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#142

Psychological Determinism or Chance: Configural Cerebral Autoselection as a Tertium Quid[1]

Paul Meehl

I begin by responding to two thoughts that I daresay are in the reader's mind, as they were in mine when I debated with myself about accepting the editors' invitation. Is it possible to say anything really new about this ancient problem in the present state of philosophical, neurological, and psychological knowledge? I myself often think that since Jonathan Edwards' great work (Edwards 1754/1969) and the important papers of Hobart (1934), the University of California Associates (1938) and C. D. Broad (1934), very little incisive and illuminating has been done, and hardly anything radically *new*. One might except from this generalization the recent formulations of free action via the concept of a rational second-order value-coherency that is compatible with determinism (see Dworkin 1970, Frankfurt 1971, Neely 1974, Slote 1980, Watson 1975). In connection with rationality and determinism I urge a reading of my paper against Popper (Meehl 1970) which, I fear, Sir Karl has chosen to deal with in a rather cavalier manner, as he did Professor Feigl's and my contribution to the Schilpp volume (Feigl and Meehl 1974, Popper 1974, pp. 1072–1078, and see comments on this by Mackie 1978, pp. 365, 371). I think I may have something refreshingly new to say about the concept of "determining a person to be genuinely free," without an abuse of language; and my speculative neurophysiology does rely on (a) the notion of command neurons, and (b) the Bernstein case in mathematical statistics, neither of which is generally familiar to philosophers.

Secondly, as to the question "Who cares anyway?," one does not know how many philosophers today are compatibilists vs. incompatibilists on the matter of determinism and moral responsibility. But one knows that there are at least some people on the fence who remain troubled by incompatibilist arguments despite

Edwards, Hobart, the California Associates, and perhaps the majority of contemporary language analysts. I myself believe that C. D. Broad makes a very strong case—almost dispositive—against compatibilism. Even at the practical "real-life" level, I know of lawyers and judges—including the highly influential and sophisticated David Bazelon—who accept the incompatibilist view. They think that if criminal conduct were strictly determined by the influence of genes and conditioning on the momentary state of the brain, no ordinary language analysis of words like "can" and "choose" would permit the attribution of blameworthiness (and, hence, punishment as just deserts) to an offender. I don't want to defend this incompatibilist view, about which I hold no firm opinion, but merely wish to indicate that in nonphilosophical circles the old-fashioned traditional stomach ache about freedom and responsibility is still a live one. Readers may wish to consult the collections by Berofsky (1966), Dworkin (1970), Hook (1958), and Lehrer (1966), which I think show that despite varied emphasis and ingenious arguments, the *basic moves* available in the game are extremely limited. So far as I know, the approach taken in the present paper is a genuinely novel one.

My paper is not directed at ordinary language analysis or refutation of the compatibilist position. But since I am going to use some speculative neurophysiology, I have an obligation to answer the kind of objection that says, "Don't talk to me about nerve cells, or about whether they 'can' or 'cannot' do something. Such talk is a category mistake if we are dealing with total actions performed by the whole human person." Now I am not so naive as to think that one can properly refer to one of Mr. Reagan's neurons as being Republican. Nor do I hold the view that the *semantics* of intentional words can be completely rendered in neurologese. However, that one cannot reduce the semantics of 'intending to mail a letter' to statements about single nerve cells is one thing; that my neuronal firing patterns have no *causal* importance in understanding my letter-mailing is quite another thing. The possibility and usefulness of a purely molar (Littman and Rosen 1950) description at the level of action (or phenomenology) does not make the micromachinery irrelevant when concepts like "possible" are under discussion. True, I can know what I mean by saying Mr. Reagan is a Republican without knowing anything about brain cells; I can know how to find out whether he is; I can be sophisticated about the avoidance of category mistakes when relating his Republicanism to his brain cells; but none of these things—about which I take it there would be no argument—permits us to declare independence of *all* statements about his Republicanism from all possible conjunctions of statements about his brain cells. Thus, if asked to predict whether he will be a Republican a year hence, it might be relevant to know whether his brain cells are undergoing senile changes.

There is a view that when we talk about human choices, decisions, intentions, and actions we are, by virtue of having chosen that level of description, emancipated from consequences of a theory of how the head works. This view strikes me as rather like that of some molar behaviorists who, in discussions of the alleged phenomena of latent learning, where one theoretical model for explaining the molar behavior is the possibility of the rat forming stimulus-stimulus connections not mediated by peripheral muscular events, argued that they had *absolutely zero* interest in whether the auditory and visual perception brain areas are internuncially connected, even by a huge bundle of axons. I vividly remember Michael Scriven pointing out to me, when I took this "Iowa-1950" position *arguendo*, that one can no more declare a relevant fact nonrelevant to a theoretical claim than one can decide by fiat that a logically *ir*relevant fact should be counted as part the evidence! Of course if a behaviorism is purely dispositional, as Skinner's approaches being, then the two sets of facts each stand on their own feet; neither is privileged. If there *seems* to be an incompatibility between correctly deducible consequences of generalizations about how the brain is built and generalizations from Skinner box data at the molar level, the only thing one can do is wait around to see which set of generalizations turns out to be incorrect.

This approach will not wash for behaviorism less purely dispositional than Skinner's. Thus, it will not work for Hull's or Tolman's (or, needless to say, for nonbehaviorist entities like Freud's). Both the indefinitely extensible class of brain-facts and that of molar behavior facts are incompletely known, and the latter do not entail the molar theories, they merely tend to corroborate them. So if well-corroborated brain-wiring facts were to render S–S learning antecedently probable, a weakly corroborated molar theory that precludes such learning is suspect. The "facts," as first order generalizations of observations, may (almost, sometimes) speak for themselves; but since the domain of experimental contexts is still rather scantily mapped, "the facts" cannot speak so strongly for one molar theory as to exclude a competitor.

I think, in this connection, of a grandfather clock. A molar behaviorist (or ordinary language analyst) might tell me that he neither needs nor desires to enter into discussion of the clock's innards. But if he complains and expresses mystification about the fact that the grandfather clock tends to run slow in summer and fast in the winter, he shouldn't put his fingers in his ears when I tell him that that's because the brass pendulum follows the physicist's law of linear expansion with increase in temperature, and the period of the pendulum follows Galileo's law of varying as the square root of the length; and therefore, of causal necessity, a grandfather clock being built the way it is built, it is going to run slow when warm and fast when cool.

I don't mean to prove anything substantive by these analogies, but only to motivate the discussion and prepare you to read some speculative neurophysiology in answer to what begins as a seemingly straightforward question at the level of molar behavior and consciousness. At the risk of displaying my philosophical ignorance, I venture to say that the alleged exhaustive dichotomy "determinism/chance" is "frame-analytic" (cf. Meehl 1966, p. 108, fn 1). The exhaustiveness of the dichotomy is surely neither a truth of logic, nor obtainable from one by substituting synonyms (I usually refer to this broader analyticity, that requires semantics, as "Webster-analyticity"). Therefore it must, if it is analytic, be what I call frame analytic. I leave it to the logicians to tell me exactly what that is, but it's obvious that there has to be some such thing if we're to understand physics and mathematics. Now I don't know any way to show that an alleged exhaustive dichotomy is *not* frame analytic when we deal with a loose, nonformalized, and very incomplete "conceptual frame" like psychophysiology. When a dichotomizer claims it is frame analytic, in my experience he usually pushes that by saying, in effect, "Well, tell me what else it could be? If your behavior on a given choice occasion is not strictly determined, then you are saying that it's not a causal function of anything; and that *means* it's a matter of chance, doesn't it?" But my speculative psychophysiology aims to present a fairly simple and consistent alternative. If coherent, this alternative, being clearly *not* chance and clearly *not* determinism, shows that the frame analyticity is an illusion.

I'm going to permit myself free use of the concept of a nomological and assume we all agree—however the future logicians manage to fix it up for us—that some rather basic distinction must be made between nomologicals and accidental universals. The research scientist (say, in a field like psychopharmacology) can't even set up an experiment and discuss its meaning if he can't have a nomological underlying his understanding of counterfactuals. He needs counterfactuals in order to talk about a "control group," to apply his results to advising individual patients in the future, to advocate public health measures, and so on. I am also fairly happy with the notion of causal necessity, because given the fundamental nomologicals, all of the nomologicals that are derivable from them are "necessary" in as strong a sense of necessity as any of us wants or needs, namely, deductive necessity. And the relations between particulars that instantiate those nomologicals are then necessary as well. It goes without saying that a hard-core Humean (are there any? not among scientists I know) who consistently rejects even the faintest whiff of "causal necessity" will find the rest of this paper of no interest, since he should have no moral or political stomach ache about free choice, nor any epistemological worry about the possibility of rational belief, to begin with.

If I am a strict psychophysiological determinist, what does this mean for the ordinary language analysis, whether by Jonathan Edwards or one of the moderns, of the statement, "Jones stole the money, but he could have done otherwise"? Suppose someone pushes incompatibilism by (a) saying he couldn't have done otherwise and (b) invoking Kant's dictum that 'ought' implies 'can.' I suppose the commonest compatibilist reply is to say that whether he's determined or not (i.e., whether or not his behavior instantiates nomologicals), what we *mean* by "can" or "could have" in a molar statement about conduct is something like: "He could have had he chosen to." Here I could examine that gloss on "could have," where we distinguish an act that is impossible because of the mechanical limitations of human musculature, or an act that is impossible because the individual has never learned a certain motor skill, from any of the senses of "possible" that refer to motivations. We say that in ordinary language 'to be unable to do otherwise' means that it would be counternomological in these first two ways (strength or skill) but not in the third (motivational state). Ringing the changes on this one has consumed trainloads of wood pulp, but I cannot perceive most of it as illuminating, nor even as genuinely engaging Broad's rigorous, deep level thesis.

