truth criteria – e.g. is a hypothesis implied by certain premises. And it is the way to bring in the subject's concerns – conscious ideas under certain conditions are expressions of the kernel of the self.

Concluding, it can be said, negatively, that although Libet's experiments and theory are thought provoking, his experiments on spontaneous moves reveal next to nothing about intention formation and little about the processes leading to such moves in the various settings; they leave open too many possible causal interpretations. In particular, in themselves they prove *nothing* regarding the existence or inexistence of a (compatibilistically conceived) free will. Positively however, the amendment of empirically discovered possibilities, like *distal* fine implementation intentions and executive systems which decide on irrelevant leeway in decision-making at random, to intentional causalism extends considerably the realm of behaviour that can be explained as intentional. And the outline in the last section provides a new explanation of the effectiveness and possibly free character of decisions and intentions, based, among others, on various roles of consciousness: comprehensive criticism, universal information retrieval, complex serial algorithmic processing and participation of the self for choosing the personally best action.

ACKNOWLEDGEMENTS: I would like to thank Patrick Haggard, Marc Jeannerod (†) and Hugh McCann for very helpful discussions of an earlier version of this paper.

REFERENCES

Baars, Bernard J. (1997): In the theatre of consciousness. The workspace of the mind. New York: Oxford U.P.

Consciousness and Cognition (2002): Vol. 11, issue 2 (= pp. 141-375).

Dennett, Daniel C. (2003): Freedom Evolves. London: Penguin.

Evans, Jonathan St. B. T. (2010): Thinking Twice. Two minds in one brain. Oxford: Oxford U.P.

Goldberg, Elkhonon (2009): The New Executive Brain. Frontal Lobes in a Complex World. [Revised and Expanded Edition.] Oxford; New York: Oxford U.P.

Haggard, Patrick; Martin Eimer (1999): On the relation between brain potentials and the awareness of voluntary movements. In: Exp. Brain Research 126. 128-133.

Haynes, John-Dylan (2011): Beyond Libet. Long-term Prediction of Free Choices from Neuroimaging Signals. In: Walter Sinnott-Armstrong; Lynn Nadel (eds.): Conscious Will and Responsibility. Oxford; New York: Oxford U.P. 85-96.

Herrmann, Christoph S.; Michael Pauen; Byoung-Kyong Min; Niko A. Busch; Joachim W. Rieger (2008): Analysis of a choice-reaction task yields a new interpretation of Libet's experiments. In: International Journal of Psychophysiology 67. 151-157.

Keller, I.; H[einz] Heckhausen (1990): Readiness potentials preceding spontaneous motor acts. Voluntary vs. involuntary control. In: Electroencephalography and Clinical Neurophysiology 76. 351-361.

Libet, Benjamin (1985): Unconscious cerebral initiative and the role of conscious will in voluntary action. In: Behavioral and Brain Science 8. 529-566.

Libet, Benjamin (1989): Conscious Subjective Experience vs. Unconscious Mental Functions. A Theory of the Cerebral Processes Involved. In: Rodney M. J. Cotterill (ed.): Models of Brain Function. Cambridge [etc.]: Cambridge U.P. 35-49.

Libet, Benjamin (1993): The neural time factor in conscious and unconscious events. In: Experimental and theoretical studies of consciousness 174. 123-146. (Wiley, Chichester: Ciba Foundation Symposium.)

Libet, Benjamin (1999): Do We Have Free Will? In: Benjamin Libet; Anthony Freeman; J. K. B. Sutherland (eds.): The Volitional Brain. Towards a Neuroscience of Free Will. Thorverton: Imprint Academic. 47-57. (Original publication: Journal of Consciousness Studies 6, no. 8/9 (1999). 47-57.)

Libet, Benjamin (2004): Mind Time. The Temporal Factor in Consciousness. Cambridge, MA; London: Harvard U.P.

Libet, Benjamin; Anthony Freeman; J. K. B. Sutherland (eds.) (1999): The Volitional Brain. Towards a Neuroscience of Free Will. Bowling Green: Philosophy Documentation Center. (Originally published in: Journal of Consciousness Studies 6, no. 8/9 (1999).)

