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The Neurodynamics of Free Will

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Abstract

A model of dynamic brain function based on the work of Walter Freeman offers a more satisfactory account of free will than alternative accounts that attempt to confirm or reject it. Freeman has shown us that mammalian brains function between open-ended information gathering and cycles of practiced response to form a rhythm which engages us with the world. This kind of response cannot be explained in agent-causal or mechanistic terms. These models offer a stark choice between action as independent of external causes, or as a product of physical parts and processes internal to an organism. A neurodynamic model conceives of the will as a continuous action-producing neurocognitive process shaped by the organism's interaction with its surroundings and its imagined and self-originating continuation of a set of rhythms in responding to them. These rhythms confront us with the fragility of our own existence and adaptation, which cannot be unpacked like an industrial system or digitalized like a computer program. The fluidity of our interaction with the world and the fragility of our being are more adequately dealt with by continental thinkers than recent analytic philosophy. Both are naturalistic, but the former are more open to human creativity and a sense of freedom to which we can aspire.

1. The Freeman Model of Dynamic Brain Function: A Lifelong Interaction

The pattern of interaction with the world realized by an individual develops over the individual's lifetime into a characteristic way of being in the world. In Wittgenstein's terms, these are "ways of going on" at individual and collective levels (Wittgenstein 1953, pp. 179ff). These cannot be fully described or prescribed in cognitive or abstract terms because they are personal styles, techniques or characteristic modes of sensorimotor interaction with the physical and social environment. Examples include

tying a knot or curving a ball into the net in football. Freeman has shown us the dynamic brain in action in several carefully researched experiments on living animals with normally functioning brains. One finds that the brain oscillates between an information-gathering mode and a practiced routine of response (Freeman 2000, 2001, Freeman *et al.* 2009, Buzsaki and Freeman 2015).

The discovery was originally made by looking at the processing activity of live rabbit brains. But the relevance of Freeman's neurodynamic model is much wider (Bressler *et al.* 2018). It tracks the brain from engagement with the environment through acquiring and processing information to the development of adaptive behaviors in human subjects. One significant implication of this model, specifically its inclusion of a perception-action cycle, is that neural oscillations and synchronization generate the capacity for intentionality and decision-making necessary to engage in these behaviors (Fuster 2013, pp. 87ff, Freeman and Changeux 2015, Liljenstrom 2018). These processes maintain an equilibrium in the brain allowing neurocognitive control of our thought and action.

Over the history of the organism, the motor effects of this routine form a set of skills. These skills involve the whole brain and its associative tendencies. They involve activity at both brain-systems and mental-systems levels. These systems are entangled as representational streams that inform and guide action (Freeman and Vitiello 2016). The motor and cognitive capacities generated by interaction between the systems enable us to form intentions and execute them in actions in response to external events.

By providing us with the capacity to respond appropriately to events in executing intentions, neurocognitive control provides us with free will (Fischer and Ravizza 1998, pp. 28ff, Bratman 2007). This model has a structure which is dynamic and evolving so that it provides a way to fashion novel responses from the inherited behavioral patterns of the animal species. These responses can be melded into a new set of skills. Thus, the behavior at any time can be assembled under the influence of open-ended sensorimotor interaction with the environment and the subsequent development of a regular rhythm of activity from it. According to this dynamic, the animal senses and then responds to the environmental effects of its activity.

The sensorimotor system steadily develops over the lifetime of an animal and ultimately in evolutionary time as the species undergoes genetic and environmental change. The rhythms range in time scales from microseconds to millennia. This process results in the gradual emergence of a wide repertoire of responses, each with its own conditions of emergence. Each response arises from a core of responses that have a strongly genetic component for an increasingly distinct genetic cluster of species with its own course of differentiation and distinctive developmental features. In-

dividual acts follow a probabilistic rather than deterministic pattern and thus are not predictable (cf. Haynes 2010).

This holistic, or interactionist, model provides a more plausible explanation of human behavior than an agent-causal model focusing on the agent as the origin of action unaffected by natural laws and events in the past (Kane 1996, Clarke 2003, Strawson 2010). It is also more plausible than a mechanistic model focusing on internal parts and processes that realize organism-level functions in a bottom-up way (Craver 2007, Bechtel 2008). These models ignore or fail to pay adequate attention to brain-mind-environment interaction. The animal's brain is involved in this activity as a unified site of inclusive information processing and response. It is not easily dissected into identifiable compartments, each with its own, proper causal and measurable triggering conditions.