This gloss on the word 'possible' (= can or could) in "He could have done otherwise" does not help me one bit if I am stuck with the incompatibilist dilemma by Kant's principle. Suppose I am a thorough going psychophysiological determinist like Freud or Skinner. One of the strongest meanings of the word 'impossible,' the strongest one I know of other than violating the laws of logic; and the meaning used in common life, in theoretical science, in medicine, and in the law courts—with the same meaning—is that the counterfactual particular contemplated would be counternomological. We say, "That can't happen," because we believe for it to happen would violate the laws of physics or chemistry or biology. That's not quite as bad as violating the laws of logic, but it's pretty bad! It's plenty bad enough to use the word 'impossible' whether in the laboratory, the parlor, or the courtroom. And if for the individual who stole the money to have done otherwise, to have resisted temptation, to have avoided stealing, it would have been necessary for his muscles to do, at the molar level of motion, something that his brain cells *could not* transmit the physically necessary impulses for them to do, given the state of his brain at that time; then for him to resist stealing was impossible in a full-bodied, potent, nonmetaphorical meaning of that term. He is like the grandfather clock who loses time at the molar level because of the way his innards are put together and the hot weather. My objection to the ordinary language dissolution of this problem from Jonathan Edwards (or, for that matter, Calvin, Luther and Augustine) to the moderns is simple: If the gloss on "he could have done otherwise" means he could have done otherwise had he willed to or had he chosen to, or had he wanted to badly enough (inasmuch as he had the necessary conceptual knowledge, motor skills and muscular strength); then the conclusion of these two lines of reasoning is that "under certain circumstances people can do things that are impossible!" Since I find it hard to attach meaning to that sentence, I am, if I'm a consistent physiological determinist, pushed to reject an ordinary language compatibilist gloss on "could have done otherwise." The gloss is more confusing than clarifying. The discussion of this "possible/impossible" problem in the criminal responsibility context by Wilson is the best that has come to my attention (Wilson 1979, Part V) although I cannot quite accept all of it.

So much for the motivation, and now for my speculative psycho-physiology. I first introduce the concept of a "command neuron," known in some earlier writings as "pontifical neuron" or "trigger neuron." This is not a new discovery, the earliest replicable finding of a command neuron being now almost forty years old (Wiersma 1952). For information about the command neuron concept and summaries of experimental evidence corroborating my statements in text following, the reader may consult Grillner and Shik (1975), Hubel and Wiesel (1962), Perkel and Bullock (1969), Rosenbaum (1977), Rosenbaum and Radford (1977), Schiller and Koerner (1971), Wilson (1970), and see summary of concept's status by Kupfermann and Weiss (1978). There are conceptual controversies among neurophysiologists about defining properties at the furry edges of this concept, but they are not relevant here. The basic idea of a command neuron is that it is a single nerve cell which by spiking, either in a series of impulses or in some instances by one single impulse, controls (given a certain background of other neuronal action) a sizeable number of later neurons in the chain to bring about the performance of a complex act, whether motoric or perceptual. Thus, for instance, there is one single command neuron in a certain species of crayfish which, when it spikes (a single pulse!), commands the integrated firing of some 300 neurons that jointly accomplish a complicated defensive reflex in one half of the animal. Command neurons were originally discovered in invertebrates but subsequently found in vertebrates, including cat and monkey. Since they involve microelectrode stimulation methods it is not easy to study them directly in humans, and there isn't consensus among neurophysiologists as to whether there are command neurons in the human, although many believe that there are. There are molar behavior data some take to corroborate the existence of command neurons in the human, and I am going to conjecture that we have them, like our primate relative the monkey. Since my paper is conceptual, aimed at showing the abstract possibility of a state of affairs that is neither deterministic nor chance, I may be allowed to play with this empirical hypothesis, it being a plausible extrapolation not contradicted by present scientific evidence. To give you some idea of how far some neuroscientists are willing to push it, one of the leading neurophysiologists in the world, Dr. Theodore Bullock, when teasingly asked at a symposium, "Surely you don't think that I have a 'Ted Bullock-perceiving' command neuron in my visual system?" replied that he thought that was quite possible, maybe even likely!

For expository purposes I am going to postulate that a certain action has 10 components (never mind whether some are simultaneous and others serially integrated); and that in an acculturated, morally educated and prudential human being, an act like stealing money out of the till when your employer isn't looking involves 10 such components; and that each of these components is subject to inhibition by one command neuron. I am going to set aside Freudian parapraxes, whereby an abortive act is performed as a result of mental conflict. I'm going to postulate that the remainder of the cerebral system, whose complicated neural networks (both wired genetically and acquired by learning) are the cerebral subsystems for money-lust, fear of jail, recalling your Sunday school lessons, and whatever else enters into the picture, is strictly deterministic, although I think nothing crucial to my discussion hinges upon that simplification. Given a momentary cerebral state produced by perception of the money, hearing the employer slam the door as he leaves for the afternoon and the like, and the recent memory of one's wife saying this morning she would like a mink coat if we could afford it, and so forth; then if there *were* no such inhibitory command neurons, the rest of the system would run off in a certain predictable way in accordance with the nomologicals, leading either to stealing the money or resisting temptation, as the case may be. Note that I am *not* locating the brain's "prudential (or moral) engrams" in these command neurons. The prudential and ethical memory banks are located elsewhere; and it is only when they are activated in a suitable deterministic way that the command neurons even enter into the system. I will say more about that later.

Secondly, I'm going to conjecture the existence of genuine quantum indeterminacy of some, although not all, brain events. The presynaptic cells that synapse on the command neurons may be the locus of that quantum indeterminacy; or it may be that at the individual synaptic knobs which stimulate a command neuron there is a sort of "local outcome" uncertainty in the synaptic space events.

Now imagine a series of temptations of, say, 10 occasions over the course of the year when the individual is tempted to steal out of the till. Let us impose some indeterministic restrictions (that sounds funny but it's what I mean) on the events involved. Considering an individual command neuron on 10 successive occasions, assume it fires or not at random, although a run this short wouldn't suffice to *show* that it satisfies Mises' criterion of randomness. It has probability each time $p = 1/2$ of spiking, and that probability does not depend on any place selection. Further, the Utopian biophysicist, after studying the local circumstances at the terminal button, tells us that the distances, energies, and times involved are of such an order of magnitude as to be possibly quantum uncertain, so he would not be surprised to find they are statistically indeterminate. The question whether quantum indeterminacy at the synapse plays a significant role in molar behavior remains unanswered, although Hecht's half-century old conjecture (Hecht 1934) that it could do so at the retinal receptor element seems generally accepted. For discussion pro and con of its "behavioral" relevance see Eccles (1951), Eccles (1953, pp. 271–286), Eddington (1929, pp. 310–315), Eddington

1935, pp. 86–91), Eddington (1939, pp. 179–184), Jordan (1955, pp. 108–113), London (1952), Pirenne and Marriott (1959), Ratliff (1962). For criticism of the notion that quantum-indeterminacy at the single-unit microlevel could be relevant to psychological determinism at the level of molar behavior and experience see Grünbaum (1953), Popper (1966, pp. 13–14), Schroedinger (1951, pp. 58–64), and Stebbing (1937, pp. 141–242). Unfortunately the terms 'quantum' and even 'quantum hypothesis' have been, used by neurophysiologists to denote certain conjectures concerning the amounts and step-functional effects of transmitter substance released at the synaptic interface, which would seem only remotely related, if at all, to the indeterminacy question. Since the present paper concerns conceptual analysis (as bearing on certain metaphysical arguments), I permit myself the assumption *arguendo*, that genuine Heisenbergian quantum indeterminacy obtains for some—we need not say all, or even most—synaptic events. That is, of course, an empirical question, not settled on present evidence.

We find further that there is pairwise independence between the local events, that is, the depolarizing inputs from the precommand cells. On those occasions *when the command neurons are in the system at all* the molar outcome is unpredictable and the sequence of response attributes "steal/not steal" satisfies Mises' criterion. So everything appears to be chance—until we reflect on the astounding fact that the 10 command neurons always act in concert. That is, there are no Freudian parapraxes or abortive actions, so that while we never know what will happen at a particular locus, and we cannot tell from what happens, at locus A on command neuron I what will happen on locus B of command neuron X, we do know that if command neuron I spikes, so does command neuron X, and so do all eight of the others. So what we have is a radical indeterminacy (not due to ignorance —I'm talking about an ontological indeterminacy of the kind physicists believe in) at the level of the local synaptic events, as well as a complete indeterminacy at the molar level of action, provided that the actions studied are those in which the command neurons have been in the system at all. So that everything would look like a big random mess of quantum uncertain events, except for the astonishing fact that the command neurons always act configurally. That is, in concert they manifest a kind of joint intentionality with respect to their "necessary cooperation in the integrated outcome," so that the ten part actions are either all performed (when I steal), or all inhibited (when I resist the temptation). Such a system is clearly not determined, at either the micro or molar level; but it seems equally clear that it is not "pure chance." With ten command neurons operating, each of which has a random firing probability of 1/2 on any one occasion, when all spike or all fall to spike, we are already past the traditional statistician's .01 significance level ($p < 10^{-3}$); and for such patterning to happen on ten occasions over the course of a year has a probability that is minuscule.

