https://doi.org/10.21555/top.v760.3296

# Human Free Will and Determinism: Critical Considerations on Daniel Dennett's Philosophy and the Dangerous Idea of Freedom in Evolutionary Epistemology

# El libre albedrío humano y el determinismo: reflexiones críticas sobre la filosofía de Daniel Dennett y la peligrosa idea de la libertad en la epistemología evolutiva

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Recibido: 28 - 11 - 2024.
Aceptado: 01 - 08 - 2025.
Publicado en línea: 01 - 06 - 2026.

Cómo citar este artículo: Claramonte Sanz, V. & Guarinos Rico, R. (2026). Human Free Will and Determinism: Critical Considerations on Daniel Dennett's Philosophy and the Dangerous Idea of Freedom in Evolutionary Epistemology. *Tópicos, Revista de Filosofía*, 76, 159-185. https://doi.org/10.21555/top.v760.3296

**Abstract**

This paper proposes some critical considerations on Daniel Dennett's philosophy, particularly on his notion of human free will in relation to determinism. To this effect, it analyses the four types of possibility studied by Dennett and their relationship with causality and chance in the context of the philosophy of biology. In addition, it also critically evaluates the distinction made by Dennett between deterministic, indeterministic, and nihilistic universes, with special attention to the treatment conferred in physics to the idea of causality in classical, relativistic, and quantum mechanics. Finally, it explains how the compatibility between human free will and deterministic natural laws defended by Dennett could be developed and explained in evolutionary epistemology.

*Keywords*: free will; determinism; indeterminism; causality; philosophy of biology; evolutionary epistemology; Daniel Dennett's philosophy; philosophy of science; materialism; libertarianism.

**Resumen**

Este artículo propone algunas reflexiones críticas sobre la filosofía de Daniel Dennett, en particular sobre su concepción del libre albedrío humano en relación con el determinismo. Para ello, analiza los cuatro tipos de posibilidad estudiados por Dennett y su relación con la causalidad y el azar en el contexto de la filosofía de la biología. Además, evalúa críticamente la distinción que establece Dennett entre universos deterministas, indeterministas y nihilistas, prestando especial atención al tratamiento que la física hace de la idea de "causalidad" en la mecánica clásica, la relativista y la cuántica. Por último, explica cómo la compatibilidad entre el libre albedrío humano y las leyes naturales deterministas defendida por Dennett podría desarrollarse y explicarse en la epistemología evolutiva.

*Palabras clave*: libre albedrío; determinismo; indeterminismo; causalidad; filosofía de la biología; epistemología evolutiva; filosofía de Daniel Dennett; filosofía de la ciencia; materialismo; libertarismo.

## 1. Introduction

In *Freedom Evolves*, Dennett (2003) examines the relationship between human freedom and natural causation on the basis of a notion of freedom grounded in an evolutionary epistemology—that is, one not understood as a metaphysical issue, but rather as the evolutionary outcome of a biological process. Such an analysis, in our view, requires an examination of the concept of causality as it is generally employed in the sciences, and particularly in physics, which in turn entails elucidating the ideas of cause and effect and the relation between them.

For the purposes of his study of the relationship between freedom and causation, Dennett proposes a distinction among deterministic, indeterministic, and nihilistic universes—a distinction upon which we wish to offer several critical observations. These consist primarily in questioning the factual existence of nihilistic universes and in discussing their logical viability. We shall therefore advance arguments to suggest that nihilistic universes ought rather to be regarded as subsumed under either the deterministic or the indeterministic category.

Finally, we shall show that Dennett's compatibilist position regarding human freedom and natural causation rests on the conception of freedom as a natural, biologically grounded phenomenon—one that should be understood primarily in biological rather than metaphysical terms. On this view, freedom emerges as an evolved phenotypic trait conferring adaptive advantage through the guidance of intentional learning oriented towards the range of real possibilities available to an organism. Freedom thus becomes a matter of cognition, whereby the future delineated by both genetics and environment can be represented and modified through a representation of the present and of the various possible futures.

## 2. Casual and causal: on the real and the biologically possible

As a propaedeutic for his analysis of the idea of freedom within the scope of an evolutionary epistemology, Dennett (1999, p. 161) examines the concept of possibility based on a typology that distinguishes at least four different types or degrees: logical, physical, biological, and historical. Logical possibility requires only the absence of contradiction: an organism cannot simultaneously be alive and dead. Secondly, a

physically possible phenomenon or process, like any living being, would only appear if its existence does not violate any known or yet-to-be-discovered physical or chemical law of nature: in this sense, an organism faster than light would be impossible. Biological possibility entails, in addition to not violating any known or yet-to-be-discovered physical or chemical law of nature, an organism capable of evolving from a genotype constituted by any combination of the four nucleotides—adenine, cytosine, guanine, and thymine—that make up the DNA alphabet, and also being viable for survival and reproduction within a given ecological environment: a flying elephant in and of itself would not transgress any physical or chemical law, but it would only be biologically possible if the evolution of a genotype capable of implementing a Bauplan or body development pattern suited to the requirements of weight, mass, gravity, strength, aerodynamics, etc., necessary for flight in a specific ecosystem were to occur, while also ensuring a minimal level of fitness or biological reproductive efficacy. Finally, historical possibility requires synchrony between an evolutionarily viable genotype and an ecosystem potentially compatible with the expression and development of such viability: the superorder of the Dinosauria was undoubtedly the dominant taxon on the planet until the impact of an asteroid created the Chicxulub crater in the Yucatán Peninsula around sixty-five million years ago at the end of the Cretaceous-Tertiary period, but in the current biosphere, they would be biologically-historically inviable, just as the class Mammalia could only diversify and attain its predominant position in biological systematics after—and not before—the collision of the uranolite with Earth. Furthermore, the philosophical perspective that denies any alternative possibility to reality, that is, the idea that only the real is possible, is often referred to as actualism, and Dennett himself (1999, p. 165) argues against it, defending compatibilism, according to which the notions of free will and determinism are perfectly compatible, and holding a simultaneous belief in both does not entail any logical inconsistency.