There are rhythms of response involving the whole animal. As Gyorgy Buzsaki (2006, p. 276) states,

> the neuronal "signal" in response to a given environmental perturbation of the brain state is not an initial condition but part of an ever-changing pattern in the brain's landscape.

In response to an inclusive mode of information gathering in interaction with the environment, the animal develops new patterns of activity. The more familiar and settled the environment, the more characteristic will the responses be. But the tendency for incremental innovation originating in the animal itself is always there. These constantly evolving rhythms enable the animal to meet current adaptive requirements and anticipate contingencies. They enable behavior control in the neurocognitive realization of free will (Gillett 2015). Freedom and creativity in choosing between alternative courses of action is a function of the cerebral cortex in its reciprocal interaction with the environment (Fuster 2013, pp. 77ff).

A neurodynamic model aligns with Buzsaki's model of a hierarchy of multiple parallel loops in the brain. These dynamic functions involve excitatory loops between the thalamus and neocortex and inhibitory loops between the basal ganglia and cerebellum. Balanced excitatory and inhibitory neural processes, and the mental processes that emerge from them, promote adaptability and effective navigation of the world. According to Buzsaki (2006, p. 31),

> the main pathways are genetically determined, but the fine-tuning of connections ("calibration" by the output-input match) is under the supervision of the body, environment, and interactions with other brains.

The difference between highly connected and fast-acting conscious action systems and the unconscious functions of behavior coordination and practiced routines are highlighted by such events as basal ganglia lesions.

These do not affect the cognitive contents of consciousness but have a profound effect on motor coordination and patterning.

Neural, mental and social factors are necessary to explain how we reason, decide and act. Some neuroscientists have challenged this view. In experiments conducted in the 1980s involving subjects who were asked to flex their wrist or finger, Benjamin Libet noted that unconscious brain events preceded the conscious intention to flex by 300 to 500 milliseconds. Readiness potentials in cortical brain regions were recorded by EEG (Libet 1985). Libet (2004, p. 8) concluded that

> the discovery that the brain unconsciously initiates the volitional process well before the person becomes aware of an intention or wish to act voluntarily ... clearly has a profound impact on how we view the nature of free will.

For many neuroscientists, the impact has been negative. Based on Libet's experiments, Patrick Haggard (2005, p. 91) claims that, because "conscious intention occurs after the onset of preparatory brain activity, [it] cannot ... cause our actions".

Alfred Mele has argued that the timing of conscious intention in these experiments does not prove that it has no causal role in the outcome. Unconscious cerebral initiative alone does not provide a complete causal explanation of our decisions and actions. In addition to a proximal intention to act at a specific time, a distal intention at an earlier time can influence the content of and motivation to form and execute the proximal intention in the action (Mele 2009, pp. 45 ff., 2014). Equally important, Haggard (2008, p. 944) notes that the ability to respond to factors external to the brain can influence neural processes:

> Interestingly, both decisions [to act or not act] have a strong normative element; although a person's brain decides the actions that they carry out, culture and education teach people what are acceptable reasons for action, what are not, and when a final predictive check should recommend withholding action. Culture and education therefore represent powerful learning signals for the brain's cognitive-motor circuits.

Emphasising that human actions have a complex set of causes, Haggard (2011, p. 23) states that these causes "reflect the flexibility and complexity of our response to our environment".

These comments are consistent with Buzsaki's explanation of brain function and how it is shaped by a person's interaction with the environment. They are also consistent with a broad interpretation of Freeman's neurodynamic model. Neural oscillations and synchronization generate and sustain intention and action-perception in decision-making through the brain's response to factors external to it.

2. A Situated Agent

Animals navigate continuously through different dynamic situations. Each of these situations has an almost infinitely varied configuration of notional elements. These situations and elements create many interactive centers of neurocognitive activity. There are other connections between things which are not easily identifiable but color the overall ethos or atmosphere in which events are normally encountered. These connections affect the ecological situations which are variously able to be characterized by explicit specification. As dynamic and interactive animals, we can alter an encounter in many subtle ways by our engagement with it. That makes the problem of "retro-thinking" this dynamic almost impossible because it fails to capture the natural feel of the encounter – of why you might say this or that or do just what you, in fact, do.