On our antecedent knowledge that the spike probability for each neuron, given a concurrent brain state sufficient to throw the command neurons "into the system," is and remains at $p = 1/2$, an occurrence of ten firing in concert shows that something nonrandom—something patterned, orderly, "configural"—is taking place. Even a single such coherent occasion might legitimate such an inference of nonrandomness at a statistical significance level customary in the life sciences, the probability of coordinated firing on the chance model being 2^{-10}. In this extreme case, we do not need to know anything about the effector events controlled (in this case inhibitorily) by the neuron to make a "non-chance" inference. *A fortiori*, we need not know how the achievement response class (MacCorquodale and Meehl 1954, pp. 218–231)—the instrumental molar act—corresponding to that disjunction of effector movements is socially, legally or ethically categorized. A totally non-ethical cognizer from Saturn would be able to recognize the statistical evidence for a nonrandom, configural, "patterned" process. However, it is also true in this simple, clear case that having made the identification of the 10-spike event as highly unlikely on a chance basis, one can then go on, if he *has* the available action semantics, to characterize the molar outcome that is closely correlated with the (neurally necessitated) effector activities. The conjoint event is in itself "non-chance," but is also "non-chance *such that*...[achievement-characterized R-class]..."

A more interesting case is the following: There are 10 command neurons, 6 of which activate certain components (whether simultaneous or sequential) of a complex molar action, and 4 of which inhibit effector-patterns that would interfere—perhaps the 4 components of an "alternative action" at the molar level. On a particular occasion, the Utopian neurophysiologist observes a 6:4 split as to spiking, a split very close to the chance expected value. Neither expected value or mode is appreciably larger than this one. So there would be no basis to infer anything "systematic" (non-chance) if we consider only the firing pattern of the command neurons on this occasion. However, if we supplement our microphysiological knowledge with information about the effectors thus controlled, and can also characterize the effector pattern in terms of an achievement class (e.g., stealing, speaking French, apologizing) we can discern the configurality at the command neuron level, *but only by reference to the molar action outcome, intentionally characterized*. So this is an interesting case philosophically. The Utopian physiologist takes note that if any one of those that fired, or refrained from firing, on the particular occasion of a 6:4 split under study, had performed the other way, a "nonsense" action, like a fumbling or an aphasic outburst or a parapraxis, would have occurred. The reasoning here is very like the geneticist's in recognizing a "nonsense coding" that takes place when even a single base in the codon triplet (say, thymine) is replaced by adenine, out of a string of two or three hundred triplets, each designating an amino acid, coded to control the synthesis of a particular polypeptide chain. A nonsense code makes a nonsense protein; which means, in turn, one that doesn't "do its job" in the metabolism of the cell.

It is worth noting that what kind of conceptual equipment the Utopian physiologist must possess to discern this, if he comes from Alpha Centauri, varies with the action-domain under scrutiny. It is possible to recognize some effector sequences as instrumental nonsense acts without employing ethical or social categories. For instance, a rat does something with some of his muscles that leads to the lever not being pressed, although the rest of the musculature does what it usually does, effector sequences that would get the lever down except for this one aberrant subsequence. In other cases, the "nonsense" would be discernible only by reference to higher level social concepts, such as the economic, legal or moral significance of the instrumental action.

Consider an introspective account where one says, "I chose freely, after reflecting on the pros and cons, being influenced one way by my desire for the money and, opposing this, by moral and prudential reasons against stealing it." The corresponding brain state should presumably involve a causal dependency of the command neurons' functioning, or their being in the system at all, on activation of prudential and ethical memory banks. Let us suppose there is a "scanning" cerebral subsystem that plays a critical role in putting and keeping the command neurons "in the system." It is not Utopian (merely improving existing single unit stimulation and recording techniques) to ascertain what happens if artificial means are employed to suppress activity in the ethical and prudential memory banks, or to interfere with the scanning subsystem's operations. Suppose we find that on the subset of occasions when such artificial interference prevents the counterconsiderations from even being available—cerebral tokenings of the argument sentences cannot neurophysiologically occur—the money motive always wins out, because the command neurons do not show their "normal" activity of inhibiting on half the occasions. I suggest that this is a plausible account of what, at the molar behavior and phenomenological level, we mean when we say that radical, existential freedom of choice in non-trivial situations involves the weighing of alternatives, the evaluating of reasons, the computing of utilities, the counterbalancing of motives, and the like. It would be incorrect to make the too-easy inference, found in Hobart and Jonathan Edwards, that *if* these counterconsiderations play a significant "influencing" role, *therefore* they must determine the outcome. It is true that these considerations (I prefer to say, "The cerebral events that are tokenings of sentences expressing the considerations") must play a significant influencing role if we have a kind of indeterminism that is affirmatively meaningful as a form of personal freedom, a real choosing. What they determine is that the outcome is indeterminate. That is shown by showing that preventing their usual activity, while leaving the rest of the cerebral system to run off as it normally would, yields a molar choice stealing probability no longer 1/2 but $p = 1$. On such occasions, the behavior is consistently "controlled by the strongest motive," the money drive, no countermotive being available.

After Hobart's powerful "If my action is not determined by my character, it is not *my* actions, and I am not responsible, capable of blame or regret.…" I think the next strongest (but, as I hope to show, rebuttable) objection to radical free will, as I used to hear it from Professor Feigl and other positivist colleagues, goes like this: "Look, the action is either determined, or it is a matter of chance. You *either* behave as you do because of a combination of internal and external causes (including your acquired cognitive and motivational dispositions, considered as causal), *or* you respond at random. You can't have it any other way, because there *is* no other way." When this plausible molar dichotomy is reduced to conjectural brain models, it still seems seductive to most philosophers and psychologists. When I talk about command neurons and indeterminacy they reply with, "Well, you still are trying to have it both ways. If the local micro-event is truly quantum indeterminate—that is, it's a chance happening—then no matter how you wire things up and no matter how many such local synaptic outcomes you consider, you still get a big random mess; you are trying to have your cake and eat it too, by alleging that the micro-events are, both epistemologically and ontologically, indeterminate. Yet somehow you want to claim the macro-event is not merely a big random cascade effect, like the final distribution of marbles at the bottom of a Galton Board. That's inconsistent of you. If the component events are random, then the whole thing is random, however cleverly you fiddle with ways of describing that make it appear otherwise."

Now this, plausible as it sounds, is mistaken. It is presented as analytic—as a *conceptual* dichotomy, not requiring empirical data. As a conceptual dichotomy, it must rely on formal or semantic implications of the concepts "random" and "independent." There are three purely formal (mathematical) truths that all contradict such a dichotomist thesis, although in different ways at different levels of analysis:

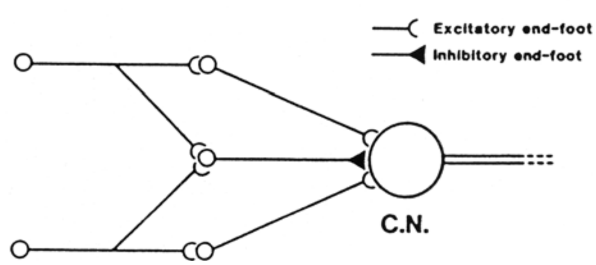
1. Given $p(E_1/C_1) = 1/2$ and $p(E_2/C_2) = 1/2$ (even if $C_1 \leftrightarrow C_2$) then any correlation $[-1 \leq \varphi\ (E_1E_2) \leq +1]$ may be assigned without contradiction.

2. Pairwise independence of events does not entail total configural independence within the system (Bernstein's Theorem, Cramér, 1946, p. 162; Feller, 1957, p. 117).

3. Numerical values of pairwise dependencies among *non*-independent events do not suffice to deduce the values of higher-order dependencies by adding probability increments. There can be interaction effects, as recognized in standard analysis of variance formulas, the extreme, "pure configural" case being where significant interaction terms exist despite absence of an overall main effect.

The first of these principles assures us that the 10 command neurons may regularly fire (or not-fire) "in concert," despite each one's firing being indeterminate at

Fig. 1

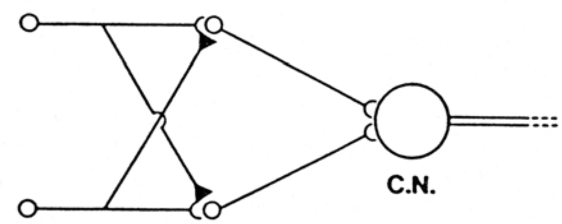


$p = 1/2$, this p-value remaining constant over an indefinitely extended time-sequence of occasions. This suffices to refute the determinism/chance dichotomist. The other two principles are helpful when we examine various *presynaptic deterministic* cases. Consider the situation in Figure 1. Here the command neuron ("C.N.") is controlled by input from three presynaptic neurons, two excitatory and one inhibitory. One excitatory input suffices to fire C.N., if not inhibited. The three are in turn controlled by two "first-order presynaptic" neurons earlier in the chain. Assume the inhibitory neuron requires simultaneous inputs from both first-order initiators to spike.