Once this quadruple distinction between types or degrees of possibility has been established and exemplified, Dennett (1999, pp. 176 et seq.) points out certain complexities or difficulties regarding biological possibility, based on the relationship between genotype and phenotype, upon which we would like to highlight certain nuances that we consider relevant, especially regarding the certainly complex issues of DNA reading and the viability of the phenotype.

Regarding the former, difficulties arise when considering that DNA sequences cannot specify any organismic traits without the action of readers. When a new organism is generated, the first basic effect of this action consists in the production of proteins from amino acids, and among the countless possible types of proteins, only those dependent on the read DNA sequence will perfect themselves, subsequently interacting with each other through a process that begins with the division of the zygote into two cells—each of which obviously has its own duplicated copy of the entire DNA sequence under reading—these in turn dividing into two more, and so on, until the embryo is developed. Ultimately, without a reader capable of deciphering the genomic recipe, it is impossible for the DNA to be specified in phenotype, a circumstance that makes the plot of the film *Jurassic Park* purely fantastical, as the DNA of *Velociraptor mongoliensis*, even if complete, would contribute at most half of the necessary genetic information and could not model a viable phenotype without the other half provided by the egg cell. Thus, the causal mechanism through which biological possibility is realised in phenotype depends simultaneously on the DNA sequence as well as the reader.

Regarding the latter, that is, the viability of the phenotype of a given species, it seems to be an immediate consequence of the historical possibility described in the previous paragraph, as it depends on the environmental setting and the ecosystem in which the organism lives and is adapted: it would hardly be viable for any species without a breathable atmosphere and one relatively protected from solar radiation, for instance. Moreover, considering that the environmental and ecological surroundings change in a slow but continuous manner, one can understand why there are so many cases of taxa whose extinction can only be comprehensively understood and explained in macroevolutionary terms. Thus, chance would influence causality arising from the interaction between the DNA sequence and its required reader, for if, due to bio-historical circumstances external to the biological possibility itself, the genetic mechanism specifying the phenotype ceases to be operational in the environment to which the organism had previously been adapted, viability becomes ineffective in itself, and sooner or later the species will inevitably become extinct.

In the last third of the 20th century, Jacques Monod (1910-1976) had already outlined this relationship between chance and causality in terms of randomness and necessity in *Biology* (Monod, 1993). From

his perspective, the notion of bio-historical possibility proposed by Dennett also underlies, in one way or another. Natural selection, the unrelenting and decisive judge between adaptation and extinction, would play a role, albeit with certain differences, analogous to necessity or causality, while mutation would operate equivalently to chance through a dual stochastic variable: one of random changes that alter the nucleotide sequence of DNA, and the other concerning the greater or lesser adaptive fit or misfit to the given ecological environment within the existing temporal span—here lies the confluence with bio-historical possibility—until the ultimate effect of positive or negative selection of the mutated trait takes place. All of this, finally, within the framework of a materialist conception of the universe, long ago formulated by Democritus of Abdera (ca. 460–ca. 370 BCE), whose *arkhé* or organising principle of all natural entities was also postulated in terms of chance and necessity.

Additionally, Dennett (2004, p. 92) links his concept of causality to a series of factors that are hierarchically organised in an approximate order of precedence, such as causal necessity, causal sufficiency, independence, temporal priority, and a miscellany of further criteria that are not expressly listed. We understand that these notions of causal necessity and sufficiency proposed by Dennett vividly and respectively echo those of necessary and sufficient conditions used in logic, a circumstance which warrants pointing out certain details in order to eliminate or at least reduce any potential confusion in meaning.

By themselves, necessary conditions do not express the existence of a causal relationship between the antecedent and consequent of an implication: thus, for example, drinking water is an essential requirement for life, but it is evident that ingesting water does not cause life. Sufficient conditions can express a causal relationship, but not always or in every case. In the statement, "If you take poison, you die," there exists a causal relationship between the antecedent "taking cyanide" and the consequent "dying," but this is not the case in the statement, "If Pedro comes, we will go to the cinema," where the antecedent "Pedro coming" is a sufficient condition for the consequent "going to the cinema." However, it seems clear that the cause of going to the cinema does not strictly reside in Pedro's arrival, but rather in the prior will or agreement of those who wish to share the cinematic experience upon Pedro's arrival.

Thus, sufficient conditions would only point to a causal relationship when they express a singular factor, but not when a co-cause is involved

that is not entirely subsumed within the antecedent—that is, when the causation of the consequent is multifactorial, and the antecedent does not express all the required factors for its production. Given all the above, only those conditions that are simultaneously necessary and sufficient could be interpreted as causal. Therefore, an approximate definition of cause could be proposed, understood as the result of the set of necessary and sufficient conditions for the production of an event, such that conditions $c_1$, $c_2$, $c_3$… $c_n$ would produce effect E if and only if $c_1$, $c_2$, $c_3$… $c_n$ are both necessary and sufficient conditions, in such a way that if these conditions occur, the effect will occur, and if they do not occur, the effect will not take place. Both the set of necessary and sufficient conditions, on the one hand, and the effect, on the other, are terms on either side of an equivalence equation, and this, obviously, necessitates the transition from the implicator to the co-implicator or equivalator.

However, in his analysis, Dennett does not include anything resembling a "simultaneous causal necessity and sufficiency" in his prioritised list of factors. In our opinion, this circumstance warrants a revision in pursuit of a preferable logical consistency. Lastly, among the factors associated with the concept of causality included in the Dennettian list cited above, we wish to specifically address the issue of temporal priority. As Dennett observes in reference to this, "a reliable way to distinguish causes from effects is to note that causes occur earlier" (2004, p. 93). In physics, this assertion appears entirely congruent with the causal determinism characteristic of classical mechanics. According to its principles, rooted in the foundational work of Isaac Newton (1643–1727), the cause precedes the effect in time. That is, every event or effect EEE is assumed to be produced or caused by a prior event $c_1$ or prior events $c_1$, $c_2$, $c_3$… $c_n$. Consequently, with complete and exact information about the current state of the universe, it would be possible to accurately predict any future event EEE.

