# Chapter 16
# The Two-Stage Model to the Problem of Free Will

## How Behavioral Freedom in Lower Animals Has Evolved to Become Free Will in Humans and Higher Animals

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**Abstract** Random noise in the neurobiology of animals allows for the generation of alternative possibilities for action. In lower animals, this shows up as behavioral freedom. Animals are not causally predetermined by prior events going back in a causal chain to the origin of the universe. In higher animals, randomness can be consciously invoked to generate surprising new behaviors. In humans, creative new ideas can be critically evaluated and deliberated. On reflection, options can be rejected and sent back for "second thoughts" before a final responsible decision and action.

When the indeterminism is limited to the early stage of a mental decision, the later decision itself can be described as adequately determined. This is called the two-stage model, first the "free" generation of ideas, then an adequately determinism evaluation and selection process we call "will."

**Keywords** Free will • Determinism • Two-stage model • Chance • Randomness

## 16.1 Introduction

In the May 14, 2009 issue of Nature Magazine, Heisenberg Martin (Heisenberg 2009) challenged the idea, popular in the recent psychology and philosophy literature, that human free will is an free will illusion (Wegner 2002). Heisenberg suggested that a lot could be learned by looking at animals, to see how they initiate behavior. The behaviorist idea that actions are deterministic causal responses to external stimuli has been discredited. For decades, Watson–Skinner behaviorism focused on stimulus and response. They ignored the existence of internal states in

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the mind, but today such internal mental states are accepted as the causes of actions, in animals and humans. Can these mental states themselves be only statistically "caused?" Can mental states—thoughts and ideas—involve an indeterminism which breaks the deterministic causal chain to all events in the "fixed" past, but which does not make our actions themselves "random?"

In my own correspondence with Nature in their June 25, 2009 issue (Doyle 2009), I connected Heisenberg's thinking with James, William's 1884 two-stage model of free will (James 1956, p. 145). The first stage is the chance generation of possibilities, alternative (ideas just "pop into our heads"). The second stage is a "willed" decision "caused" by our reasons, motives, and feelings that help an agent evaluate and "select" among the first-stage alternative possibilities. In the second stage, the agent evaluates the options in a "determined" way, but not one that was "predetermined" from the time before the new possibilities were generated (Doyle 2010).

Long before twentieth-century behaviorism and logical empiricism had limited the study of the mind to externally observable phenomena, James had argued in *The Dilemma of Determinism*, that random chance played a role in generating alternative possibilities.

> The stronghold of the determinist argument is the antipathy to the idea of chance. . .This notion of alternative possibility, this admission that any one of several things may come to pass is, after all, only a roundabout name for chance. (James 1956, p. 153, Doyle 2010)

And James explicitly connected spontaneous variations in the evolution gene pool with random images and thoughts in the human brain.

> [In mental evolution], if anywhere, it would seem at first sight as if that school must be right which makes the mind passively plastic, and the environment actively productive of the form and order of its conceptions; which, in a word, thinks that all mental progress must result from a series of adaptive changes, in the sense already defined of that word. . .It might, accordingly, seem as if there were no room for any agency other than this; as if the distinction we have found so useful between "spontaneous variation," as the producer of changed forms, and the environment, as their preserver and destroyer, did not hold in the case of mental progress; as if, in a word, the parallel with Darwinism might no longer obtain. . .And I can easily show. . .that as a matter of fact the new conceptions, emotions, and active tendencies which evolve are originally produced in the shape of random images, fancies, accidental out-births of spontaneous variation in the functional activity of the excessively instable human brain. (James 1880)

Heisenberg, Martin thus became the latest in a long list of philosophers and scientists who sought a "two-stage" model (see http://informationphilosopher.com/freedom/two-stage_models.html), a temporal sequence of first acausal randomness, then causal law-like selection, as the basis for human freedom. Before Heisenberg, the question always was how to free the *human* brain from deterministic worries. Now that Heisenberg has extended the concept of randomly generated alternative possibilities for action throughout the animal kingdom, he has liberated all life from the complete predeterminism implied by the Newtonian and Laplacian world view of William James's time.

## 16.2 Antipathy to Chance and the Standard Argument against free will

What James, William called the "antipathy to chance" goes back 2,300 years to the Stoic and Academic philosophers' attack on Epicurus' notion of an atomic "swerve." Epicurus said such a random swerve was needed to break the bonds of his materialist and atomist colleague Democritus, whose strict causal physical determinism denied human freedom (Lucretius 1982). Stoics and Academics attacked Epicurus for suggesting that human freedom was the result of chance. That, they said, would make our actions random and deny human responsibility (Cicero 1951). For the Stoics, Nature was identical to God and Reason (Long 1986). To suggest that chance really exists in Nature invites the atheistic thought that God is either irrational or ignorant of future events.

The standard argument *against* free will is the very simple and logical claim that either determinism or indeterminism is true. If determinism is "true," we are not free, if indeterminism is "true," we are not responsible (Ayer 1954; Doyle 2011, Chap. 4).

Our free-will model of two stages in a temporal sequence is motivated by the need to answer the two objections to free will in the standard argument against it. Limiting indeterminism to the first stage prevents it from making our decisions themselves *random*, which would threaten our responsibility. The "determinism adequate" of the second stage defeats the problem of *predeterminism* from the Big Bang that threatens our freedom. By "adequate" determinism we mean that there may be some low level of indeterminism in the second stage but it is statistically irrelevant.