Given these assumptions, the wiring entails that if either first-order neuron fires, C.N. fires; but if both initiators fire, C.N. does not fire, because the inhibitory neuron prevents it. Figure 2 shows another way to get this result by cross-inhibition on the second-order neurons. Empirical examples like these have been reported.

Assume that, given the extra-command neuron cerebral state necessary and sufficient to put the command neurons into the system, the input neurons each

Fig. 2



have indeterminate firing probability $p = 1/2$ and their fire-probabilities are independent. This implies that the command neuron fires half the time. Suppose the same values obtain for the other nine command neurons. Then each of the presynaptic events is indeterminate at $p = 1/2$; each pair of presynaptic events is independent, whether they are on the same or different command neurons; each trial is independent of preceding trials; but a *tetrad* of presynaptic events associated with only *two* command neurons is not configurally independent, given our constraint that the command neurons fire "in concert."

While formally possible, case I may strike you as far-fetched. Case II (Figure 3) is less "rigged"-appearing. Here also, the command neurons fire deterministically as a function of their (indeterministic) inputs, iff 2–3 loci (+). The local events on each C.N. are pairwise and three-wise independent ($p = 1/2$). Table 1 shows the eight event-patterns, and the resulting "fire"/"not-fire" outcome on each. From the (2+) input firing condition we compute that the firing probability conditional on a (+) at any locus is .75; and the inverse probability (that a locus is (+), conditional on command neuron firing) is also .75. The conditional probability of locus a_{II} on CN-II being (+), given that locus a_I on CN-I is (+), is then $(.75)^2 = .5625$, an increment of only .0625 over the unconditional $p = 1/2$ at the locus. This increment is

Table 1

INPUT STATE a	b	c	C.N. fires?
+	+	+	+
+	+	–	+
+	–	+	+
+	–	–	–
–	+	+	+
–	+	–	–
–	–	+	–
–	–	–	–

$p_I(F) = .50$

$p_I(F/a^+) = .75$

$p_I(F/b^+) = .75$

$p_{II}(F) = .50$

$p_{II}(a^+/F) = .75$

$p_{II}(b^+/a^+) = .50$

$p(a_{II}^+/a_I^+) = (.75)^2 = .5625$

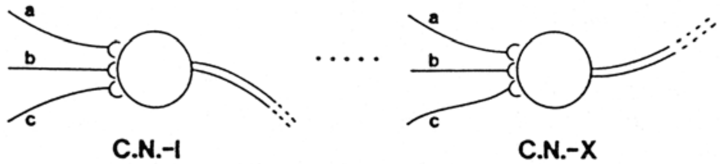
Increment $\triangle$ p = .0625 “Main Effect”

But due to “in concert” constraint on C.N.’s,

$p(b_{II}^+/a_I^+\, b_I^+\, a_{II}^-) = 1$

what conventional Fisherian statistics calls a “main effect.” If a statistician were required to guess the probability of a local event (say b_{II}) on CN-II being (+), conditional upon (+) events a_I^+ b_I^+ on CN-I together with (–) event a_{II}^- on CN-II, he would reason thus: “There’s a main effect of .0625 from each (+) event, and a reasonable guess is approximate main effect additivity—if this stuff acts anything like agronomy or medicine. Since pairwise independence obtains between loci on each C.N., there is no reason to think that conjoining the (–) event a_{II}^- alters the b_{II}^- probability. So (recognizing that I'm guessing) I predict the $p(b_{II}^+/ a_I^+\ b_I^-/ a_{II}^-)$ at around .0625, which I get by simply adding the two main effect increments." But this value is way off the mark, because the condition $(a_I^+\ b_I^+)$ fires CN-I for sure,

Fig. 3

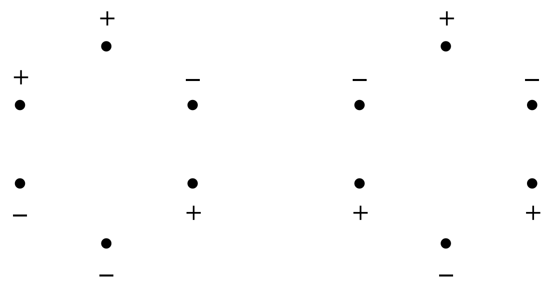


so if CN-I and CN-II always fire in concert, this requires two (+) loci on CN-II; but locus a_{II} is negative, hence both remaining loci b_{II}, c_{II} must be (+).

Case III (Figure 4) is one I concocted 35 years ago during an argument with Professors Feigl and Sellars in the early days of the Minnesota Center for Philosophy of Science. (Previous published treatments appear in Meehl 1958, pp. 213–225, 328–338, Meehl 1966, pp. 122–124, and Meehl 1978, pp. 386–390 and *passim*.) There are six loci, each has a (+) probability $p = 1/2$, and the controllee neuron fires iff two or more *adjacent* loci are (+), very like neurons do respond. So Pattern A spikes the command neuron and Pattern B does not. Suppose exactly half the loci are (+) on each occasion. Then we cannot have pairwise independence between one command neuron's inputs (as in cases I and II). But we can have pairwise independence between local inputs on *different* command neurons (unlike case II). Note that by adjusting the p values we can set the controllee neuron's spike-probability anywhere in the closed interval [0, 1], despite *all* the local outcomes being strictly indeterminate at $p = 1/2$, Mises' criterion holding over the long run for each.

Suppose it happens that my fellow clerk (Figure 5) over the series of occasions when he perceives that I am tempted, sometimes tries to influence my conduct by purely moral appeals, and sometimes relies on prudential ones. For easy arithmetic, suppose the relative frequency of these two approaches is one half, although you will see in a moment that nothing qualitative hinges upon an even split. Assume that I

Fig. 4

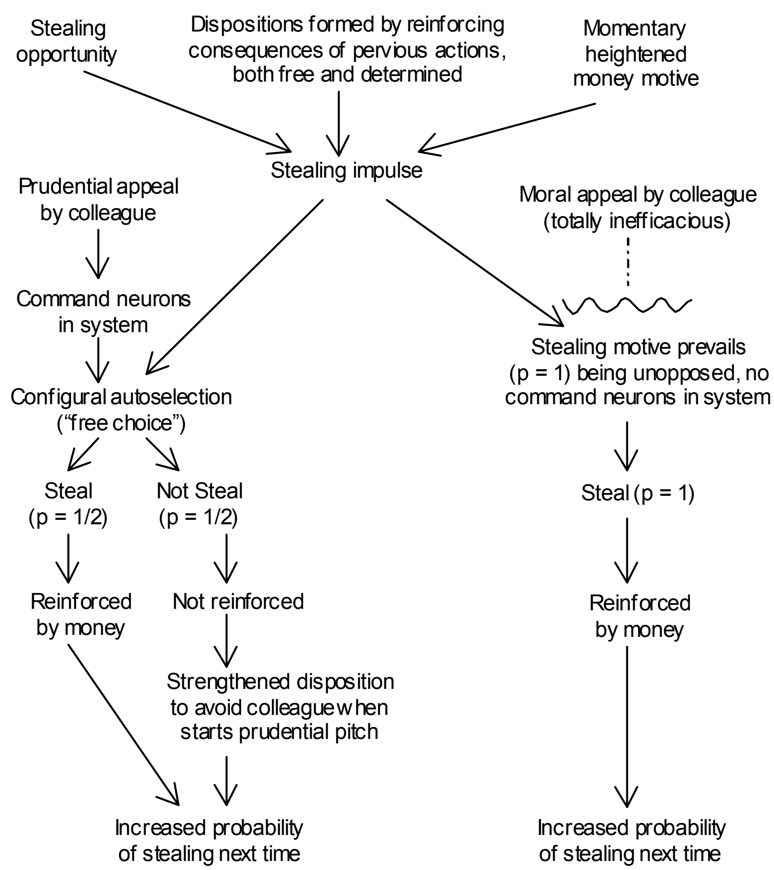


Pattern A Pattern B

am (deterministically) disposed to respond only to prudential arguments, being completely cold to moral ones. So the deterministic cerebral state throws the command neurons into the system only on the occasions of a prudential argument. On the other half of the occasions, faced with the totally inefficacious moral appeal, I deterministically follow the stealing motive. Among the remaining half of the occasions, acting under the influence of the efficacious prudential arguments, the command neurons are in the system and (indeterministically) inhibit stealing half the time. So that over the long run I succumb to the stealing temptation 75% of the time. Among those succumbing occasions, the Utopian neurophysiologist knows that two out of three of them were determined, and the remaining third were free. In 25% of the total series of occasions, I refrain from stealing, all of those taking place under the influence of the prudential arguments. I submit that it is then literally correct to characterize my dispositions as we ordinarily would: We may properly say that Meehl is often tempted to steal; that he is uninfluencable by moral considerations when so tempted; that he is, however, influencable by prudential arguments; that when so influenced he successfully resists temptation half the time; and on those occasions when he is acting under the prudential appeal influence—choosing sometimes to steal and sometimes to refrain—either way, his choice is radically free.