The most extreme formulation of causal determinism was proposed in the *Philosophical Essay on Probabilities* by the Marquis Pierre-Simon Laplace (1749–1827). Its preface includes a famous passage presenting the thesis of the so-called "Laplace's demon," according to which "we ought to regard the present state of the universe as the effect of its antecedent state and as the cause of the state that will follow it" (Laplace, 1985, p. 25). This extrapolated the causal determinism of classical mechanics to all phenomena and processes, enabling this deterministic causality to be formulated mathematically in terms of the laws of nature.

The seemingly invulnerable solidity of this thesis began to erode when Henri Poincaré (1854–1912) conceived the possibility of chaos, understood as a systematic sequence of effects exhibiting a strong dependence on initial conditions. This hypothesis was later confirmed and expanded by chaos theory. According to this theory, slight variations in the initial conditions of certain types of complex systems and nonlinear dynamic systems—such as vehicular traffic, fluid dynamics, or meteorology—even when strictly deterministic, can result in future effects so markedly different that they render Laplacian predictability entirely impossible, particularly in the medium to long term. Thus, chaos theory establishes the unpredictability of certain physical systems typical of classical mechanics, due to their stochastic or chaotic causal behaviour.

In the framework of relativistic mechanics, however, the temporal precedence between cause and effect inherent in causal determinism, and defended by Dennett as an intrinsic factor of the notion of causality, faces even greater challenges. First, in the special theory of relativity formulated by Albert Einstein (1879–1975) in 1905, although the previous idea of causality remains broadly intact, the absence of an absolute, observer-independent time and the introduction of relative time render the classical mechanical concept of simultaneity inapplicable—particularly for events unrelated causally, where synchrony now depends on the observer. Consequently, the very notion of temporal priority or precedence between cause and effect appears unstable. In other words, within the framework of the special-relativistic principle of causality, a cause only temporally precedes its corresponding effect in the case of inertial observation, that is, observation free of any force. The practical impossibility of a truly inertial observer—neutral to all forces (gravity can only be reduced exactly to zero at infinite distance, a condition that cannot factually exist in the universe)—was precisely the anomaly that led Einstein to reformulate special relativity.

Thus, in the general theory of relativity, the notion of causality is generalised—it becomes redundant to observe this. Temporal precedence between cause and effect is no longer required: it suffices for the effect to belong to the future light cone of its respective cause. The quasi-classical notion of causality employed by Dennett now appears to suffer from greater inconsistency. It is, therefore, unsurprising that authors such as Patrick Suppes (1922–2014) developed a probabilistic theory of causality (Suppes, 1970). However, despite the laudable effort

of its author and the incorporation of temporal considerations, the notion of positive statistical relevance is "insufficient to convey the intuitive idea of production, fundamental to any causal description" (Álvarez Toledo, 1999, p. 28).

Finally, in quantum mechanics, the notion of causality seems almost entirely decoupled from the Dennettian requirement of temporal precedence between cause and effect. This is particularly true since Werner Heisenberg (1901–1976) introduced the uncertainty principle in 1927. This principle states that it is impossible to simultaneously and precisely determine the values of certain pairs of physical variables, such as the position and momentum of a particle. Consequently, greater certainty in determining a particle's position is inversely proportional to the certainty of its momentum or linear motion and, therefore, its velocity and mass. Within this conceptual framework of particle physics, how could the temporal precedence of the relationship between cause and effect be established? If Heisenberg's uncertainty principle is valid—and it appears to be—there would be no conceptual obstacle to accepting "that the cause may be prior to or simultaneous with the effect" (Álvarez Toledo, 1999, p. 26). As Álvarez Toledo (1999, p. 26) illustrates, when an aeroplane takes off, the movement of the air above and below the wings causes its elevation. However, this movement is not prior to the elevation but simultaneous.

Recapitulating the considerations outlined in the preceding paragraphs, it can be understood that Dennett seeks to clarify the everyday and technical-philosophical notions of possibility, necessity, and causality. He begins with an exploration of possibility through a quadruple filter—logical, physical, biological, and historical—through which he attempts to conceptualise the idea of free will from a naturalistic, materialist, and Darwinian perspective. This approach is directed not so much towards an individual understanding as towards a phylogenetic one. His meticulous analysis of the connections between freedom and causality, as developed in *Freedom Evolves*, undoubtedly aims to demonstrate the compatibility between the deterministic laws of nature and the existence of a human being endowed with free will. However, his concept of freedom is articulated exclusively within the framework of biological-evolutionary coordinates, without veering into metaphysical terrain beyond what is strictly necessary.

That said, in our view, this analysis does not seem to distinguish particularly clearly or explicitly between the notion of logical or

philosophical causality—logically possible worlds—and the concept of causality as used in science—physically possible worlds. Furthermore, his conception of causality in physics aligns closely with classical mechanics but could be said to correspond far less to relativistic mechanics and almost not at all to quantum mechanics. Nonetheless, we do not believe this represents a personal philosophical difficulty for Dennett. Instead, it stems from the pressing need within philosophy to revisit the concepts of cause and effect and the relationship between them. This is especially true in light of the current state of scientific knowledge, particularly regarding the issue of temporal precedence between cause and effect, which is often treated as though it were a logical axiom or a universal physical constant.

## 3. Materialism, determinism, and indeterminism

In his materialist analysis of the meaning of determinism and indeterminism and their distinction, Dennett adopts, as a premise, the simplifying allegory advanced by Willard Quine (1908–2000) under the label of "Democritean universes" (Quine, 1974). These are imaginary elemental cosmoses consisting of a handful of atoms moving through space, though these atoms are not understood in the contemporary sense, with a complex quantum structure, but rather in the pre-Socratic sense as homologous and indivisible units of matter. Dennett defines determinism in line with the notion proposed by Peter van Inwagen (1942–), which states, in the latter's literal terms, that "at any given moment, there is exactly one possible future" (1983, p. 3), aligning this with the aforementioned model characteristic of Laplace's demon. He further introduces a reference to the laws of physics to conceptualise determinism and distinguish it from indeterminism (Dennett, 2004, p. 45): a universe is deterministic when there exist transition rules, constituted by physical laws, which precisely determine the subsequent state that will follow any particular prior state. Conversely, if there is even the slightest deviation or uncertainty, the universe would be indeterministic.