In the logical choice between the "truth" of determinism or indeterminism, it is indeterminism that is "true" in the universe, but many microscopic random events are averaged over and irrelevant in the macroscopic world. Nevertheless, most philosophers today are determinist and compatibilist, unless they embrace a metaphysical dualism (Swinburne 2011). And many scientists claim that the brain is determined (cf. Gazzaniga 2011).

We can see why so many philosophers accept the idea that determinism is "compatibilism" with free will. It is because given the forced choice between the determinism and indeterminism in the standard argument, determinism at least makes our actions responsive to reasons. They can be caused by our motives, feelings, and desires. They result from a nonrandom deliberation that evaluates our options.

What Heisenberg, Martin and many other thinkers have established is that randomness at some level or stage (the generation of alternative possibilities) need not jeopardize adequate law-like behavior at another level or stage (the adequately determined evaluation of those possibilities).

As long ago as 1690, Locke, John insisted on the separation of "free" and "will." He hoped

> to put an end to that long agitated, and, I think, unreasonable, because unintelligible, question, viz. *Whether man's will be free or no?* For if I mistake not, it follows from what I have said, that the question itself is altogether improper. . .This way of talking, nevertheless, has prevailed, and, as I guess, produced great confusion. . .I think the question is not proper, *whether the will be free*, but *whether a man be free*. (Locke 1959) [Locke's emphasis.]

A century later, Hume, David "reconciled" man's freedom with determinism in the notion we now call "compatibilism." He properly insisted that our will is determined by our motives and inclinations.

> to proceed in this reconciling project with regard to the question of liberty and necessity; the most contentious question of metaphysics, the most contentious science; it will not require many words to prove, that all mankind have ever agreed in the doctrine of liberty as well as in that of necessity, and that the whole dispute, in this respect also, has been hitherto merely verbal.
>
> By liberty, then, we can only mean *a power of acting or not acting, according to the determinations of the will*; this is, if we choose to remain at rest, we may; if we choose to move, we also may. Now this hypothetical liberty is universally allowed to belong to every one who is not a prisoner and in chains. Here, then, is no subject of dispute. (Hume 1975, p. 95)

But Hume denied that liberty depended on chance. For Hume and the great mathematicians who developed the calculus of probabilities—Abraham de Moivre before Hume and Laplace, Pierre-Simon after him, chance was merely human ignorance.

> liberty, when opposed to necessity, not to constraint, is the same thing with chance; which is universally allowed to have no existence. (Hume 1975, p. 56)
>
> Though there be no such thing as *Chance* in the world; our ignorance of the real cause of any event has the same influence on the understanding, and begets a like species of belief or opinion. (Hume 1975, p. 96)

Nevertheless, Hume recognized a serious objection to his theory, that everything might be predeterminism. Most compatibilists and determinists since Hobbes and Hume never mention the fact that a causal chain of events going back before our birth would not provide the kind of liberty they are looking for. But Hume frankly admits that such a causal chain would be a serious objection to his theory.

> I pretend not to have obviated or removed all objections to this theory, with regard to necessity and liberty. I can foresee other objections, derived from topics which have not here been treated of. It may be said, for instance, that, if voluntary actions be subjected to the same laws of necessity with the operations of matter, there is a continued chain of necessary causes, pre-ordained and pre-determined, reaching from the original cause of all to every single volition, of every human creature. No contingency anywhere in the universe; no indifference; no liberty. While we act, we are, at the same time, acted upon. (Hume 1975, p. 99)

Today we can finally reconcile free will with chance, randomness, and Indeterminism, which alone can break this "continued chain of necessary causes."

## 16.3 Chance and Randomness in Cosmology and Biology

Randomness has been present in cosmology since the origin of the universe, a state of total chaos (minimal information) nearly 14 billion years ago. But mathematicians and physicists sought deterministic explanations that attempt to avoid randomness. The most famous was Pierre-Simon Laplace, who in 1815 postulated a super-intelligence that could know the positions, velocities, and forces on all the particles

in the universe at one time, and thus know the universe for all past and future times. This implies that information is a constant of nature. Some mathematicians think that information is a conserved quantity—like matter and energy.

But midway through the nineteenth century, Kelvin, Lord (William Thomson) realized that the newly discovered second law of thermodynamics required that information could not be constant, but would be destroyed as the entropy (disorder) increased. Hermann Helmholtz described this as the heat death of the universe.

Kelvin's claim would be correct if the universe were a closed system. But in our open and expanding universe, Layzer, David showed that the maximum possible entropy is increasing faster than the actual entropy (Layzer 1975). The difference between maximum possible entropy and the current entropy is called negative entropy, opening the possibility for complex and stable information structures.

Despite the second law of thermodynamics, stable and law-like information structures evolved out of the chaos, first, in the form of microscopic particulate matter—quarks, baryons, nuclei, and electrons, then later, under the influence of gravitation—macroscopic galaxies, stars, and planets. Every new Information structure reduces the entropy locally, so the second law requires an equal (or generally much greater) amount of entropy to be carried away. Without the expansion of the universe, this would be impossible.