To the preceding conjectural brain models (presupposing the general philosophical points made at the beginning about counternomological impossibility and ordinary language analysis), a critic advances the following: “This is all very interesting, and especially illuminating as to the dichotomist position, which I am prepared to

Figure 5



grant you’ve shown to be false by constructing an internally consistent and plausible alternative to either determinism or pure chance. But I am unpersuaded that it will reassure the freewillite, or, *a fortiori*, the incompatibilist. Their original objection to determinism was that I ‘cannot’ refrain from stealing because for me to refrain would involve counternomological events in my brain, and counternomological events are *impossible*, in the strong strict literal meaning of that term. Your analysis disposes of the ordinary language gloss on 'could have done otherwise' and related expressions. As you say, it is difficult to attach any meaning to the sentence, 'Jones could have done otherwise, although the brain events involved in his actual doings and decidings, being necessarily determined in accordance with the nomologicals, were the only ones physiologically possible.' So I agree with your criticism that when the ordinary language gloss on 'He could have done otherwise' combines with a proper analysis of *possibility* in terms of nomologicals, the conclusory statement is that 'sometimes people can do things that are impossible,' and I don't countenance that statement, which, like you, I consider absurd. The incompatibilist who wants us to hold a thief nonaccountable or nonblameworthy appeals in the determinist frame to the impossibility of his having done otherwise, because he is, so to speak, merely the victim of what his neurons were (deterministically) doing. Now on your analysis he cannot say he was the victim of the deterministic action of his neurons, but surely he can still say he is the victim of his command neurons, which are firing randomly. That is, we are holding him accountable for something that is the molar outcome of a sequence of random cerebral micro-events. The thief can say to us, 'Look, we were originally troubled by your considering me a free moral agent—hence an accountable and blameworthy individual—for doing something that ordinary language says I could have refrained from doing. We rejected that ordinary language claim on the grounds that, according to determinism, for my brain cells to have fired otherwise than they did would have been nomologically impossible. You have substituted the notion that for my brain cells to have fired otherwise would have been nomologically possible, but that they fired the way they did was a chance affair. It's as if the molar action I finally perform—despite my performing it following reflection on the arguments of my fellow clerk, whether prudential or ethical—still, at that last critical stage, depends upon the outcome of the spinning of ten little organic roulette wheels in my head. I fail to see why that should give any reassurance to an advocate of free will. Why should it leave me any less exculpable than if, instead of being little roulette wheels, they were little preset clocks? For the final choice—I repeat, following upon my deliberations, considering the arguments delicately balanced on the existential knife edge—to be a matter of chance doesn't seem preferable over the original case where we had the deterministic stomach ache about freedom.'"

Now this is a powerful objection, and it remains pretty impressive even when we correct the objector by pointing out that he is not quite entitled to say that what happened in the command neurons is literally a matter of "chance." In our conjectural brain model, while *individually* the command cells act as if by chance, and a subsequence of the molar sequence of temptation occasions satisfies Mises' criterion, yet the "total cerebral event" involved in the choosing is seen *not* to be a matter of chance, because of the clearly "non-chance" patterned coherence of the several (local) outcomes. This is especially clear when what the non-chance pattern of that configural outcome at ten loci *has to be* (teleonomically) is inferred by considering significant social or moral properties of the final effector event defined as a molar achievement class.

Before meeting the objection head on, we may inquire as to what is the meaning of 'chance' that we think the consistent incompatibilist freewillite, given his original objections to determinism, ought to find equally objectionable here? The over-interpretation of 'chance' in this setting—and we don't know whether the critic is over-interpreting unless we press him to expand it further, but the passage above sounds suspiciously as though he is—is the connotation we dislike in such verbal correlatives as 'capricious,' 'meaningless,' 'blind,' 'unreasoning,' 'unmotivated,' 'without regard for such things as reasons or anticipated consequences,' and, perhaps the best word here, '*unintentional*.' Now to think properly about this we must parse the concept labelled 'chance' or 'random,' and ask which of the different (and, in most ordinary contexts, closely correlated) meanings apply.

The first "chancy" condition in the model is local unpredictability at the individual synapse, which we are postulating as present for quantum physics reasons. So the individual elements of the cerebral event are, by that definition, a matter of chance. Secondly, for the subset of all stealing temptation occasions in which the remainder of the cerebral system is in such a state as to put the command neurons effectively into the system at all (regardless of what they finally do jointly), there is sequential randomness; that is, the series of molar outcomes in the subset that are non-deterministic satisfies Mises' criterion, so the system is chance in that second respect also. But consider the strong, total system requirement that the ten local events which jointly "decide" the final outcome (the firing or nonfiring of the ten command neurons) should be *totally random*, i.e., satisfying the mathematician's condition of total independence. That requirement we have seen does not obtain in the present case; and the possibility of that total event being "non-chance" despite local indeterminacy and the Mises' criterion for the subsequence, arises from Bernstein's Theorem. Finally, a meaning of "chance" not expressed above, would be a "mentalistic" molar characterization of the events immediately preceding the final act of stealing or inhibiting, namely, that *reasons, motives, values, the weighing of considerations* and so on would play no genuine (efficacious, significant) role in the internal process terminated by the final action. Part of what is objectionable about the language "ten little roulette wheels in my head" is that such a locution makes it appear that the reasons offered by the fellow clerk, and one's reflection on them in the light of his prudential memory bank activations, only seem subjectively to be relevant in what finally comes out but in actuality are not so. This is related to a point made by C. A. Campbell in his distinction between the "inner" and "outer" aspect of a free choosing (Campbell 1951 in Berofsky, 1966, pp. 131–133).

I fear that the basic question involved in the objection, and the possibility of answering it, is that perennial problem of philosophy about persons, "What is the 'I'?" Here a preliminary terminological observation, from which I don't intend to get much mileage but simply to alert the reader and myself to a tempting semantic danger: The language of the objector, "I am a victim of my command neurons, which are acting like ten little roulette wheels," makes it sound rather as if the 'I' in that sentence is an entity wholly distinct from the command neurons. And on most (I'm going to argue below, on *all* plausible solutions to the mind/body problem, this is misleading. That is, it is not as if there are command neurons and then, in addition, there is a psychophysical 'I' separate from them, whereby they do something first and then, as a consequence of that doing as an efficient cause, a something else befalls the 'I' of the sentence. The command neurons are part of the 'I', insofar as it is a continuant (albeit a composite one); and ditto for the rest of the cerebral system that provides input to the command neurons and that responds to their commands. The 'I' is my total psychophysical system, the activities of which (when we move to a molecular level of analysis from the molar level of behavior and experience) *consist of* the firing of the neurons, command and otherwise, deterministic and indeterministic. Therefore one must speak with care, in order to avoid falling into a subtle form of category mistake we would make if we said one of Mr. Reagan's neurons is Republican. I don't mean to adduce this warning as more than a warning. It is not, just as it stands, a cure for the stomach ache of our critic. If the determinist had a stomach ache that persisted after reading Hobart (or Bradley's letter to James, Perry, 1935, pp. 238–240) where the 'I,' once in being and however composed at another level of analysis, is now acting, choosing, etc., the mere fact that this 'I' is a physical composite, and the command neurons are part of that composite, doesn't answer the objection, if the *properties of the elements* of that composite (under the deterministic scheme) make it impossible to choose otherwise than one did. I will say more on this below.

One might hope, as I did in a colloquium reading of this paper, to avoid getting into the morass of the mind/body' problem; but it seems that cannot be managed. I do think it possible to show that the several still live options to the solution of the mind/body problem do not differ importantly with respect to my "solution" of the determinism/chance problem, the possible exception being what I shall call 'Strong Dualism,' to be explained in a moment. I suggest that we can give an explication of 'The Ego' that permits asking the questions that need to be asked about the above criticism, and to answer them, at both the molar and micro level, in a way that answers the critic as well. My classification of solutions to the mind/body problem differs somewhat from the usual, and I would try to put it in the usual way if I thought it made any difference, which I don't believe it does. Even if it does, I believe the reader will find he can make his own reclassification and restate the rest of the business accordingly.

By the *identity theory* I mean the strong interpretation of Feigl, Smart, Armstrong and Co. that mental events are literally and numerically identical with $physical_2$ (Meehl and Sellars 1956) brain events. I take this as an empirical thesis, and a meaningful claim, despite the familiar semantic objection concerning how I can know the meaning of a quality word like 'red' prior to knowing what, how, or even *that* red-perceiving events occur in my brain (cf. Meehl 1966). Suppose the identity thesis is denied, while the existence of mental events is granted as against a minuscule number of probably inconsistent behaviorists (I am not myself sure there are any quite like this). Then I would prefer, as I gather most philosophers do, a theory I shall label *Event Dualism*, in which the mental entity is a "short-lived-continuant." That is, it comes into being and (quickly—the specious present) passes away. There is no truly mental entity considered to exist continuously between these happenings. I call it 'Event Dualism' to distinguish it from the Strong Dualism of a Descartes, but one then has the problem of how short-lived an "ephemeral continuant" can be before we don't count it as a continuant any more. Thus, for instance, are nuclear particles with half lives of 10^{-20} microseconds "continuants"? Or, for that matter, when an electron ceases to be at energy level K and appears at level L in an atom (without traversing space between them!) is there any basis for saying it's "the same electron," rather than that an electron ceased to be at one level and, simultaneously, another one was created at another? However, I don't see that anything hinges upon that semantic convention as to how short-lived a continuant can be and what kind of genidentity (or intercausal connections between its appearances) must obtain for it to be a continuant rather than an event or state. If most of the physicist's short-lived decay particles live long enough to be called continuants, the specious present of mental events—whether atomized or Gestalted—is surely long enough for Event Dualism. We do not want to call it a 'brain state,' because that language makes it appear as if we are still pushing some form of identity thesis.