Shortly thereafter, Dennett identifies a *tertium genus* within the typology of configurations that emerge from his elaborate thought experiment concerning these Democritean universes, derived from Quine's proposal: "those that are nothing but rubbish" (Dennett, 2004, p. 51). He labels these nihilistic universes, as they exhibit no enduring regularity between the past, present, and future states of matter. Thus,

we have three categories of universes: deterministic, indeterministic, and nihilistic.

We understand that Dennett's examination of this issue, while indeed consistent with his philosophical aim in *Freedom Evolves* to demonstrate that a universe governed by deterministic laws can be compatible with freedom conceived not in a metaphysical but in a biological sense, is insufficient—or at least presents certain deficiencies— which we aim to outline and develop in detail below.

Firstly, Dennett does not distinguish, as he does in the case of possibility discussed above, between the three types of determinism commonly acknowledged, namely: logical, epistemic, and causal (Swartz, 2004). From the perspective of logical determinism, the truth value (true/false) of every proposition is timeless, such that a true proposition is and will always be true, while a false proposition is and will always be false. The philosophical background here, already raised by Aristotle (384–322 BCE) in *On Interpretation* and later developed within Scholastic logic, primarily through the Aristotelianism of Robert Grosseteste (1175–1253) and his *De veritate propositionis* (López Cuétara, 2005), centres on the so-called contingent futures: simple declarative propositions about events that may or may not occur in the future. With regard to such propositions, the task is to decide which truth values may be ascribed to them—true/false, necessarily true/necessarily false, possibly true/possibly false, or even an absence of truth/falsity, indeterminacy, etc. (Ostalé & Pradier, 2010, p. 30).

The connection between this issue and Dennett's analysis of the notion of freedom is closer than it might initially appear, as one of the key arguments for fatalism—the doctrine that everything occurs by inescapable predetermination or fate, rendering human action powerless to alter outcomes—derives precisely from the attribution of truth values to contingent futures. This belief leads the fatalistic view to reduce individual freedom to a strictly subjective experience, ultimately devoid of any substantive ontological grounding. Epistemic determinism, in turn, not only attributes truth/falsity values to propositions about the future but also asserts that such propositions are known prior to the events they describe. Consequently, if any future event is known in advance, that event must inevitably occur. Similarly, *mutatis mutandis*, to self-fulfilling prophecies—understood as propositions about the future (analogous to Grosseteste's contingent futures) that, once formulated, themselves

cause their materialisation—epistemic determinism transforms these into a peculiar but unique duality of cause-effect and conversely.

Finally, causal determinism holds that all phenomena and processes are no more than the final outcome of certain initial conditions governed by the laws of nature. Carl Hempel (1905–1997) illustrated this idea of deterministic causality with his famous example of the broken radiator (Hempel, 1942): the malfunction is the result of the radiator's structure—filled with water but lacking antifreeze (initial conditions)—subject to the action of laws concerning the tensile strength of iron, the expansion of frozen water, and the thermodynamic circumstance of the temperature dropping below freezing for hours (laws of nature). In the case of human behaviour, this is the crux of the matter: strong causal determinism would assert that the same principle applies.

To summarise, we are faced with a triad of arguments, each leading via distinct routes to the same conclusion: human action is not free but determined, and therefore, the notion of free will is merely a pre-Kantian metaphysical delusion without any plausible ontological correlate in any region of spacetime. Hence, it is often said that the acceptance of determinism, in any form, is wholly incompatible with the existence of free will. If the states of the universe have been mechanically predictable for thousands of years and presumably will remain so for thousands more, how can one argue that *Homo sapiens* has emerged within it, determined by rigid and inexorable evolutionary laws, while simultaneously claiming that it possesses free will to self-determine?

Although Dennett's work only examines causal determinism, in our view, this is precisely the central thesis he seeks to challenge in *Freedom Evolves*, arguing instead that human freedom is compatible with the deterministic physical, chemical, and biological laws that serve as the *explanans* for its evolutionary origins. Additionally, there is another minimum common denominator across the three aforementioned deterministic arguments that we believe is crucial for elucidating the critical issue at hand, particularly concerning causal determinism, which is presumed to be intrinsically and inevitably tied to classical mechanics. This pertains to the relationship between determinism and time (Hoefer, 2024).

The three deterministic arguments presented are temporally symmetric. If, as discussed earlier, every effect EEE is caused by a prior condition $c_1$ or by prior conditions $c_1$, $c_2$, $c_3$… $c_n$, thereby implicitly assuming that the preceding states of the universe determine all

subsequent states by pointing univocally to a single future, we may also assume that all subsequent states similarly determine—inasmuch as they are determined by—all preceding states. Since a univocal temporal relationship (forward-backward or before-after) between states has been established, subsequent states retroactively point to a single past. In a chain whose links are understood as a succession of ordinal numbers, link $c_1$ fixes link $c_2$ as inexorably as link $c_2$ fixes $c_1$, neither allowing for alternatives. In the words of Pierre Curie (1859–1906), "When certain causes produce certain effects, the symmetry elements of the causes must be found in their effects" (1894, p. 401), which suggests that effects retroactively determine their causes. Hence the exploration of hypotheses and thought experiments concerning retro causality.

The difficulty of grasping the bidirectional temporal symmetry (precedent-subsequent) implicit in determinism—and seemingly well-aligned with classical mechanics—lies in our psychological propensity to accept uncritically the assumption that physical causality operates solely in the past-present-future direction, but not vice versa. This may be due to the influence of the concept of the arrow of time, coined by Arthur Eddington (1882–1944) to denote a temporal direction within a four-dimensional relativistic universe (Eddington, 1928). This concept inherently entails consequences of irreversibility and asymmetry: however, its demonstration is accepted—albeit with caveats—in cosmology, radiation, or thermodynamics (the second law), but not in classical mechanics. Nevertheless, the current state of scientific knowledge in physics does not independently support the belief that the past possesses a fixed quality absent from the present and future. Consequently, in relation to Dennett's analysis of the idea of freedom, the past exercises no ontological dominion over human action and behaviour that the present and future lack. This conclusion removes obstacles to arguing for the compatibility of determinism with human free will, as Dennett himself contends, albeit through different logical paths.