Whether the newly formed stable structure is a baryon or a planet, the new "bits" of information can be regarded as physical "measurements" that involve the collapse of quantum mechanical wave functions. Ludwig, Gunter (Ludwig 1953) and Landauer, Rolf (Landauer 1961) showed that any such measurement that increases the number of information bits must involve a compensating increase in the entropy or randomness elsewhere. For Ludwig, it was in the measurement apparatus. For Landauer, it was the energy dissipated by a computer's power supplies.

Because of the "Law of Large Numbers" in statistics, and the Correspondence Principle of Quantum mechanics (which says that quantum physics approaches classical physics for large quantum numbers), the Newtonian laws of classical mechanics, discovered in the stable and regular motions of the planetary orbits, are "Determinism, Adequate. Events are normally determined by immediate prior events, but not strictly *pre*determinism from the origin of the universe. This is despite the residue of real originary chaos in many parts of the universe, especially in the quantum-mechanical microcosmos. The effects of Quantum Indeterminacy can thus normally be ignored in the macroscopic world of classical physics. (The second stage of Two-stage Model assumes that microscopic indeterminacy can be ignored in the evaluation/selection stage.)

Whereas randomness can normally be ignored in macroscopic physics, randomness in biology plays a central role, in the evolution of species and in the life strategies of many organisms, not only animals. Darwin was circumspect and cautious about "mere chance," because in his time chance still evoked strong atheistic sentiments.

In animals, Heisenberg, Martin cites the bacterium *Escherichia coli* (Heisenberg 2009, p. 165). These tiny organisms are equipped with sensors and motion

capability that let them make two-stage decisions about which way to go. They can move in the direction of nutrients and away from toxic chemicals. They do this with tiny flagella in their tails that rotate in two directions. Flagella rotating clockwise cause the bacterium to tumble and face random new directions. When the flagella rotate counter-clockwise, the bacterium moves forward and sensory receptors on the bacterium surface detect gradients of chemicals and temperatures. If the gradient indicates "food ahead," or perhaps "danger behind," the bacterium continues straight ahead. The law-like decision to go forward is an adequately determined evaluation of sensors along the bacterium's body. If the sensed gradients are unsuitable, the flagella reverse and the bacterium again tumbles.

We see that even the lowest forms of animal can recruit randomness to serve their teleonomic purposes. Mayr, Ernst has shown that evolution is conservative, reusing existing mechanisms rather than inventing new ones. So what Mayr calls the "two-step" process (Mayr 1988) of Darwinian evolution itself may have become a feature of living organisms up to higher animals and humans.

The mind's "two-stage" ability to be creative and free is likely evolved *indirectly* from Mayr's "two-step" process and then *directly* from the combination of random and law-like behavior in the lower animals. Free will is therefore not an *ad hoc* development in humans, as many philosophers (especially theologians) have thought. It is a normal biological property, not a gift of God or an inexplicable mystery. We may not have metaphysical free will, but we do have biophysical Behavioral Freedom. Our lives are not predeterminism.

## 16.4 Four Evolving Selection Levels

The development path from behavioral freedom in the lower animals to free will in humans has primarily involved significant changes in the complexity of the second stage—the evaluation and selection process.

Randomness in the first stage always has the same source—namely chaotic thermal and Quantum noise. It is the second-stage selection process itself that has significantly evolved. We can identify different levels of selection, but note that at each level organisms use all the earlier types of selection as well.

Natural selection—for biological evolution, selection is reproductive success for a population.

Instinctive selection—by animals with little or no learning capability. Selection criteria are transmitted genetically.

Learned selection—for animals whose past experiences guide current choices. Selection criteria are acquired environmentally, including instruction by parents and peers.

Predictive selection—using imagination and foresight to evaluate the future consequences of choices.

Reflective and normative selection—in which conscious deliberation about cultural values influences the choice of behaviors.

Evolution has added more and more features to selection over time, instinct, learning, prediction, and reflection. These eventually become the many factors at work in the fully conscious human will.

## 16.5 Randomness in Psychology and Philosophy

Real (ontological, not epistemological) chance was welcomed by at least one philosopher and psychologist of the nineteenth century, namely James, William. But since the twentieth-century discovery of real chance in the form of quantum indeterminacy by Heisenberg, Werner, chance and randomness have not fared well in psychology or philosophy.

In his Gifford Lecture of 1927, Eddington, Arthur Stanley had described himself as unable "to form a satisfactory conception of any kind of law or causal sequence which shall be other than deterministic." (Eddington 1958). Yet just a year later, in response to Heisenberg's indeterminacy principle, Eddington revised his lectures for publication as *The Nature of the Physical World*. There he dramatically announced, "It is a consequence of the advent of the quantum theory that *physics is no longer pledged to a scheme of Determinism law*" (Eddington 1958, p. 295). He went even farther and enthusiastically identified indeterminism with freedom of the will.

But the critical reaction of philosophers was swift (see Stebbings 1958). A "free electron" has nothing to do with "free will," they complained. A Brain, quantum event in, amplified to affect our reasoning, can only make our decisions random. Quantum events simply happen to us. They are not "up to us." We are not responsible for them. Late in life, Eddington yielded to the criticism, saying that he could find no "half-way house" between determinism and indeterminism (Eddington 1938).