The two kinds of Event Dualism are epiphenomenalism and interactionism. In epiphenomenalism the mental event is a causal descendant of the neurophysiological (= brain) event, but it is not itself a causal ancestor of anything, either of a subsequent mental event nor acting back ("interacting") causally upon the stream of brain events. In the other form of Event Dualism, interactionism, we postulate a two-way causal influence, in which the transitory continuant or "mental event" acts upon the subsequent brain events in the brain event stream whose earlier members gave rise to it. Physical analogies exist, such as self-induction (and the resulting dispositional concept of reactance). The theoretical distinguishability of epiphenomenalism and interactionism, contrary to the views of some philosophers who deny that, even in principle, there could be a way to tell them apart, is developed in Meehl 1966, pp. 113–118, p. 124.

Finally we have Strong (Cartesian) Dualism, or what one might call *Substance Dualism*, in which we postulate a long-lived continuant (normally one thinks of it persisting during the life of the individual to whose body it is causally connected)—a psychoid, diathete (Kapp 1940, 1951), soul, mind or spirit. While not space filling, and not possessing such physical properties as charge, spin or mass, being a thinking substance rather than an extended substance, the psychoid is nevertheless space located, by a semantic convention that (like Aquinas' angel) *it is where it acts*, it is wherever the physical-neural events are that are causal ancestors of its states and upon which it acts causally in certain ways (Meehl 1966, pp. 120 ff). This psychoid is a continuant that in itself undergoes states and dispositional changes, long- and short-term, and its states or events are causally efficacious, acting as efficient causes with regard to the sequence of brain states. A side benefit of our quantum uncertain neuron model is the possibility of this kind of old fashioned ontological dualism, even if we insist that all the conservation laws of the physical realm must obtain in the brain, since there is nothing about the conservation laws that prevents nonrandom "throwing" of a local quantum uncertain event. So that the psychoid, so to speak, "throws the switches," "selects the configuration of local outcomes" in the command neuron model.

In formulating a dualist theory I consider 'The Ego' as being the total integrated causally connected psychophysical subsystem that engages in the thinking and deciding process when I am tempted to steal, reflect upon the considerations pro and con, and decide to steal or not as the case may be. Nothing philosophically important hinges upon precisely how widely we delimit that subsystem. We call it a '*sub*system' because we consider it obvious that if, say, a small region of my parietal lobe were activated briefly due to slight pressure on my foot from a crinkled shoe as I listen to my fellow clerk make his pitch against stealing, this would not play a critical role in whether I decide to steal or not. There might be special circumstances under which it would, but under such special circumstances that portion of the total cerebral system would be included in the subsystem that we are calling The Ego. We know that if a certain average overall ambient input for various modalities (including body surface pressures, etc.) is prevented by special experimental means, as in the stimulus deprivation research, changes take place in the ego, including, for some people at least, its very capacity to track, think logically, and know "who it is." Our clerk is not, however, in a stimulus deprivation experiment, and what we do with that class of special conditions is what we ordinarily do in psychology, law, medicine or genetics. We presuppose a certain *causal field* (Mackie 1974) in whose (unusual) absence questions about causality could not be put in their usual form, but whose other "normal range" variable properties do not make any difference as to the outcome.

I think that unless one is a Strong Dualist he cannot coherently object to a microanalysis of The Ego and its actions in which The Ego has parts and part-functions. I mean here both physically located parts and mental events, although on the commonest view of Strong Dualism the psychoid, while it is "part" of The Ego, does not itself have parts, one of Socrates' arguments for the immortality of the soul. If you are not a Strong Dualist, The Ego is neurons and their dispositions and actions, which actions are efficient causes of short-term mental events, which in turn either act back on the neurons (interactionism) or are nomological danglers (epiphenomenalism). The only alternative to this, if one is not a Strong Dualist but doesn't want to say that The Ego is "made up of parts" (like brain cells), is the conclusion of the Buddhist King Milinda dialogue that there is no ego.

Just what is it that the thoroughgoing reflective freewillite wants to say literally about The Ego? He wants to say that The Ego—this psychophysical system that I have just briefly sketched—is influenced by motives (e.g., avarice, wish to keep job, aim to be an honorable man, desire to please wife with mink coat); that it perceives as meaningful inputs the fellow clerk's arguments; that it remembers previous experiences; that it reflects, considers, deliberates, and after being pulled one way and another by the conflicting motives it chooses (*freely*—but "in the light of the preceding reflections"). If the muscle system works the person acts. We note that all of these requirements except "chooses *freely*" are also satisfied by the determinist model. The question is, what help, if any, is provided by the quantum uncertain command neurons in preserving the other desired features found in determinism (and which the freewillite wants, or *ought to want* for the kinds of reasons Hobart adduces) but yet provides the possibility of choosing both "freely," *and* "in the light of the preceding deliberations and memories"?

Let me introduce a utopian neurophysiology device which is, however, merely a technological improvement over things we already have, which I will call Dr. Schwitzgebel's Super-Machine. The original Schwitzgebel Machine (Schwitzgebel 1967, Meehl 1970 p. 13 note 11) was for monitoring paroled criminals, but our super one combines telemetric monitoring of single unit [= neuron] brain events with telemetric single unit stimulation by implanted micro-electrodes. Dr. Schwitzgebel is at the console of his Super-Machine on the second floor of the retail store in which I am undergoing my stealing temptation and listening to the prudential arguments of my fellow clerk. Dr. Schwitzgebel receives moment-to-moment readings on states of those several cerebral subsystems that are the physical$_2$ components of The Ego. How might he detect, for instance, that the fellow clerk's prudential arguments are "influential"? First, the machine readings enable him to trace the firing sequence, and from general knowledge of how the brain is put together he knows what the main functional connections are from one Brodmann area to another. He combines this with whatever idiographic research was necessary on me as particular subject to ascertain any microstructural peculiarities of my individual brain. Dr. Schwitzgebel knows, both from his TV screen image of the molar behavior and what the cerebroscopic machine tells him about my moment-to-moment brain-states, that when my fellow clerk starts making his prudential arguments, my attentional scanner sends impulses to my prudential memory bank neurons, thus stimulating them to fire to other neurons (in a different subdivision of the scanner mechanism, that is, the "pick-up" rather than the "eliciting" part of the scanner). These scanner neurons feed into neural subsystems which are presynaptic to the command neurons, *providing part of their input*. That normal sequence of events is already well known to him from previous research.

We have, corresponding to all this, the subject's molar ability to report (at the time or later) that "I considered the reasons that my fellow clerk was presenting.…" We also find an increase in the delay time and other molar indications (e.g., tremor of the hand, frowning, drumming on desk, subtle striped-muscle action-potential conflict indicators) showing that a state of conflict, distress, indecision has been induced. This conflictual state is different from the state induced if the clerk makes no arguments. In the case we were imagining it differs greatly from the state induced when he makes ethical arguments, since I am an amoral person in this respect and respond only to prudential ones. Finally, over a *series of occasions* (over the years of my employment before the cops finally catch me), if we identify the molar subset of occasions in which I am not appealed to by my fellow clerk, or am appealed to by the inefficacious ethical reasons, the molar probability of thievery is $p = 1$; whereas on those occasions when the clerk argues prudentially (and in those cases we find the scanner activates the prudential memory banks which feed in a certain pattern to the command neurons) the probability of stealing $p = 1/2$. Behold, further, that the cases of successful temptation resistings *are that one-half of cases in which the command neurons fire to inhibit the stealing components*, even though, on the other half of the occasions (when the command neurons fail to fire) they are receiving the same kind of input from the precursors, including those precursor neurons that are being controlled by input from the activated prudential memory banks.

Dr. Schwitzgebel can intervene with his Super-Machine by pressing the red button which suppresses what would otherwise be the "normal reaction" of the prudential memory banks to the scanner's arousal of them. It turns out that in those cases the prudential arguments of the fellow clerk have the same consistent inefficacy as the moral arguments, and I regularly succumb to temptation under those artificial circumstances. Finally, the experimenters can get an interesting introspection from me (I don't know about Dr. Schwitzgebel's presence upstairs, and maybe I don't even know about my brain being microwired), for I say, "You know, that last time it was kind of funny; it was different from the way it usually is, in that Joe started making this pitch about I didn't want to go to the clink, and I heard his words, and I even understood their meaning as I usually do—but for some reason it was impossible really to keep my mind on it. I mean it was as if I just couldn't make myself think about these arguments the way I usually do. Very strange." To which the answer is, literally, "That's right, it *was impossible* for you fully to think those arguments, because Dr. Schwitzgebel was suppressing your prudential memory banks by pushing the red button."