Secondly, we argue that the triad of deterministic, indeterministic, and nihilistic universes, defined in the preceding paragraphs in strict accordance with Dennett's treatment, is not entirely consistent with his own global analysis regarding the compatibility or incompatibility between human free will and the action of deterministic laws of nature, at least when considered as three disjoint sets or entirely separate and disconnected concepts. A separate issue, however, would be to discuss whether there are intersections between them or the potential condition

of subsets among them, if the matter is approached from set theory. By contrast, the dichotomy of determinism/indeterminism, in light of the historical-philosophical tradition that seemingly consists of terms that are incompatible or mutually exclusive, appears, at first glance, easier to accept without further objection, as it fits neatly within the bivalent true/false parameters of classical or Aristotelian standard logic. Perhaps for this very reason, the vast amount of literature devoted to the subject tends to treat determinism and indeterminism not only as disjoint sets, whose intersection, precisely because of the disjunction they embody, is an empty set, but, even more so, as what could be called opposing conceptual entities, such as "alive" and "dead" or "single" and "married," since, to the best of our knowledge, there is no technical-mathematical concept of opposite sets, though there is one for opposite numbers. This association of the analysis of determinism and indeterminism with the bivalence of true or false inherent to classical logic has likely played a significant role in intensifying and perpetuating the debate between proponents and detractors of each view. This is because, firstly, a demonstrative argument for the former seems to entail, consequently, the refutatory argument for the latter, and vice versa; and secondly, it appears entirely irrational or a mere paralogism to even attempt to propose the hypothesis of their compatibility, since the next thing that comes to mind would be the asterisk symbol as a graphical representation of the contradiction involved in asserting the simultaneous validity of two opposites, and, applying the aforementioned examples, accepting without reservation the truth of statements such as "The living are dead" or "The single are married."

Moreover, another element often underlies this debate that can also foster confusion, and against which, according to our best knowledge and understanding, Dennett does not explicitly or sufficiently guard in his analysis: this involves addressing the issue without consciously realising the shift from the logical to the causal interpretation of the concepts of determinism and indeterminism. One should recall the warning formulated by David Hume (1711–1776) regarding the inadmissibility of confusing propositions whose truth is a relation of ideas with those whose truth concerns matters of fact (Hume, 1994, pp. 47-48): Hume's famous "fork," by which every proposition is either necessary or contingent, but never both at the same time. The cumulative effect of both elements— understanding the determinism-indeterminism dichotomy through the true/false bivalence of classical

logic and failing to distinguish between their logical and causal senses—increases the level of confusion in the philosophical debate to the point where it often becomes an inextricable chaos of meaning. Obviously, logical determinism entails a type of logical causality, just as causal determinism entails empirical causality—it would be strikingly redundant to call it "causal causality," and the expression would end up being meaningless due to its sheer tautological nature—and we have just invoked the gnoseological blunder of treating propositions about relations of ideas the same as those concerning matters of fact. This is why, in the previous section, we drew attention to Dennett's insufficient distinction when studying both types of causality.

Thus, returning now to the triad of deterministic-indeterministic-nihilistic kosmos, we understand that, in proposing or defining the latter—those universes where no regularity exists between the past, present, and future states of matter—Dennett inadvertently confuses logical causality with empirical causality. In set theory, a category can be defined as any grouping of material or abstract entities, which also includes a universe whose dynamics lack any regularity, and this would lead to attributing it, in essence, a logical causality once we accept for it a non-regular, and even ultimately non-causal, causality, just as, due to the comprehensive nature of set theory, we accept a set of non-existent sets or an empty set of elements and affirm that the empty set is a set in itself and not a non-set or one that cannot be encompassed by the theory or mathematics in general. But, in physics, could we find a nihilistic universe in Dennett's sense, lacking any regularity to cause the transitions between its successive states? With the current state of scientific knowledge, this seems impossible, and Dennett certainly does not cite any empirical example, in the sense of being observable or identifiable by any method in any spatiotemporal region of the universe. It should be noted that in logic and set theory, the concept of a universe of discourse is common, in which all kinds of entities can be included, even causality aberrations—those that lack any regularity—but it is hardly admissible to extrapolate its properties to an empirical or physical universe merely because of the confusing coincidence of the term "universe." Consequently, at the logical level of analysis of this issue, a nihilistic *tertium genus* alongside the deterministic and indeterministic universes would be admissible, but at the strictly physical level, in our view, *tertium non datur*, and for this reason, we believe that Dennett's assertion of nihilistic universes unintentionally falls into a fallacy of equivocation,

which should be avoided. This is a circumstance not entirely mitigated by the explicit admission of Heisenberg's indeterminacy relation in physics for quantum mechanics, as its basic epistemological consequence is to shift from absolutely precise knowledge—at least theoretically—to knowledge based on probabilities, which, although probabilistic, remains valid and relevant.

However, the latter is by no means equivalent to knowledge articulated from the total absence of any regularity, if that were possible. And this seemingly highly plausible impossibility would not arise merely from the fact that "there are absolute limits to our ability to predict the future" (Dennett, 2004, p. 50), but primarily because the inability to process and systematise any information according to stable categories would render any cognitive endeavour a failure. In fact, in an empirically considered nihilistic universe, life, let alone human life, would not even be possible: total absence of regularity would imply the non-existence of gravity, electromagnetism, solar cycles, the translational and rotational movement of the stars, and so on, ad infinitum. And without human life, considering Nietzsche's certifiable declaration of the death of God, there would also be no knowledge. A nihilistic universe, in any case, could only be admitted at an exclusively logical level of analysis and as a subset of indeterministic universes, characterised by the total absence of regularities and causality due to the extreme nature of its properties.