["Up to us" or "depends on us" (ἐφ' ἡμῖν) was for the Greeks, and particularly for Aristotle, the term closest to the modern complex idea of free will (which combines freedom and determination in an apparent internal contradiction). Aristotle and Epicurus both said something "up to us" was a "third thing" that was neither chance nor necessity. The idea was a kind of "agent causality" that provides accountability or moral responsibility. Because our actions originate "within ourselves" (ἐν ἡμῖν), they say that as "agents" we are "causes."]

A number of prominent philosophers and scientists struggled to include quantum indeterminacy in a model of free will, including Compton, Arthur Holly (Compton 1931), Margenau, Henry (Margenau 1968), and Popper, Karl (Popper 1977). But their efforts were not convincing to the philosophical community and are rarely referenced in the free will debates.

The one living philosopher who has spent his adult career trying to explain free will as involving quantum events is Kane, Robert. Kane has had some significant success showing that we can be *Responsibility* for an event even if it happens

indeterministically. He considers the case of a businesswoman on the way to an important meeting when she observes an assault in an alley (Kane 1999). She has excellent (moral and humanitarian) reasons to help the victim. She has equally important (practical and self-interested) reasons to continue on and advance her career.

Kane argues that whichever way the businesswoman decides, and even if the "torn decision," as he calls it, is undetermined as a result of neural noise, she has excellent reasons to take responsibility either way. But Kane himself has not found two-stage free will models everything that is needed (Kane 2005), and other prominent libertarian philosophers like van Inwagen, Peter have said that "free will remains a mystery (van Inwagen 2000)."

Some philosophers have been critical of Kane and argue that the agent cannot claim responsibility if the decision was at all random and thus a matter of "luck." The idea of "Luck, Moral" is the source of many moral paradoxes and dilemmas (Nagel 1979; Williams 1981). If something happens entirely by luck, good or bad luck, it appears to be not our responsibility. But Kane's solution to the problem of an indeterministic decision between multiple alternatives, each supported by excellent reasons and motives, solves this problem of luck. The agent can take full responsibility, however she decides. And the specific "cause" of the resulting action is the excellent reason she has for doing it, says Kane.

Mele, Alfred considered a two-stage model of free will in which indeterminism (he called it incompatibilism) is confined to the early stage (Mele 1995). The latter stage he describes as "compatibilist" (effectively and adequately determined). Mele's model is similar to one proposed much earlier by Dennett, Daniel (Dennett 1978). Dennett's work incorporated the still earlier ideas of Wiggins, David (Wiggins 1973), Popper, Karl, and Compton, Arthur Holly.

Dennett did not endorse his own two-stage decision model because he could not imagine a plausible location for quantum events in the brain, one exquisitely timed to be of help in the decision process. How could a randomly timed event be of any help? He settled instead for pseudo-random number sequences (like those generated by a completely deterministic computer program) as all that is needed in his decision-making model.

In a recent book, Mele considered the problem of free will and luck (Mele 2006), comparing the indeterministic early stage of his model to a neural roulette wheel in the head, with a tiny neural ball whose probabilities may be high for landing in the wheel segment for action A, but it is still luck that it did not land in the segment for action B. In the end Mele, like Dennett, could not endorse a two-stage model.

## 16.6 The Basic Freedom, Requirements for Human

Freedom requires the randomness of absolute chance to break the causal chain of determinism (actually predeterminism), yet it must provide the conscious knowledge that we are adequately determined to be responsible for our choices, that our decisions and actions are "up to us."

Freedom requires some events that are not causally determined by immediately preceding events, events that are unpredictable by any agency, events involving quantum indeterminacy.

These random events can generate alternative possibilities for action. They are the source of the creativity that adds new information to the universe. Randomness is the "free" in free will.

Freedom also requires an adequately determined will that chooses or selects from those alternative possibilities. There is effectively nothing uncertain about this choice. "Adequate" determinism is the determination, the "will" in free will.

Determinism, Adequate means that randomness in our thoughts about alternative possibilities does not directly cause our actions.

Random thoughts can therefore lead to intentions, evaluations, and decisions that are adequately determined to produce actions, for which we can take moral responsibility.

Thoughts *come to us* freely. Actions *go from us* willfully.

We must *admit indeterminism,* but not *permit it* to produce random actions as determinists mistakenly fear.

We must also *limit determinism,* but not *eliminate it* as libertarians mistakenly think necessary.

Evaluation and careful deliberation of all the available possibilities, both ingrained habits and creative new ideas, must help us to "determine" and thus "cause" our actions.

But event *acausality* somewhere is a prerequisite for any kind of agent *causality* that is not *predetermined.*

We thus define "free will" as a two-stage creative process in which a human or higher animal freely generates alternative possibilities, some caused by prior events, some uncaused, following which the possibilities are evaluated and one is "willed," i.e., selected or chosen for adequately determined reasons, motives, or desires.

## 16.7 How Quantum Noise Can Help Free Will and Not Compromise Responsibility

In my two-stage model of free will and creativity, randomness is not (normally) the direct cause of our actions, but rather simply the free generator of Possibilities, alternative for the Determinism, Adequate will to evaluate and select. I call this noisy generator of creative ideas the "Micro Mind."