Under these circumstances, when Dr. Schwitzgebel avoids pressing the button, we are entitled to say that The Ego chooses, as per the above freewillite list of desiderata for a genuinely free Ego. All of the conditions are met, including the one that is not met under the determinist scheme. The Ego chooses freely, the outcome of its choice situation can be either to steal or not steal, without either result being counternomological. What is the role of the command neurons in this kind of analysis? They permit this last condition to be fulfilled, which determinism does not. Even on the determinist thesis, it is possible literally to say "I [= Ego = the whole psychophysical subsystem] reflected, weighed and chose." Under this analysis we can add to the preceding sentence (which, even under determinism, is taken literally) the term 'freely.' The sentence without the adverb 'freely' is literally true, given determinism. It becomes false if the adverb ‘freely’ is added, because to have done otherwise than I did would have been counternomological and, hence, literally impossible for me at the time, in that state, with my past, etc. With the indeterminate command neurons in the system, everything else is as before. It is possible to say that I reflected, weighed and chose, and now we can add ‘freely’ because to have chosen otherwise than I did is not counternomological, that is, it was literally *possible to have done otherwise*.

Now this literal statement is not falsified, or even attenuated, by our going on to say, “The entity called ‘Ego’ in the above sentence is itself a composite. It is made up of neurons, and its motions consist of its various states and the patterned firing of those neurons in an organized fashion that is not random *as a system* but is not deterministic either.”

I think it important to ask whether we can, if pressed (but under “fairly” stated conditions), formulate this at a purely molar level, turning the indeterminate command neuron conjecture into simply an interesting empirical speculation. If I am a freewillite, I want my decision to be *influenced by*, but *not strictly determined by*, motives and reasons. In what follows I shall avoid the usual metaphors of “I am a victim of,” “My acts spring from me,” or “I have to exercise my powers of...” and shall formulate things as literally as the subject matter permits. In order to avoid these metaphors and also steer clear of microphysiology, it is necessary to make use of *ceteris paribus* clauses in certain places, and to presuppose that the molar behavior is “orderly” (by which I do not mean that it is strictly deterministic but that there are orderly relations between the molar conditions and the probabilities of certain molar outcomes). To begin with, the freewillite takes it as obvious that he is influenced by the mink coat motive, that the current activated money drive was heightened by the wife’s morning remark. That I will take as obvious and part of the causal field in stating the counterfactuals to follow. The question we want to answer in molar terms is what does it mean to say that I’m influenced by the prudential appeals of my fellow clerk? The most straightforward explication of the phrase ‘influenced by...’ in causal contexts (which I have no trouble assimilating to "motives" or "reasons" contexts, despite a widespread opinion to the contrary) is that used in interpreting results of scientific investigations utilizing control groups, as in a drug study, namely, a suitably formulated counterfactual. In the present case some of the counterfactuals hold literally *casewise*, that is, assuming the external situation of employer's absence and the internal situation of mink coat motive. (Molar behaviorism and phenomenology can refer to inner motives without saying anything about microstates other than in psychological language.) Other counterfactuals apply to subcollectives only and not to nomologically formulated casewise outcomes, that is, they have to state changes in the odds. Consider the following counterfactuals that may hold casewise:

a. Fellow clerk makes no appeal, I steal; had he made a moral appeal, I would have stolen ("anyway").

b. Fellow clerk makes prudential appeal, I refrain from stealing; had he not done this, *I would have stolen*.

c. Fellow clerk makes prudential appeal, I steal; had he made a moral appeal, I would have stolen ("anyway").

These, it seems to me, are straightforward (given the *ceteris paribus* clause) and they apply casewise as well as to the whole collection of cases meeting the stated conditions. This should satisfy one who is not a frequency theorist but a propensity theorist and who views the single occasion as involving *a propensity that is not realized*, quite apart from what the relative frequency might be in the long run. Frequency theorists will have to do this by some kind of Reichenbachian posit, the application of a frequency number to decision-making about the individual case.

There are some other equally important counterfactuals that apply only to the odds changes on the subcollections, or on the propensity for the individual case once identified by the statement of its conditions, as:

d. Fellow clerk makes moral appeal, I steal; the subcollective probability of stealing here is $p = 1$. Had he made a prudential appeal instead of a moral appeal, it is possible that I would have stolen; it is also possible that I would have resisted stealing. Neither steal nor non-steal is counternomological on the prudential appeal conditions, but within that subcollective $p = 1/2$ instead of the $p = 1$ which the realized protasis sets.

We can take the shading of habits further along this line so as to recognize what everyone knows about character formation under the influence of rewards and punishments. Being an amoral individual, I experience negligible guilt on those occasions when I steal, but perhaps I experience a good deal of selfish regret on those occasions when I resist. The result of such a reinforcement schedule may be that I avoid my fellow clerk as soon as he says enough to reveal that his objections will be prudential, but I remain relatively willing to listen to him when the appeal is moral. These second order dispositions to listen or avoid listening are themselves deterministic, once established in me, but note that the very learning process that strengthens those differential dispositions to hear arguments of one kind versus those of another are the outcome of the consequences (having the stolen money or regretting that I don't have it) following (deterministically!) upon genuinely free acts of choice on a proper subset of occasions. So we make allowance for the laws of reinforcement, the attribution of stable traits, and the shaping of traits over time by one's life experiences, none of which is contradictory to the thesis of there being a subset of choosings that are radically, metaphysically free.

I must emphasize again that the subset which is indeterministic is still properly characterized as being "non-chance," and the genuinely free choosings are made in consideration of the (sometimes effective) prudential arguments. If the prudential arguments were not made, I would always succumb to the temptation—as I do when the inefficacious ethical arguments are made. Consequently our ordinary view, that the arguments are irrelevant if they are without influence, is preserved by the model. But this "influence" takes the *statistical* form of altering a probability via introducing the command neurons, which does not require us to admit, following Edwards and Co., that the prudential arguments strictly determine what I do.

Consider a nonpsychological example, the Schroedinger cat experiment, not with the usual emphasis given it (the paradoxical mixed state of a molar cat who we know is actually either alive or dead) but simply with regard to the *determinacy* of his demise or survival. The single photon aimed precisely at the dividing line of a half-silvered mirror will pass through or will be reflected to a photocell, which outcome electrocutes the cat as a quantum indeterminate event. If the apparatus is misadjusted, say a millimeter to the left, it is determined that the cat lives. An opposite bias a millimeter to the right of the midline determines that the cat dies. How do we describe what the research assistant does if he detects such a misalignment and adjusts it properly? We say that he has determined to bring about a quantum uncertain event. What he has determined by his adjustment is that the outcome will be quantum uncertain, not that a certain outcome occurs. We have to speak carefully of what he does. If it was initially misadjusted for certain survival, we could arguably (but with a certain danger of misunderstanding) say that he had "killed the cat" by centering it properly, if the outcome of the quantum uncertain event is reflection of the photon. If he moved it from a millimeter left to a millimeter right of the midline, we would be entitled to say he had deterministically killed the cat. An adjustment in the opposite direction would clearly entitle us to say he had saved the cat's life. Suppose he moves it from the clear death position to the indeterminate position. What we say then depends upon the outcome of the uncertain event, because if the cat lives, we are surely entitled to say that he saved him, whereas if the cat dies nevertheless, despite the readjustment, we have to say something more complicated like, "Well, he gave the poor beast a fighting chance."

Let's apply this to a case where I argue with my fellow clerk, as I perceive he is tempted to steal the money. Whether I offer him prudential or moral arguments, what am I doing on this model? This is the kind of case where the dichotomist says that there would be no point in arguing with him if I didn't think that I was determining his conduct, an objection I here vigorously dispute. It may be that he is cerebrally determined to steal unless I, by my objections, throw his brain into such a state that the command neurons enter the causal system. But it may also be that my arguments are compelling, that my words lead to some cerebral scanning of his moral or prudential engrams or memory banks, which scanning determines him to resist stealing on this occasion. The point is that I do not need to know *which* of these circumstances obtains in order to make it rational for me to argue with him. Because if he is determined to steal when the command neurons aren't in the system, and my arguments put him on the existential knife-edge by throwing the command neurons into the system, then he's like Schroedinger's cat in that now he has a fighting chance to resist. If my arguments, instead of making him have an even chance, determine him to resist, that's all right too. In my state of ignorance of the microdetails of his cerebral system, I can't lose. A decision theorist would say here that arguing with the clerk dominates non-arguing, whatever the (unknown) state of nature. Notice that this model combines the notion of genuine (radical metaphysical knife-edge) "free choice" with the obvious fact, known to all sane persons centuries before Freud and Skinner, that people learn and develop habits, including the habits of reflection (or not) and the ability (or inability) to resist temptation. Any freewillite who does not deal with this obvious truth of human conduct is of course in serious implausibility trouble. There is a total sequence of molar choices of a clerk who, by repeatedly succumbing to temptation, becomes a habitual thief or who, by repeatedly resisting, becomes a reflexly honest character. That total sequence obviously does not satisfy Mises' randomness criterion over time, and it should not do so. Any theory of the mind that ignores the empirical laws of reinforcement or psychodynamics we must reject. But at the microlevels, the Utopian neurophysiologist knows that there is a proper subset of occasions which, unfortunately for free will with regard to stealing, become scarcer as we go through the fellow's life. On these occasions, the *rest of the cerebral system* is determined by the history of previous choices and their consequences and the current stimulation (and, for all I know, by sun spots or barometric pressure) to throw the command neurons into the system. On that subset of occasions, the man is radically free to choose. Knowledge of the molar circumstances and the microlevel, including the biophysicist's most detailed knowledge of the synapse, will not enable us to predict how he will choose before he does. That subset of molar occasions does satisfy Mises' criterion.