Thirdly and finally, the considerations established in the preceding paragraphs lead us to contemplate the viability of plausibly discussing the possibility that there may be an intersection between the set of deterministic and indeterministic universes as proposed by Dennett's analysis. Where would we, for example, classify the previously (briefly) mentioned theory of chaos, which forms the theoretical basis for the study of complex or dynamic systems? In fact, the epistemology of specialist determinism unambiguously posits the existence of deterministic chaotic systems, essentially characterised by two main attributes (Hoefer, 2024): a radical short-term divergence in the evolution of their successive states from identical or nearly identical initial conditions, such that the movement underlying the system's behaviour exhibits extreme instability in its trajectory—authors such as Batterman (1993) focus solely on this requirement—and consequently, a lack of predictability or algorithmic computability, since in the long term they effectively emulate genuine random or stochastic processes. Furthermore, these epistemologists

also acknowledge a varied typology of chaotic dynamic systems, such as discrete, continuous, two-dimensional, three-dimensional, higher-dimensional, particle-based, fluid-based, and so on. Lastly, they debate fervently for and against the qualification of certain phenomena studied in physics as chaotic deterministic systems, such as models of escape to infinity and spatial invasion, particle collision phenomena, classical mechanics' systems of supertasks and hypertasks, and the static black holes of Karl Schwarzschild (1873–1916), the dynamic black holes of Roy Kerr (1934–), or singularities in quantum mechanics.

Now, based on the current state of scientific knowledge, the empirical existence of systems like those investigated by chaos theory and others of a similar nature can only be explained within the framework of the distinction between deterministic and indeterministic worlds, as established by Dennett, through two plausible hypotheses. First, the laws of nature governing the behaviour of such systems are genuinely, and not merely apparently, random or stochastic, in which case they would fall within the set of indeterministic universes; or, second, these systems possess a genuine physical idiosyncrasy of a chaotic nature despite being governed by deterministic laws, the rules of transition between states of matter referred to earlier by Dennett. This is why Suppes (1993) asserts that chaotic deterministic examples such as those listed above can perfectly be classified as deterministic systems fully aligned with classical mechanics, as well as processes that are simply and unequivocally indeterministic. Similarly, Van Fraassen (1941–) sought to establish the epistemic foundations for explaining physical phenomena without presupposing that they are caused by laws that cause or explain their behaviour (Van Fraassen, 1989).

However, leaving aside genuine randomness and returning to the second hypothesis, which returns us to Dennett's dichotomous distinction, given their formal properties and phenomenology, systems characterised by deterministic chaos or chaotic determinism—a phrase that is, in fact, close to paradoxical, as its meaning almost equates to indeterminable determinism, indeterminate determinism, or even indeterministic determinism—only serve to confirm our earlier assertions in favour of seriously considering the possibility of admitting an intersection between both sets, and at the same time, opposing the presumption of their strictly disjoint nature. This corollary, curiously, helps to sustain Dennett's thesis regarding the compatibility between human free will and the action of deterministic laws in nature.

## 4. Darwinism and the libertarian belief

It is important to highlight that, for our author, not only are free will and determinism compatible, but the issue of freedom, in its essence, has little to do with the metaphysical debates between libertarians and determinists of various kinds. This is because his compatibilist position rests on the idea that freedom is a natural biological phenomenon which, therefore, must be understood and studied as part of the science of biology, rather than being treated as a metaphysical issue. The same applies to the metaphysical debates surrounding phenomena such as avoidability, the existence of real and not merely illusory possibilities, and so on. In this sense, he makes the following statement of intent: "I will try to show that this traditional problem of free will is, in spite of its pedigree, a distractor, a puzzle of no real importance that draws our attention away from some neighboring concerns that truly matter" (Dennett, 2003, p. 9). His naturalistic and naturalising stance must, therefore, rest on a definition of the concept of freedom capable of keeping it within the natural order. He defines freedom as a natural phenomenon grounded in intentional action: "the enveloping, enabling, life-shaping, conceptual atmosphere of intentional action, planning and hoping and promising—and blaming, resenting, punishing, and honoring" (Dennett, 2003, p. 10), always in accordance with his materialist theory of consciousness (Dennett, 1991) and the Darwinian algorithms that would govern evolution (Dennett, 1995). Once we refer to "freedom" as the phenomenon of intentional action, it becomes a phenotypic trait, where approximate degrees of intentionality are possible and where freedom follows an evolutionary course in which it makes sense, emerging and being made possible by the dynamics of that course.

This being so, the close relationship between freedom and the possession of real options to choose from changes completely. Dennett argues, with respect to probability and based on the idea of possible worlds, that it is a neutral issue with respect to the debate between determinism and indeterminism. This is because, when we say that something could have been otherwise, we do not normally mean, in a limited sense, that, given *the same* initial conditions, the consequence could have been otherwise, but that, under similar but slightly different initial conditions, other consequences could have followed. This counterfactual aptitude is useful to us, and is evolutionarily relevant because we do not

operate knowing the exact description of the initial conditions in which we live. As a result, playing with counterfactual variations is essential to us and imagining different possibilities is, therefore, part of the causal fabric of reality, whether or not it is deterministic. Possibility can only be ruled out in a deterministic world if it is interpreted in its narrow or limited sense. Therefore, "the truth or falsity of determinism should not affect our belief that certain unrealized events were nevertheless 'possible', in an important everyday sense of the word" (Dennett, 2003, p. 77). Following this line, what increases freedom is the increase in the number of possibilities that we are capable of seriously considering, a matter entirely foreign to the metaphysical debate. One begins with an entirely necessary course of action in the deterministic sense, that is to say, characterised by the absence of possibilities, and from then on develops degrees of freedom: "When life began, there was just one way of being alive. It was do A or die. Now there are options: do A or B or C or D or… die" (Dennett, 2003, p. 144). To move from one state to the other requires intentional action and this can only be based, Dennett says, on information regarding the future course of your life, without the need for it to be psychological (Dennett, 2003, pp. 154-155). Such information would allow us to move from a "mere opportunity" (bare opportunity) to a real opportunity (Dennett, 1984, pp. 116-117), so that, refining the above, our degree of freedom will be directly proportional to the amount of real possibilities available, which links the notion of freedom with the notion of control, its lower range being the model of a switch, "a simple switch, turned on and off by some environmental change" (Dennett, 2003, p. 162). As the real possibilities increase, the need for control will increase, generating an increasingly need for refinement of the information that can be captured, which in turn paves the evolutionary path for our brains (Dennett, 2003, p. 162).