An important additional requirement is that the adequately determined will, which I call the "Macro Mind," must have the power to invoke the generation of alternative possibilities (turn it on when needed and off when it is simply interfering with thought processes). For example, the bacterium in Heisenberg's example can turn on randomness by reversing the direction of flagella rotation. This is sometimes called "downward causation (Murphy et al. 2009)." It is not that the mind is

actually controlling specific quantum events. Quantum events are uncontrollable. But the mind can turn access to quantum randomness off, and on again when chance is needed to produce new ideas.

The Micro Mind is different from the early stage in previous two-stage models because it does not depend on a *single quantum event* in the brain that gets amplified to the Macro Mind. The insoluble problem for previous two-stage models has been to explain how a random event in the brain can be timed and located —perfectly synchronized!—so as to be relevant to a specific decision. The answer is it cannot be, for the simple reason that quantum events are totally unpredictable. The mind, like all biological systems, has evolved in the presence of constant noise and is able to ignore that noise when it is unhelpful. It can utilize that noise when it provides a significant competitive advantage, which it clearly does as the basis for freedom and creativity in the first stage of my two-stage model.

Rather than search for a single cause behind a decision, we assume that there are always many contributing causes for any event, and in particular for a mental decision. The two-stage model does not depend on single random events, one per decision. It recruits many random events in the brain as a result of ever-present *noise*, both quantum and thermal noise, that is inherent in any information storage and communication system.

In the Newell-Simon "Blackboard" mind model (Newell and Simon 1972) and Bernard Baars' "Theater of Consciousness" and "Global Workspace" models (Baars 1997), there are always many competing possibilities for our next thought or action. Some of these possibilities may be traceable to causal chains that we ourselves did not initiate. Many possibilities are the result of genetic inheritance or environmental conditioning, for example. Some are well-established habits that are the result of what Robert Kane calls "self-forming actions" (Kane 1984) that happened long ago.

Each of these possibilities is the result of a sequence of events that goes back in an assumed causal chain until its beginning in an uncaused event.

If we could trace any particular sequence of events back in time, it would come to one event whose major contributing cause (or causes) was itself uncaused (a *causa sui*).

For Aristotle, every series of causes "goes back to some starting-point (ἀρχή), which does not go back to something else. This, therefore, will be the starting-point of the fortuitous, and nothing else is the cause of its generation." (Aristotle 1933a)

We can thus in principle assign times, or ages, to the starting points of the contributing causes of a decision. Some of these may in fact go back before the birth of an agent, hereditary causes for example. To the extent that such causes adequately determine an action, we can understand why hard determinists think that the agent has no control over such actions. (Of course, if we can opt out of a habitual action at the last moment, we retain a kind of control. We can always just say no!)

Other contributing causes may be traceable back to environmental and developmental events, perhaps education, perhaps simply life experiences, that were "character-forming" events. These and hereditary causes would be present in the

mind of the agent as fixed habits, with a very high probability of "adequately determining" the agent's actions in many well-understood situations.

But other contributing causes of a specific action may have been undetermined up to the very near past, even fractions of a second before an important decision and moments after the "circumstances" mistakenly thought by some compatibilists to *determine* the action. The causal chains for these contributing causes originate in the noisy brain. They include the free generation of new alternative possibilities for thought or action during the agent's deliberations. They fit Aristotle's criteria for causes that "depend on us" (ἐφ' ἡμῖν) and originate "within us" (ἐν ἡμῖν). (Aristotle 1933b)

Causes with these most recent starting points are the fundamental reason why an agent can *do otherwise* in what are essentially the *same circumstances* (up to the starting point of considering options).

These alternatives are likely generated from our internal knowledge of practical possibilities based on our past experience. Those that are handed up for consideration to Baars' "executive function" may be filtered to some extent by unconscious processes to be "within reason." They likely consist of random variations of past actions we have willed many times in the past.

Note that the random events that generate a new possibility need not be located in the brain itself, nor even be contemporaneous with the immediate decision. It could have been an idea first generated years ago and only now acted upon. And it could have had its origin external to the brain, in the ideas of other persons or in environmental accidents. It need only "come to mind" during deliberations, which itself is partly a matter of luck. But as with the "problem of luck" discussion above, the chance element in the first stage does not make the second-stage decision itself random.

Note also that the evaluation and selection of one of these possibilities by the will in the second stage is as deterministic and causal a process as anything that a determinist or compatibilist could ask for, consistent with our current knowledge of the physical world.

But remember that instead of strict causal determinism, the second stage offers only *adequate* determinism. The random origins of possibilities in the first stage provide freedom of thought and action. As long as the Micro Mind can create new alternative possibilities, we can be free.

## 16.8 A More Detailed Look at the Micro Mind

Imagine a Micro Mind with a randomly assembled "agenda" of possible things to say or to do. These are drawn from our memory of past thoughts and actions, but randomly varied by unpredictable negations, associations of a part of one idea with a part or all of another, and by substitutions of words, images, feelings, and actions drawn from our experience. In information communication terms, there is cross-talk and noise in our neural circuitry.

In a "content-addressable" information model, memories are stored based on their content—typically bundles of simultaneous images, sounds, smells, feelings, etc. So a new experience is likely to be stored in neural pathways alongside closely related past experiences. A fresh experience, or active thinking about an experience that presents a decision problem, is likely to activate nearby brain circuits, ones that have strong associations with our current circumstances. These are likely to begin firing randomly, to provide unpredictable raw material for actionable possibilities.