Language has developed the complex grammatical apparatus of reference and predication (Gillett 1992) to enable us to differentiate and communicate about a whole variety of situations in which objects, their specifications and activity, become communicable without major ambiguity. In this way, we pass on to the group of which we are part complex techniques of adaptation, which become cultural knowledge and styles of interaction. This knowledge shapes the plans we form and execute in adaptive self-making (Gallagher 2020, pp. 218ff).

These settled patterns of interaction are so characteristic between and among different human groups that our "ways of going on" carry a cultural signature which operational and cybernetic models cannot incorporate. Wittgenstein continually attacks such models as part of his critical remarks about rule-following as an example of agency and understanding in his *Philosophical Investigations* (Wittgenstein 1953, pp. 138–242). This activity involves a process of epigenetic development which results in a culture with a distinct style of being. In his *Brain and Culture*, Bruce Wexler (2006, pp. 3f) makes the epigenetic point that it is the

> ability to shape the environment that in turn shapes our brains that has allowed human adaptability and capability to develop at a much faster rate than is possible through alteration of the genetic code itself.

These actions contribute to our identity and show themselves in the way we describe and name ourselves. The latter activity also carries the distinctive mark of family and history.

The family or cultural identity that we come to inhabit is comprised of ways of going on, or styles of living, that equip us as agents. This is not a random activity, in the sense of being disengaged from a context or ecological niche, but instead is deeply reflective of our shared and particularly familial experience. It is not caused by conditions in the world

but represents the way we navigate it based on what we know and have learned. In this sense, each of us makes our distinctive mark on the world and carries an identity which is worth demarcating by a proper name. It allows us to track our interactive and complex development of agency.

A proper name has a singular reference. It denotes an individual and not just a type, however well the latter is described. It is instructive that our grammar has a special place for this feature of our lives, and it has attracted a philosophical literature all its own. For Wittgenstein, grammar tells us a great deal about a thing, and this includes ourselves as objects in the world. But the rhythms of life we inhabit are so descriptively elusive that it is no wonder that we have no singular way of talking about ourselves. This makes human action difficult to characterize because grammatical individuation devices are not among the terms of a scientific account of thought or movement. We develop concepts in cognitive psychology as a science by rendering them into general scientific terms. The scientific categories of agency refer to named types with descriptors that can become part of our generalizable patterns of knowledge.

3. Constructed and Complex Situations

The human lexicon of speech acts associated with our linguistic ability enables us to develop ways to characterize and convey our knowledge of different situations and moments of agency (Austin 1962, Searle 1969). This cognitive achievement gives us a clear advantage over our animal cousins, who do not have recourse to this sophisticated and adaptive mode of responding and sharing behavioral strategies. The endless creativity of language and the way it serves as one of the major media of art and styles of action means that abstract scientific and procedural characterizations of our linguistic ability always seem impoverished by comparison with our richness of communication with each other. We can convey ways of looking at the environment and communicating about it by increasing our information-gathering capacities. This creative aspect also applies to action and our individual and collective characteristic styles of going on. We must note, however, this is not the mere repetition of previous behavior. Rather, it allows for something novel with nuances and color blended into it by the experience of the agent and the intricacies of a situation in which he acts.

An individual response is spontaneous in the sense that it is influenced but not determined by previous events and the context in which it occurs. All the details of action in a situation, and especially its intentional aspect, relate the acts, precursors and possible deviance of the agent who acted at that point in time to a possible departure from rational and moral norms and the specific end they serve. Each description is a response to

a situated knowledge of human life and the manoeuvres and techniques which form cultural rhythms that are potentially innovative. But they may also form part of the cultural capital of the group. These acquired and innovative rhythms increase the adaptability of the group. They can be located in an ecological niche so that they represent an explicit mode of empowerment that increases the ecological competence of the human group concerned.

This dynamic goes on at the growing edge of language and human affairs as a constantly changing epigenetic phenomenon. Because it emerges from an intricate configuration of brain, mind and world, judgments about such things require acculturated courts who are conversant with all the details of the situation and common-sense human thinking that occurs within it. This involves more than just formulaic classifications.