A set of neural networks emerging from this need depends heavily on both the speed and reliability of their representations. However, such neural networks will inevitably make mistakes, gathering information that is not useful or missing information that is. In response to these errors, it will be adaptive for the organism to adjust its behaviour within an acceptable period of time. Thus, the concept of freedom is linked not only to control and the range of real possibilities, but also to a capacity for intentional learning aimed at perfecting the organism-environment adaptation. Therefore, from the

perspective of an evolutionary epistemology, the mind does not generate freedom, but it does refine and amplify it.

The next amplifier, obviously, lies in language. The difference between, say, birds and humans lies in our ability to, based on the uncertainties inherent in the possibility of choice, articulate doubts through language and thought, so that when our innate equipment malfunctions or its proper functioning proves adaptively insufficient, we can, in a sense, rewrite it and thus expand our available set of strategies, and with it, our freedom: "That sort of bridging of the gap between appearance and reality is a wrinkle that we human beings alone have mastered" (Dennett, 2003, p. 165).

Thus, freedom becomes a matter of knowledge, for through these abilities, we can, through culture, accumulate and share information—representations of reality and of our own interoceptive and behavioural processes to confront it—and this not only results in better strategies for tackling immediate or distant problems, but also in comparing different methods to attain truth or adaptive success, overcoming mere appearance, depending on their performance. In this way, the future projected by our genetics or our environment can be taken into account, represented, and changed once we understand how it works. In other words, we can say that freedom consists in the ability to intentionally exploit the widest achievable spectrum of real possibilities in terms of control based on a dual and interconnected representation of the present and the different possible futures arising from that representation of the present. It is in this sense that we "dwell" in the possibility of making mistakes, of falling into error, for we can misrepresent any of these realities, making learning an essential part of freedom.

Consequently, an indeterministic world does not provide us with more possibilities than a deterministic one, as the notion of possibility understood in this sense is independent of both. That is, once we place freedom within the Darwinian framework, libertarianism becomes irrelevant insofar as determinism loses its fatalistic sense of unconditional determination of phenomena, and is also detached from the principle of causality. If the world were indeterministic, as libertarians claim, we would retain possibilities in the same sense. Therefore, the fact that determinism implies a preestablished future does not exclude the human being from the realm of possibility, self-improvement, and choice. On the contrary, these elements would be part of the causal fabric of reality for a being burdened by ignorance, living by gathering the

necessary information to remedy it, since it has evolved to do precisely that. The belief in an incompatibility between determinism and freedom would arise from simultaneously adopting a cosmic view—derived from taking the perspective of God's eye on the entire universal history as already given, whether it is a single deterministic course or "a static branching tree of trajectories" (Dennett, 2003, p. 93)—and the particular experiences that we constantly undergo.

If we were merely beings embedded in a deterministic world, we would be beings living in a world determined to present sets of possibilities for us to choose from when such situations arise. It would be irrelevant whether the choice was determined, for in any case, we would be choosing between possibilities, between options, and we would have evolved "to" choose in the best possible manner. A libertarian world—that is, an indeterministic one—does not, in this naturalistic sense, provide us with a greater number of possibilities or a wider range of choice. In both worlds, we would have evolved to consider a set of real possibilities, that is, those we are aware of and that are available, and whose use and control depend on the quality of our intellectual representations, which will vary depending on the needs required to make such representations. Freedom, from Dennett's Darwinian perspective, is the ability to act by choosing between real possibilities based on representations of the present connected to representations of possible future outcomes, whether short-term or long-term. And this is independent of both the libertarian and the deterministic positions.

A more interesting philosophical question is whether Dennett's arguments succeed in cancelling or dissolving the need for the metaphysical debate. We might agree with him that the problem can be naturalised without sharing the anti-metaphysical flavour of his proposal, assuming that each problem has its own place. Dennett, we might say, has dissociated the issues without dissolving any of them, such that a Darwinist need not reject libertarianism, but rather simply know how to distinguish between freedom as a natural phenomenon—which, against authors such as Immanuel Kant (1724–1804), would indeed be possible, not confined to the mere realm of the noumenal, nor should it be assumed as the domain of a kind of faith born from the needs of practical reason, since, as we saw, freedom would be feasible in a deterministic world, just as responsibility would be—and freedom as a cosmic or transcendent reality. More specifically, the freedom that is possible in the natural world would be an entirely biological

phenomenon, that is, "a natural freedom," as the title of the first chapter of *Freedom Evolves* (Dennett, 2003) states, and would be based on action that seeks control, which relies on foresight, in one form or another and to varying degrees.

However, if this is the case, then it seems that with the problem of freedom on a cosmic scale we are truly only discussing the classic debate between determinism and indeterminism. That is, there would indeed be a dissolutive component in Dennett's position: freedom would not be a cosmic problem but rather one relative to organisms, while the debate between determinism and indeterminism would apply to both scales without involving the issue of freedom. In other words, there would be, as Dennett (2005) points out, ways of defining freedom that are logically or conceptually possible but simultaneously incompatible with a deterministic world. The point, according to Dennett, is that they do not matter, insofar as they fall outside of a naturalistic view, since they remove themselves from nature itself, introducing an unnecessary ontological duality into our world. Darwinism, as Dennett puts it, "in a single stroke […] unites the world of meaning and purpose and design with the world of meaningless matter and mechanism, cause and effect" (2005, p. 449). In other words, it is incorrect to think that the mere logical possibility of a concept is equivalent to its relevance, as among the set of logical possibilities regarding freedom, what is significant is the subset of logical possibilities that are physically and biologically realizable. It is in this sense that Dennett dismisses as irrelevant those concepts of freedom that fall outside this select subset. What matters to us is, to paraphrase Dennett himself, "the realm of genuine possibility" (2005, p. 451).