The strong feeling that sometimes "we don't know what we think until we hear what we say" reflects our capability for original and creative thoughts, different from anything we have consciously learned or thought before. A new idea may be something as simple as substituting a synonymous word, or more complex replacements with associated words (metonyms) or wild leaps of fancy (metaphor) are examples of building unpredictable thoughts. Picturing ourselves doing something we have seen others do, from "monkey see, monkey do" childhood mimicry to adult imitations, is a source for action items on the agenda, with the random element as simple as if and when we choose to do them.

But how exactly is the required randomness recruited to build these alternative possible thoughts and actions?

Some critics argue that brain structures are too large to be affected at all by quantum events. But there is little doubt that the brain has evolved to the point where it can access quantum phenomena. The evolutionary advantage for the mind is freedom and creativity. Biophysics tells us the eye can detect a single quantum of light (a photon), and the nose can smell a single molecule. It seems clear that the brain has evolved to the quantum limit and thus has access to quantum noise—when randomness is helpful, when it enhances reproductive success.

If the Micro Mind is a random generator of frequently outlandish and absurd possibilities, the complementary Macro Mind is a macroscopic structure so large that quantum effects are negligible. It is the critical apparatus that makes adequately determined decisions based on our character and values. It can suppress quantum noise, by averaging over many such effects to achieve statistical regularity, or perhaps even with the kinds of error detection and correction techniques designed into modern computers.

Note that information about our character and values is probably stored in the same noise-susceptible neural circuits of our brain cortex. Macro Mind and Micro Mind are not necessarily in different locations in the brain. Instead, their difference is probably the consequence of different information processing methods. The Macro Mind must suppress the noise when it makes an adequately determined decision. But it also can turn on the sensitivity to noise in the Micro Mind when new possibilities are needed.

Normally noise is the enemy of information, but it can be the friend of freedom and creativity.

The Macro Mind has very likely evolved to add enough redundancy to reduce the noise to levels required for an adequate determinism. This means that our decisions are in principle predictable, given knowledge of all our past actions and given the randomly generated possibilities in the instant before decision. However,

only we know the contents of our minds. New possibilities exist only within our minds. So other persons could not predict our actions, and until neuroscientists can resolve the finest details of information storage in our brains, they too could not predict our thoughts and decisions.

The two-stage model accounts not just for freedom but also for creativity, original thoughts and ideas never before expressed. Unique and new information may come into the world with each new thought and action. We are the originators of the new information, the authors of our lives, and in this respect we are co-creators of our universe (Doyle 2011; Chap. 22).

Biologists will note that the Micro Mind corresponds to random variation (mutations) in the gene pool (often the direct result of quantum accidents). The Macro Mind corresponds to natural selection by highly determined organisms. Karl Popper may have been the first to point this out (Popper 1977).

Psychologists will see the resemblance of Micro Mind and Macro Mind to the Freudian id and super-ego (*das Es und das Über-ich*).

Note that the two-stage model accounts quantitatively for the concept of wisdom. The greater the amount of knowledge and experience, the more likely that the random Agenda will contain more useful and "intelligent" thoughts and actions as alternative possibilities. It also implies that an educated mind is "more free" because it can generate a wider Agenda and options for action. It suggests that "narrow" and "closed" minds may simply be lacking the capabilities for generating new ideas of the Micro Mind. And if the Macro Mind were weak, it might point to the high correlation between creativity and madness suggested by a Micro Mind out of control, or it might be an indicator for Aristotle's "weakness of will" (*akrasia*).

Philosophers of mind, whether determinist or compatibilist, should recognize that the second-stage Macro Mind has everything they say is needed to make a carefully reasoned and responsible free choice. But now our choices include self-generated random possibilities for thought and action that no external agent can predict. Thus the choice of the will and the resulting willed action are unpredictable. The origin of the chosen causal chain is entirely within the agent, a condition noted first by Aristotle for voluntary action, the causes are "in us" (ἐν ἡμῖν). The two-stage model clearly describes "self-determination."

## 16.9 Decisions are a Multistep, Even Continuous, Process

The two-stage model is not limited to a single stage of generating alternative possibilities followed by a single stage of determination by the will.

It is better understood as a continuous process of possibilities generation by the Micro Mind (the parts of the brain that leave themselves open to noise) and adequately determined choices made from time to time by the Macro Mind (the same brain parts, perhaps, but now averaging over and filtering out the noise that might otherwise make the determination random).

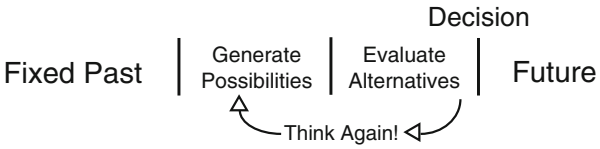


**Fig. 16.1** The two-stage model of free will

In particular, note that a special kind of decision might occur when the Macro Mind finds that none of the current options are good enough for the agent's character and values to approve. The Macro Mind then might figuratively say to the Micro Mind, "Think again!"

Many philosophers have puzzled how an agent could do otherwise in *exactly* the same circumstances. Given the myriad of possible circumstances, it is impossible that an agent is ever in *exactly* the same circumstances. The agent's memory (stored information) of earlier similar circumstances guarantees that.