An agent responds to an inflected construction of a situation which may be novel. Because of the holistic nature of the cerebral response to any state of affairs, the variations that emerge achieve an epigenetic advance in behavior that can spread through a group. This may occur through highly detailed communication and the adverbial modification of words for action. It may also occur through imitation by any person or others whom they wish to emulate. The variations within a response to what has been encountered before form the growing edge of human adaptation and our epigenetic endowment. They are an individual departure from the norm, though the spirit of the norm might be preserved. Such a phenomenon is not genetically determined but depends upon genetically endowed features of our cognitive apparatus and action system. These variations are not merely caused by environmental changes. They are in part generated by how the agent interprets the situation.

Thus, the new learning of the agent lends its own inflection to a situation because many of the developed techniques will modify the context in which they occur. In that sense, the individual response is doubly innovative and conditioned by cognitive factors partly arising in language and our linguistic means of communicating with and learning from each other over a lifetime. Indeed, through the written word, this response develops over the course of history and the shared inheritance of any given culture.

This explication and development of behavioral skills and their dissemination through a human group allow for significant development in historical and not just biological or evolutionary time. This fact facilitates the capacity of human beings, acting and living together, to rapidly become the apex species in an ecological niche (Fuchs 2017). As apex species with extensive skills, they are both biologically dominant over their fellow creatures and in a position to modify that ecological setting for good or ill.

In our time, we have seen these powers develop to a frightening extent – "frightening" because our power over the environment sometimes

threatens the very lifeworld that we inhabit and its delicate balance. That threat has increased exponentially as human beings have become more empowered and less limited by their biological capacities. Our imaginative tendencies are not limited by the ecology we inhabit because we are able to envisage fictional and counterfactual worlds in which we are possible agents.

However, this very transcendence of our limitations can also be a great danger and allow us to conceive of our actions and their impact in unrealistic ways. When combined with powers unprecedented in nature, we may threaten our own existence on the planet for which we have been designed. This has been dramatically illustrated in many urban settings, as the recent COVID-19 lockdown has seen the return of a diversity of birdlife to our inner cities. This is particularly noticeable in New Zealand, where urban settings are seeing native birds that have been displaced from them by introduced species and the modification of their habitats.

4. Behavioral Rule Responses

The behavioral rule-governed responses that develop in a newly encountered situation are guided by many factors. These include the shared experience conveyed in language by a co-operative style of living. Even in the subhuman world, animals living in a group or collective can learn from a much broader experience than what is available to a single agent. This experience is variously named in the human collective as apprenticeship, culture, tradition, or group cooperation. The Amish practice of barn-building is just one example. The rules are merely for the purpose of passing on the ecologically specific techniques or ways of going on that the group has explicitly developed in different settings. They are informed by the history and reservoirs of imagination such as myths and legends. Because these shared resources are difficult to specify in precise terms apart from the dynamic engagement with the environment, rule-following can be contrasted with procedural specifications. One must experience this engagement rather than master a group of precise prescriptions as is beloved by mathematically minded philosophers.

No one reflects this view of philosophy more than the early Wittgenstein in his *Tractatus Logico-Philosophicus* (Wittgenstein 1921/1961). In his later work, he realized the error of his ways so that his last book, *On Certainty*, is almost a hymn to our collective pragmatic existence and techniques of going on in response to the demands of the natural and social milieu (Wittgenstein 1969). Even earlier in the *Philosophical Investigations*, he rejected the logicism and formalism of the *Tractatus* and described "language games" or techniques of communication embedded in our "forms of life" (Wittgenstein 1953, p. 19ff). Our collective knowledge and social practices generate a context in which biological individuals

have a propensity to do much better as a communicating group than other biologically related creatures who developed survival techniques through different means.

Indeed, it could be called a quantum leap in evolution whereby the shared skills of individuals, conveyed by differentiated linguistic markers, provided a flexible and sensitive means of conveying lived experience. This developed into something much more than imitative troop experience as a means of skill development. Our lifelong history allows these skills to be progressively refined so that they are exquisitely adapted to the nuances and subtleties of a constantly changing ecological setting. Whether that is encountered naturally or constructed in the imagination, it is a resource upon which we collectively draw in acting in the world.