Libet, Benjamin; C. A. Gleason; E. W. Wright; D. K. Pearl (1983b): Time of conscious intention to act in relation to onset of cerebral activities (readiness-potentials). The unconscious initiation of a freely voluntary act. In: Brain 106. 623-642.

Libet, Benjamin; E. W. Wright; C. A. Gleason (1982): Readiness-potentials preceding unrestricted 'spontaneous' vs. pre-planned voluntary acts. In: Electroencephalogr. Clin. Neurophysiology 54. 322-335.

Libet, Benjamin; E. W. Wright jr.; C. A. Gleason (1983a): Preparation- or intention-to-act, in relation to pre-event potentials recorded at the vertex. In: Electroencephalogr. Clin. Neurophysiology 56. 367-372.

Lumer, Christoph (2002): Entscheidungsfreiheit. In: Wolfram Hogrebe (ed.): Grenzen und Grenzüberschreitungen. XIX. Deutscher Kongreß für Philosophie, 23.-27. September 2002 in Bonn. Sektionsbeiträge. Bonn: Sinclair Press. 197-207.

Lumer, Christoph (2005): Intentions Are Optimality Beliefs - but Optimizing what? In: Erkenntnis 62. 235-262.

Lumer, Christoph (2009): Rationaler Altruismus. Eine prudentielle Theorie der Rationalität und des Altruismus. 2nd, supplemented ed. Paderborn: mentis.

Lumer, Christoph (2013): The Volitive and the Executive Function of Intentions. In: Philosophical Studies 166. 511-527.

Mele, Alfred R. (2007): Free Will. Action Theory Meets Neuroscience. In: Christoph Lumer; Sandro Nannini (eds.): Intentionality, Deliberation and Autonomy. The Action-Theoretic Basis of Practical Philosophy. Aldershot: Ashgate. 257-272.

Mele, Alfred R. (2009): Effective Intentions. The Power of Conscious Will. Oxford: Oxford U.P.

Mele, Alfred R. (2011): Libet on Free Will. Readiness Potentials, Decisions and Awareness. In: Walter Sinnott-Armstrong; Lynn Nadel (eds.): Conscious Will and Responsibility. Oxford; New York: Oxford U.P. 23-33.

Neumann, Odmar; Wolfgang Prinz (1987): Kognitive Antezedentien von Willkürhandlungen. In: Heinz Heckhausen; Peter M. Gollwitzer; Franz E. Weinert (eds.): Jenseits des Rubikon. Der Wille in den Humanwissenschaften. Berlin [etc.]: Springer. 195-215.

Passingham, Richard E.; Hakwan C. Lau (2006): Free Choice and the Human Brain. In: Susan Pockett; William P. Banks; Shaun Gallagher (eds.): Does Consciousness Cause Behavior? Cambridge, MA: MIT Press. 53-72.

Pauen, Michael (2014): Naturalizing Free Will. Empirical and Conceptual Issues. In this volume.

Pockett, Susan (2006): The Neuroscience of Movement. In: Susan Pockett; William P. Banks; Shaun Gallagher (eds.): Does Consciousness Cause Behavior? Cambridge, MA: MIT Press. 9-24.

Pockett, Susan; Suzanne C. Purdy (2011): Are Voluntary Movements Initiated Preconsciously? The Relationship between Readiness Potentials, Urges and Decisions. In: Walter Sinnott-Armstrong; Lynn Nadel (eds.): Conscious Will and Responsibility. Oxford; New York: Oxford U.P. 34-46.

Roskies, Adina L. (2011): Why Libet's Studies Don't Pose a Threat to Free Will. In: Walter Sinnott-Armstrong; Lynn Nadel (eds.): Conscious Will and Responsibility. Oxford; New York: Oxford U.P. 11-22.

Soon, Chun Siong; Marcel Brass; Hans-Jochen Heinze; John-Dylan Haynes (2008): Unconscious determinants of free decisions in the human brain. In: Nature Neuroscience 11. 543-545.

Trevena, Judy Arnel; Jeff Miller (2002): Cortical Movement Preparation before and after a Conscious Decision to Move. In: Consciousness and Cognition 11. 162-190.

Wegner, Daniel M. (2002): The Illusion of Conscious Will. Cambridge, MA; London: MIT Press.