The debate, therefore, hinges on what is included in genuine possibility and what is not, leading us to a very different discussion: that of the merit of the naturalistic approach itself, as well as the best way to understand and modulate it. It is, we might say, an ideological debate about the best way to do philosophy, and it is evident, both from the tone and wording of some of its critics—Tim O'Connor (2005), for example, accuses Dennett of setting up a "church"—as well as from Dennett's sharp irony– continuing with the example, he describes O'Connor's article as "a generally funny article" (Dennett, 2005, p. 455)—that multiple psychological and emotional elements are at play, which in turn reveals the traditional importance of this debate for the moral life of human beings.

It is here that Darwinism can adopt a paradoxical relationship with libertarianism: could it be that the tendency to adopt a libertarian view has, in general, been adaptive? Or, more finely, could it be that our propensity for reward-punishment, for blaming and punishing or praising and rewarding actions, is itself adaptive, and more easily explained in libertarian terms, even though this may be erroneous or unnecessary, such that it indirectly emerges from this adaptivity as the predominant belief? What, in sum, is the Darwinian explanation for libertarianism?

For example, Sarkissian et al. (2010) demonstrate how the belief that the world is indeterministic and that a deterministic world is incompatible with the attribution of responsibility spans at least four different cultural contexts based on a sample of 231 undergraduate students living and studying in the United States, Hong Kong, India, and Colombia. Certainly, their sample is small and their study insufficient to determine why this predominance occurs in psychological terms, but it is not dismissible that, more or less paradoxically, it may have been the Darwinian structure of the biological dynamics of our world that has led to the predominance of the tendency towards libertarianism.

This points to the need for an experimental philosophy that studies these notions, not only by naturalising their content, as concepts that must be shaped from their genuine possibility, but also by naturalising the ideas themselves as elements with their own framework within the world woven by the Darwinian algorithm. If Dennett's approach is to naturalise, then accepting it means that philosophers and their debates must also be naturalised, and the failure to achieve this is clearly reflected in the bitterness of the expressions exchanged between them. Dennett may find the irony that it is the Darwinism that requires no libertarianism whatsoever that insists on the birth and flourishing of libertarianism, and then, what purpose do our debates serve, other than perpetuating a similar distribution of positions over the centuries?

Also, and against the homogenising aspirations of traditional philosophy, which is determined to provide a singular answer to every question posed, we may find that naturalising our investigations perhaps requires assuming heterogeneous answers depending on the situation (Nichols, 2011), as they address a function whose fulfilment does not respond to philosophy's drive to find the truth.

## 5. Conclusions

Against actualism—the view that only what is real is possible—we concur with Dennett in defending compatibilism, maintaining that the simultaneous belief in the notions of free will and determinism within the philosophy of biology entails no logical inconsistency, as the two are perfectly compatible. Nonetheless, the coherence of compatibilism crucially depends upon the definition of possibility, and we take it that the position would gain in rigour by clarifying how possibility may be simultaneously related to the notions of causal necessity and causal sufficiency.

When analysing the issue of temporal priority in the cause-effect relation, it is necessary to distinguish among the different theories established within physics. In classical mechanics, as illustrated by chaos theory, some typical systems are unpredictable due to their stochastic or chaotic causal behaviour. Consequently, it is problematic to describe them as deterministic in the strict sense, even though they are governed by deterministic mechanistic laws: temporal precedence is generally the rule, yet admits exceptions. In relativistic mechanics, a cause precedes its effect temporally only under inertial observation—that is, in a situation free from any external force—a condition that is in fact physically impossible, since gravity would be exactly zero only under the equally impossible hypothesis of infinite distance. It may therefore be said that, in relativistic causality, temporal precedence between cause and effect ceases to be a necessary requirement for explaining the ordinary behaviour of physical systems, as it suffices for the effect to lie within the future light cone of its corresponding cause. Hence the development of probabilistic theories of causality.

Finally, in quantum mechanics, temporal precedence between cause and effect appears even less indispensable, since, given Heisenberg's uncertainty principle, there is no logical or conceptual obstacle to admitting that a cause may be simultaneous with, or even posterior to, its effect. Let us not forget that quantum—or non-commutative—probability (commutativity referring to the interchangeability of operands without alteration of result) accommodates both quantum and classical states, and that the epistemological nature of quantum mechanics is intrinsically probabilistic, relying on notions such as probability amplitude to describe the behaviour of systems. Accordingly, since the same cause

does not always produce the same effect, but a range of possible effects, it becomes impossible—and, in a sense, irrelevant—to link the cause-effect relation to necessary temporal precedence.

Within Dennett's distinction among deterministic, indeterministic, and nihilistic universes—where the latter are defined by the absence of any regularity among past, present, and future states of matter—the difference between logical and empirical causality is not made sufficiently explicit. At the logical level of analysis, a nihilistic universe could indeed be conceivable alongside deterministic and indeterministic ones, but such an assertion seems far less plausible at the physical or factual level. This circumstance allows us to question the assumption that the sets of deterministic and indeterministic universes are mutually exclusive, and to examine the properties of their intersection. Thus, to account for chaotic systems within an operational framework of deterministic rules would require accepting that the laws of nature governing their behaviour are genuinely random—a *contradictio in terminis*—or, more simply and consistently, admitting that such systems possess a genuinely chaotic character despite being governed by deterministic laws.

Finally, if we remove the debate concerning freedom from a primarily metaphysical context and confine it within the framework of an evolutionary epistemology, referring it to the phenomenon of intentional action, then freedom may be regarded as a phenotypic trait associated with the control and range of real possibilities, as well as with an intentional learning capacity aimed at enhancing organism–environment adaptation. That is, freedom becomes an epistemic matter conferring adaptive advantage. It consists in the capacity to intentionally exploit the broadest attainable range of real possibilities in terms of control, by means of a dual and interconnected representation of the present and of the various possible futures, thereby acting through choices among real possibilities based on representations of the present linked with representations of future states—whether short or long term. From this perspective, human beings would not be deprived of the domain of possibility, self-improvement, and choice, despite the implications of a future determined by natural law.

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