5. Modification as Innovation

Such is the process of information gathering in life and the need to attune the developed interactions and contents of our mental life to our surroundings. According to Freeman's neurodynamic model, it is from these interactions and contents that the neural net develops. A kind of holism results, such that apparently insignificant features of a stimulus setting become part of a neural, mental and environmental context that induces a behavioral response.

What is more, the alternation between periods of real-life engagement and periods of imagination develops rhythms of response and dissociation with a deep role in the functioning of the organism. The rhythm of switching smoothly from one response to another means that a period of disengagement and refiguring will allow the neural net to allow new possibilities for action. These periods conveniently occur during sleep when free association and cognitive imagination and adventurousness can safely occur.

Strict rules govern our terms of settled engaged communication. But it is not the same for all our activity because some of it must be allowed to occur freely, unconstrained to some degree by neural processing and the sometimes harsh contingencies of the real world. We can call those periods of freely ranging association and imaginary or unreal response "dreaming" language and thought. They are constantly shaped by neural processing but not uniquely determined by it.

Many theories have claimed that thought is either prior to or developmentally secondary to language. But such ordering by philosophers, linguists and psychologists is misinformed in construing thought and its explicit grammatical structure as less than concurrent with and contributory to language in a dynamic way. This separates mental content from its natural accompaniment. Instead, thought and language go together

and resonate to inform imagination and dreaming as essential parts of engaged human life and shared activities and attainments (Gillett 1992). This account of elevating human thought above that of animals through language is correct. But the claim that language is prior and formative all by itself in relation to cognition is misplaced. Real lived experience is anchored in objects of acquaintance. These objects, and the fears or rewards we encounter along with them in nature, is the *fons et origo* of all our ways of going on.

Proper names and definite descriptions consisting of names, verbs and adverbs enable us to differentiate objects in constructing a realistic conception of the world. Building on the Fregean doctrine of reference and predication, many philosophers and some philosophically minded linguists argue that referents are the basic components of language (Frege 1892/1952). But this doctrine and its descendants fail to capture the creativity with which we use language to communicate and describe and explain our actions in different settings. This creativity is a function of neural, mental and environmental interaction.

Against a Fregean framework, we should always be aware that linguistic communication occurs in the service of dealing with the world through the identification of singular reference and elaboration by the modifiers. These are needed to reveal, in a fine-grained way, exactly what the objects concerned can be used for or modified to. Once we have such a basic orientation in place, the nature of our self-originating behavioral techniques can be clarified. In relation to the arguments about free will, this is the liberty of spontaneity rather than the liberty of indifference (Hume 1739/1978, Secs. 407ff, Honderich 2005, p. 48).

For Hume, the liberty of indifference is the absence of causation or necessity. The liberty of spontaneity does not imply impulsive or nondeliberative action. Rather, it is equivalent to the ability to make decisions free from constraint and act as we choose to act. Consistent with this type of liberty, free will is the ability to form and execute action plans according to one's own desires, beliefs and reasons. This ability is a function of neurocognitive control. It aligns in some respects with compatibilist accounts of free will but, unlike these accounts, is suitably informed by neuroscience (Dennett 2003, Roskies 2006).

The distinction between the liberty of spontaneity and the liberty of indifference was initially proposed in the mediaeval era and was discussed then and later by Hume in relation to naturalism and universal causation. But the present discussion is different. It holds that we are not indifferent to the world in which we are functioning but instead creatively involved in seeing it in different ways and acting informed by what we see. Although this is a kind of spontaneity, it has left behind the strictly causal terms of the post-industrial debate. It has nested the account of free will in a re-conception of brain function based on the idea that a human being is

self-organizing and self-directing through practiced rhythms of responding to the world.

On this interpretation, the liberty of spontaneity is a matter of creative originality allowed for in the open-ended flexibility of the neural network (Fuster 2013, pp. 107ff, 146ff). With its link to dreaming and creativity, as in art or storytelling, we come upon a purely human innovation which has nothing to do with a mysterious realm of immaterial substances, but has everything to do with the flexibility and complexity of our neural net. That this may disturb but also inspire us is the two-edged complication of the human condition. The duality of Yin and Yang, heaven and hell, positivity and negativity, real and imaginary has been a feature of human thought in all its guises since antiquity. So much is this the case that whole systems of philosophy have been based on dualistic thinking that is now rejected by post-industrial naturalism.