But given the "laws of nature" and the "fixed past" just before a decision, philosophers wonder how a free agent can have any possible alternatives. This is partly because they imagine a timeline for the decision that shrinks the decision process to a single moment.

Collapsing the decision to a single moment between the closed fixed past and the open ambiguous future makes it difficult to see the free thoughts of the mind followed by the willed and adequately determined action of the mind and body.

The view of two stages in a temporal sequence makes a somewhat artificial separation between the creative randomness of the Micro Mind and the deliberative evaluation of the Macro Mind. These two capabilities of the mind can be going on at the same time. As Fig.16.1 shows, this can be visualized by the occasional decision to go back and think again, when the available alternatives are not good enough to satisfy the demands of the agent's character and values.

Our thoughts are free and often appear to come to us. Our actions are adequately determined for moral responsibility and appear to come from us. They are up to us (Aristotle's ἐφ' ἡμῖν).

What then are the sources of alternative possibilities? To what extent are they our creations? We can distinguish three important sources, all of them capable of producing indeterministic options for thoughts and actions. Two come in from outside the mind, the third is internal.

The first source is the external world that arrives through our perceptions. It is perhaps the major driving force in our lives, constantly requiring our conscious attention. Indeed, consciousness can be understood in large part as the exchange of actionable information between organism and environment. Although the indeterministic origin of such ideas is outside us, we can take full responsibility for them if they become one of our adequately determined willed actions.

The second source of options is other persons. The unique human ability to communicate information means that alternative possibilities for our actions are being generated by our reactions to other minds.

Finally, and most importantly, the Micro Mind generates possibilities *internally*. Alternative possibilities truly originate within us (Aristotle's ἐν ἡμῖν). In the two-stage model, the agent is a creative source, the author and originator of her ideas.

## 16.10 Six Ways Chance Contributes to Free Will

1. Chance exists in the universe. Quantum mechanics is correct. Indeterminism is true, etc.
2. Chance is necessary for free will. It breaks the causal chain of predeterminism.
3. Chance does not directly cause our actions. We can only be responsible for random actions if we flip a coin and claim responsibility "either way."
4. Chance can only generate random (unpredictable) alternative possibilities for action or thought. The choice or selection of one action must be adequately determined, so that we can take responsibility. And once we choose, the connection between mind/brain and motor control must be adequately determined to see that "our will be done."
5. Chance, in the form of noise, both quantum and thermal, must be ever present. The naive model of a single random microscopic quantum event, amplified to affect the macroscopic brain, never made sense. Under what *ad hoc* circumstances, at what time, at what place in the brain, would it occur to influence a decision?
6. Chance must be overcome or suppressed by the adequately determined will when it decides to act, de-liberating the prior free options that "one could have done."

Earlier two-stage models have embraced the first two of these roles for chance, but very few thinkers, if any, appear to have considered all six essential requirements for chance to contribute to libertarian free will.

## 16.11 How Does the Two-Stage Model Improve on Other Recent Free-Will Views?

The two-stage model lies *between* the work of libertarians and compatibilists, who believe that free will is compatible with determinism.

Apart from religious thinkers, who think free will is a gift of God, and metaphysical dualists, who think freedom lies in an immaterial noumenal realm, the leading libertarian model is that of Robert Kane and his followers Laura Waddell Ekstrom (Ekstrom 2000) and Mark Balaguer (Balaguer 2010). They and Kane's critic Richard Double (Double 1991) have all reached for the dream of genuine indeterminacy "centered" in the "moment of choice," while nevertheless achieving agential control over actions.

Kane calls it "dual voluntary control" when an agent has good reasons for deciding either way in a "torn" decision. So the choice can be random and yet the agent still can feel responsible. We accept Kane's clever argument for responsibility "either way." But it seems confusing to describe this as "control" at the moment of choice when the final choice is avowedly random, and Kane's critics have strongly objected.

Double started out trying to justify three Kane conditions for free will—control, rationality, and dual/plural alternative possibilities that allow the agent to choose otherwise in exactly the same circumstances.

But in the end Double concluded that these three conditions could not be met simultaneously by Kane's model and said so in his 1990 book The Non-Reality of Free Will. To be sure, Double may simply share the goal of "Impossibilists" like Galen Strawson (Strawson 1994), or "Hard Incompatibilists" like Derk Pereboom (Pereboom 2001) or "Illusionists" like Saul Smilansky (Smilansky 2000). All these thinkers share a goal. They want to deny moral responsibility in order to eliminate moral "desert" and retributive punishment. But responsibility can be separated from punishment (see http://www.informationphilosopher.com/freedom/separability.html).

Let's see how my two-stage model can improve on Kane's example of the businesswoman mentioned above. Recall that she is "torn" between helping the victim in the alley and continuing to her important business meeting. Before she decides (randomly) between the given choices, she can activate her alternative possibilities generator and the Micro Mind might come up with additional alternative possibilities. She might for example continue on to her meeting but get out her cell phone to report the crime and call for assistance. On her way she might tell any passersby to go to the victim's aid. Note that these creative new options can "come to her" up to and even beyond the moment of choice in this case (she is on her way to the office).

So my two-stage model with the generation of alternative possibilities appears to provide real freedom beyond earlier two-stage models that Kane properly found unacceptable.