We also know that on those occasions, whose *occurrence* may be determined and predictable, but whose outcome when they occur is radically unpredictable (not just epistemologically but ontologically so), the *system* is not behaving like "pure chance" because the configural effect shows that something orderly and, if I may so speak, "intentional" or "teleological" is taking place.

It is interesting to conjecture what the introspections might be that correspond to these funny brain events. What the freewillite objects to when the positivist determinist tells him that his only alternative to determinism is "pure chance" is that the subjective experience of moral or prudential choice under conflict and with reflection *seems* very "unchancy," whether or not an external observer could predict what I finally decide. I think my model shows that there is a soundness to this instinct. Consider the uninteresting case of a person being asked whether he wants chocolate or strawberry ice cream for dessert. He doesn't care much about dessert at all and the only reason he gives an answer is to get rid of the waitress. He doesn't much like ice cream to begin with, he doesn't want any dessert, and even to the extent he slightly enjoys them on occasion, he has absolutely zero stable preference as between the two flavors. Now this system might be molar indeterminate, but without involving a micro-indeterminacy of command neurons. They would probably not even be in the system. The *molar* indeterminacy here might be the same sort as the molar indeterminacy of a steel ball rolling down the Galton board, which we usually assume (*pace* Popper!) is, nevertheless strictly determined by the laws of mechanics, friction, biased dropping, slight variations of the pin position and so forth. The Utopian micro-physiologist might know that when a person has genuinely no preference (as in some of Thurstone's research on the intransitivity of unreliable food preferences, where no latent hedonic scale can appear if they're too close together, and no utility function derived) there is a micro-determined wave-like oscillation between chocolate and strawberry, with a certain period; and then there is a decision tension while the waitress waits; and a tension threshold for speaking one's decision. So the Utopian microphysiologist knows from the initial state that it will take 4.7 seconds for the decision tension to reach the critical score at which the man will speak, and he also can predict that at that instant the sine wave for ice cream flavors will be such that strawberry is momentarily in the ascendancy. So what is molar uncertain is microdeterminate. When you ask this chooser to introspect, he says, “What the hell, I couldn’t care less either way, I just said something because I had to say something. I don’t like ice cream.” And if we press him further on his introspections as to how did he decide, he says, “I don’t know, I just picked one. Who cares?” This introspective report is of course totally unlike the introspective report following on intense moral or prudential conflict over a life-significant contemplated action like stealing, or leaving the Communist party, or proposing to Drusilla, or whatever.

It is conceivable that the intensity of the conflict, the introspection “It took an awful lot of will power to resist that temptation, believe me!” might involve some kind of quantitative difference in the number of command neurons that have to fire, which requires a more complicated set-up than the one I have imagined. The point is that our phenomenology of significant conflict, the consideration of reasons, the weighing of the utilities, etc., is very unlike the capricious, whimsical, “random” choice of ice cream flavors by someone who genuinely doesn’t care. I am arguing that there must be a corresponding difference at the microlevel.

I now have to address a question which has doubtless occurred to the reader: “How could such a thing possibly be?” I might turn it around and ask, “Why do we find such an idea—despite the plausibility of both command neurons and quantum uncertainty existing in the brain, and the simple mathematical point of Bernstein’s case—so spooky and unlikely?” I am not up on the recent literature of reductionism in philosophy of science, so perhaps it is rash for me to consider this; but I am going to do it anyway, because I think it’s fairly clear what is the source of our uneasiness about such a spooky business. It’s the notion of ten anatomically separated command neurons acting in concert when each is on a quantum uncertain knife edge to spike or not to spike; we find that kind of “coordinated action at a distance,” so to speak, something that we don’t believe could happen in a brain. I am of the “we”, I don’t believe it either.

Why couldn't it happen? The best I come up with is that we Western materialists (we are almost all that at heart and in mind, whatever our official philosophy) find it incredible that there could be configural effects, patterns defined by a teleological specification of "outcome," unless that configurality is itself deducible as a theorem from a conjunction of statements about (a) properties of the parts and (b) their physical arrangement, as in the grandfather clock example. Discussion of this would involve the current state of arguments about emergence, concerning which I am insufficiently informed; but it seems that there are some kinds of "emergent" properties that do not distress us from the standpoint of our scientized metaphysics, and others that do. We are not, for instance, distressed when a computer can solve differential equations or carry out complicated iterative procedures to improve its approximation of a communality in factor analysis, although a single transistor in the computer's innards cannot do these things. It seems that certain kinds of configurality, at certain levels in the pyramid of the sciences, trouble us more than others.

I give two examples from physics, neither of which bothers the physicists, as far as I'm aware. Niels Bohr took some flack about his old quantum theory from people who said that it was simply a transcription of the Balmer formula. There is a smidgeon of truth in this criticism, so such people were pleased when de Broglie's later idea of an electron as a bunch of waves permitted derivation of the impossibility of electrons being between two Bohr energy states, because the waves would get in each other's way. There you have a configural principle about possible energy levels for an electron to exist in, that was (on the old Bohr model) *derived*, and in that sense "reduced" or "explained" by the properties of the parts. Not quite like a grandfather clock, but still.…

Compare this with the Pauli Exclusion Principle which, as I understand it, is *not* derivable as a theorem from more elementary principles, yet which is clearly configural in nature, simply forbidding two elementary particles belonging to the same system to share all four quantum numbers. If I knew more physics, I would be tempted to ask why nobody tried to derive it as a theorem. My hunch is that you would have to start talking about some kind of waves or globs or particles, say, Paulons, that would be sent from one electron to another, and before you were through you would have to reduplicate the Pauli Principle about these "informers," having gained nothing except more particles to worry about. In any case, what interests me here is that the physicist is not bothered by having a rock-bottom principle that is configural, even though he was pleased about the electron wave-cancellation business. It seems to be part of our reductionist conjecture about the universe that, despite the numerous remarkable emergent properties of living systems, we find it intellectually offensive if a configural property has to be simply postulated, and is not (at least potentially) a theorem flowing from statements about the parts and their arrangement. That's not very good, but it is the best I can do at present. It adds insult to injury, for most of us, if the very *statement* of that configural property has a teleological, intentional or purposive component, as in the present case.

Finally, it occurs to me as worth pursuing some other time, the question whether such a configural cerebral autoselection might give aid and comfort to the metaphysical dualist? Suppose the integrated action of ten command neurons were left for a very long scientific time period on the shelf as a rock-bottom, underived configural principle. We might just get used to saying, "Well, that's the way brains are! When brains get complicated enough, they start showing this funny kind of internal autocerebral configural selection of local events with respect to molar outcomes." One thinks of the arguments that if computers became sufficiently complicated, even though made out of hardware rather than amino acids and colloidal dispersions and so on, a certain kind of complexity itself makes consciousness emerge. We have all had fantasies (Prof. Gunderson published one 1963) about the kind of conversation with a super computer concerning whether it had a subjective side, that would lead us, however reluctantly, to conclude that it did. Somebody who remains offended by action at a distance, and fascinated by the intentional molar-outcome-oriented coherence of spiking/nonspiking by command neurons, might ask whether this provides at least a little basis for the idea of a psychoid, entelechy, or Kapp's "diathete" (Kapp 1940, 1951, 1955). A dualist might conceive a mental entity coordinated uniquely with a certain brain and, at times, getting into the act as the neurophysiologist Eccles has conjectured in his writings (particularly in the recent work with Popper). I, of course, disagree with Eccles and Popper in their view that quantum indeterminacy couldn't have anything to do with free will and choice. I suspect they have both been convinced of the dichotomist argument that the only alternative to determinism at the micro level is randomness there and at all "higher" levels.

Finally, since I, after all, do belong mainly to a Psychology Department, and wouldn't want any scandalous rumors to reach my brethren over there, let me report that while I think this is an interesting kind of model, whose very possibility refutes the strong dichotomist position, showing that there are conceivable circumstances under which we would distinguish a *free choice* both from a "chance whim" on the one side and a strictly determined result on the other; yet I don't myself expect Utopian neurophysiology to find such a state of affairs. If I had to lay my own bets, I would be with Freud and Skinner as a psychological determinist.

Notes

1. This topic is the last one I discussed with Grover Maxwell, and the argument has benefitted greatly from his (as always) fair, open-minded, but searching, "no-nonsense" criticisms. I should perhaps record that the amended form (read at a Philosophy Department Colloquium, April 10, 1981) failed to convince him that I had concocted a *via media* between determinism and chance in human choice. I am indebted to Tony Anderson for his forceful "ten little roulette wheels" objection at the colloquium. The basic idea of relying on Bernstein's Theorem and command neurons was propounded by me during early meetings (1953–4) of the Minnesota Center for Philosophy of Science, and I no longer recall what sharpenings of the issue came from Herbert Feigl, Wilfrid Sellars and Michael Scriven. Previous publications on selected aspects appear in Meehl 1958 pp. 213–215, 328–338, Meehl 1966 pp. 122–124, and Meehl 1978 pp. 386–390

and *passim*. While I no longer subscribe to the Lutheran theology in the first of these, the rest of the metaphysical analysis therein still seems to me quite acceptable.

The manuscript of this chapter was in the editor's hands before I had the opportunity to read the indeterminism volume of Sir Karl Popper's *Postscript* (Popper 1983).

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