In the past, philosophers were faced with a stark choice between mechanistic or causal accounts in either a reductionist or vague and undefined "coming to be" prominent among spiritual and mystical thinkers. The present view of brain function as a dynamic and fluid interaction with the world places the agent at the center of this interaction and its formative effect on the brain and mind. It is spontaneity indeed, as the character of the agent and her relationships to others are crucial in shaping the rhythmic resonance that is established between the brain and the constantly changing world. Social factors are crucial to understanding this kind of spontaneity, which is a narrative and creative reflection of human engagement with the physical and cultural environment.

The neural and mental functions resulting from this engagement cannot be formalized in computational terms because they do not follow an algorithm. These functions change in response to factors internal and external to the agent. For this reason, a more inclusive dynamic model suits our ever-changing and fluid adaptation to our being-in-the-world, as has been suggested by philosophers such as Heidegger (1927/1996), Merleau-Ponty (1945/1962) and Sartre (1947/2007). These philosophers pioneered a type of philosophy that was much more speculative than what later emerged from the naturalistic work of Wittgenstein. He was clearly influenced by the style of thinking he found on the continent yet seemed to be motivated in part by naturalistic realism and not formal or quasi-mathematical approaches to human cognition. These approaches fail to explain brain-world interaction and the agent's ability to navigate the world based on it.

The early philosophical work in the continental tradition, with its emphasis on freedom and self-formation, is the proper entree into this kind of a naturalistic account of free will. This account is open-ended but not idealistic in the philosophical sense. In the work of Sartre and Heidegger (1927/1996), we find a repudiation of idealism and a focus

on action and responsibility for oneself and one's actions. All this work is based on the creative mind and its dynamism in a changing world for which reductionist accounts focusing on parts and processes in the organism will always be inadequate. No doubt, for that reason, Sartre has been adopted by creative artists as an inspiration for their work while being dismissed by many post-industrial analytic philosophers. They tend to see the brain as a sophisticated machine, or as a digital device executing formulated prescriptions for action which can be measured and specified in precise terms. These conceptions entirely miss the fluidity and two-way dynamism of the relationship between the brain and the world.

6. A Dance of Survival

The idea of a dance is consistent with the idea of both improvisation and prescribed or pre-rehearsed routines. When we also consider the disciplines involved in learning a language, we begin to see that it is not only improvisation that needs to come into view. We act on an infinitely varying stage which expands into the imagined future and draws on the remembered past. Our repertoire of techniques is infinitely modifiable but not unrealistically so. We have our chance at unconstrained adventures of ideas in dreaming and in the creativity of play. Yet when we get down to the business of life, contingency and the power of our agency to respond to it are always there to be dealt with. Under their influence, we have shaped ourselves into creatures who can adapt to different settings. These settings cannot be formalized in terms of the mathematical complexities we have discovered or the scientific concepts we have conceived for ourselves because they extend beyond them.

Even our environment is modifiable and at our mercy as we are learning to transform things that were beyond the abilities of our ancestors. This exciting and frightening possibility was mythicized in a whole set of stories which served as warnings to us when we strayed beyond the well-worn parts of adaptation that we had forged for ourselves through history. Our increasing alarm in those quarters, where a materialist model is not well equated with the reach of human thinking and science, is understandable. We can begin to imagine both what is mathematically and scientifically conceivable and what our destiny might be if we were able to transcend our industrial limitations. This kind of cognition may be described by some as fanciful. But it reflects our hope in an environment which can be altered by our intervention, an environment which is frighteningly dependent on our freedom.

The sense of "frighten" here shares much with existentialists such as Sartre. It is about humanity having to will itself "to be" after being thrown into existence with all its uncertainties and as-yet unexplored domains of experience. In this brave new world, our freedom to will and act

is a two-edged sword which has no obvious handle and where our grip on it also constantly threatens to affect us in ways that may be disabling. It may open new rhythms that might even be fatal to us and our fellow creatures. This is the existential meaning of freedom. We live with it all the time as our brains open themselves to life and seek to find ways of action. These may open new rhythms with which we can resonate and safely live within the ecological settings into which we are thrown. Viewed within a broadly continental philosophical framework involving brain-mind-world interaction, Freeman's neurodynamic model offers a compelling way of explaining how we freely plan, decide and act.

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