The leading thinkers to have proposed but not endorsed a two-stage model are the compatibilist Daniel Dennett (Dennett 1978, p. 286) and the agnostic Albert Mele (Mele 1995, p. 212). Neither of them could see how quantum events could provide an intelligible explanation. But they both saw benefits. Dennett said his decision model could "give libertarians what they say they want." He was right, and it is surprising that more libertarians did not adopt Dennett's model and try to improve upon it, perhaps finding the proper role for quantum events, as the two-stage model has now done.

Mele's "agnostic autonomism" and "modest libertarianism" were designed to take the best parts of libertarian and compatibilist positions, and make them defensible whether determinism or indeterminism was "true."

Like Mele's models, the two-stage model is less "free" than extreme libertarian views, but more responsible. As Mele has said, in the second stage, the will is as adequately determined as any compatibilist could desire.

The two-stage model is also less "determined" than some extreme Compatibilist views, because it is not predetermined in the sense of a causal chain back to the

universe origin. But it is more creative than standard compatibilist views. It provides for adequate *determination* of the will by the agent's reasons, motives, feelings, and desires. But it also provides the limited indeterminism needed for the generation of new ideas that allow the agent to be the originator and author of her life.

David Hume reconciled freedom with determinism. We believe that the two-stage model reconciles free will with indeterminism.

Might compatibilists find this a satisfactory model for a more comprehensive compatibilism, one compatible both with adequate determinism *and* with indeterminism that is limited to the generation of alternative possibilities?

Of course the model is still *incompatible* with predeterminism, and it is distinct from the indeterminism after or centered at the moment of choice, including Kane's cases of "torn decisions."

The two-stage model is perhaps less "event-causal" and more "agent causal," because the agent has creative powers during the extended "moment of choice." These are the kind of powers sought by agent-causalist libertarians like Roderick Chisholm (Chisholm 1995), Richard Taylor (Taylor 1966), and Keith Lehrer (Lehrer 1966). These philosophers called for an absolute freedom, even from causes like reasons, motives, feelings, and desires. This shocked compatibilists at the time. Could such agent causalists be satisfied with the agent's ability to generate totally unconstrained new ideas right up to and including the "moment of choice," ideas that are not caused by anything prior to their generation?

Nothing in the events of the "fixed past" (and the laws of nature, as compatibilists like to say) up to the "moment of choice" *pre*determines the agent's decision. Because the first stage generates new alternative possibilities, the two-stage model lets the agent *choose otherwise* in exactly the same circumstances that obtained before the beginning of deliberation. Kane calls this the "Indeterminist Condition," he says "the agent should be able to act and act otherwise (choose different possible futures), given the same past circumstances and laws of nature" (Kane 2005).

This ability to do otherwise is often considered the most extreme requirement for libertarianism. The two-stage model now provides a credible explanation for this very important ability to do otherwise in exactly the same circumstances before the decision process began.

Discussions with Robert Kane at the Social Trends Institute's Experts Meeting in Barcelona and later have led to a convergence of views between Kane and the author. We both embrace indeterminism as an essential part of free will, the author in the first stage of my two-stage model, Kane in the late stage of a decision, where a choice between different options in a "torn decision" can involve indeterminism but without loss of responsibility.

## 16.12 Conclusion

Although the problem of free will is nearly twenty-three centuries old, it is time to acknowledge that today we have a plausible, practical, and scientific two-stage solution to the problem. About 125 years ago, William James said that we must

accept absolute chance as a part of that solution, comparing the role of chance explicitly to its role in evolution that Darwin had announced a quarter century earlier.

It has been a hundred years since William James's death, time for recognition of his great achievement, bravely proclaimed to an audience of Harvard Divinity School students in an age when chance was still considered atheistic and an affront to God's foreknowledge.

Seventy-five years ago, James's most important student, Dickinson Miller, writing under the pseudonym R.E. Hobart and just a few years after quantum indeterminacy was discovered, reminded us that *determination* by the will was also required (Hobart 1934). Unfortunately, Hobart's work was misread by many compatibilist philosophers as requiring *determinism*, not simply *determination*. Hobart explicitly denied *predeterminism*.

Fifty years ago, A.J. Ayer (Ayer 1954) and J.J.C. Smart (Smart 1961) perfected the standard logical argument against free will, that either determinism or indeterminism must be true, and that free will was impossible either way. If we are determined, we are not free. If we are undetermined, our will is random.

Just over a quarter century ago, Karl Popper, Henry Margenau, and Daniel Dennett discussed two-stage models for free will that connected random events to our decisions, but the general philosophical community remained determinist and compatibilist. This was despite Peter van Inwagen's *Consequence Argument* (van Inwagen, 1983), which denies free will if all our actions are traceable in a causal chain to events back long before we were born. And it was despite Robert Kane's book *Free Will and Values* (Kane 1984) which launched his campaign to find some intelligible way to make quantum indeterminacy the key to free will.

Now Martin Heisenberg has identified chance as generating alternative possibilities for action in the lowest animals. Evolution has no doubt conserved this ability to recruit chance, since it provides the significant biological advantage of creativity. Behavioral freedom in lower animals has evolved to become free will in higher animals and humans.

The two-stage model of first "free" and then "will" is simple, intuitive, and the common sense view of the layperson. Our thoughts *come to us* freely. Our actions *go from us* willfully.

We conclude that science is indeed compatible with our desire for human freedom.

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