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Of Rats and Men II
A Pragmatist Reconstruction of the Basis of Agency *via* the Free-Energy Principle

О крысах и людях II
Прагматистская реконструкция оснований агентности посредством принципа свободной энергии

Абстракт

Во второй части триптиха *О крысах и людях* дается положительный ответ на выводы, сформулированные в первой части. Ссылаясь на концептуальные ресурсы прагматизма, а также интерпретации фундаментальных физических принципов, разработанные в рамках современных неортодоксальных теоретических подходов – метафизики процесса, расширенного эволюционного синтеза и теорий, связанных с так называемым «прагматистским поворотом» в когнитивных науках, в частности принципа свободной энергии (англ. *Free Energy Principle*, FEP) и предиктивной обработки (англ. *Predictive Processing*, PP), предлагается реконструкция оснований агентности. В статье отстаивается тезис о том, что агентность, понимаемая как способность организмов действовать по причинам, не является признаком исключительности человеческого познания, а скорее неотъемлемым свойством самого процесса

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Abstract

In the second instalment of the *Of Rats and Men* triptych, the foundations of agency are reconstructed as a positive follow-up to the previous paper's conclusions. For this task, the article draws on pragmatic insights and interpretations of fundamental physical principles – derived from unorthodox contemporary theoretical approaches such as process metaphysics, the extended evolutionary synthesis, and frameworks associated with 'the pragmatic turn' in the cognitive sciences – namely the free-energy principle (FEP) and its operationalisation in predictive processing theory (PP). The aim is to defend the thesis that agency, understood as a capacity to act for reasons, is not a hallmark of human metaphysical exceptionalism but rather an inherent property of life itself, anchored in the organism's internally generated existential imperative to maintain temporal homeodynamics against the entropic tendency towards dispersal. The author defends the use of intentional terminology in жизни, связанным с экзистенциальным императивом организма поддерживать гомеодинамическую стабильность. Автор обосновывает необходимость использования интенциональной терминологии для объяснения поведения животных, указывая, что FEP допускает подобный подход, а также подчеркивает его соответствие плюралистической позиции прагматизма и антиредукционистскому направлению процессуальной метафизики в философии биологии. Статья закладывает основу для дальнейшего анализа более сложных форм агентности, который будет представлен в завершающей части триптиха.

Ключевые слова: прагматистский поворот, метафизика процесса, принцип свободной энергии, предиктивная обработка, основания агентности

explaining animal behaviour, arguing that FEP and PP enable such an approach. This perspective is also consistent with the pluralistic stance of pragmatism and the anti-reductionist direction of processual metaphysics in the philosophy of biology. The article lays the groundwork for further analysis of advanced forms of agency, which will be explored in the final part of the triptych.

Keywords: pragmatic turn, process metaphysics, free energy principle, predictive processing, simple agency

> [W]*hat one takes there to be are what one admits as values of one's bound variables.*[1]
>
> Willard Van Orman Quine, 1990

In the preceding paper, *Of Rats and Men I: A Pragmatist Take on the Concept of Free Will as a Challenge to the Human–Animal Dichotomy*, we have tried to navigate the intricate routes leading to the prevalent belief in free will (FWB) within Western culture.[2] We began by presenting the paradigmatic sketch of free will's (FW) indispensability articulated by philosopher Józef Bremer in his introduction to the discussion on the current state of the debate, dubbing it "The Free Will Conundrum (FWC)." We contend Bremer's concern that humans, bereft of this attribute, would not be distinguishable from [other] animals – which are purportedly driven solely by instincts and reflexes – to be feebly founded. More so, our issue with such a depiction of the FW essentialness is more profound inasmuch as it encapsulates views that underpin the historical objectification of other species. "Free will," comprehended as a natural kind term, has traditionally been considered a mark of our species' uniqueness. It serves as the core of the distinction between "humans and

[1] Willard Van Orman Quine, *Pursuit of Truth* (Cambridge: Harvard University Press, 1990), 26.

[2] Zbigniew Słuszkiewicz, "Of Rats and Men I: A Pragmatist Take on the Concept of Free Will as a Challenge to the Human–Animal Dichotomy," *Zoophilologica. Polish Journal of Animal Studies*, vol. 2, no. 14 (2024): 1–43, accessed January 27, 2025, https://doi.org/10.31261/ZOOPHILOLOGICA.2024.14.12.

brutes," demarcating the boundary of the human–animal dichotomy. We have thus set out to inspect whether the justifications for Bremer's suppositions are incontrovertible. We have examined those through a pragmatist assessment of how nonhuman animals have been portrayed in scientific narratives and by deconstructing the alleged hallmarks of FW that are claimed to be uniquely human.[3]

At the outset, our venture involved circumnavigating theological, philosophical, and folk justifications for the existence of FW in humans[4] while touching upon the traditional explanatory practices of animal behaviour. These explanations prove to fall short when they rely on instincts and reflexes. A similar issue persists with explanations that invoke associative mechanics. They end up being insufficient for various demonstrated cases of animal acumen or cannot be discerned from mechanisms underlying human cognitive capacities. What seems to be of most importance is that although proponents of the associationistic and behaviouristic frameworks are unable to capture the agency's origins, they, *per fiat*, credit humans with it while denying its presence in animals. Philosophers have traditionally rationalised the above assertion by invoking claims about the supposedly exclusive human ability to derive motifs for action from "the space of reasons," an epistemology suspicious and over-intellectualised idea.[5]

To investigate it, we, therefore, have shifted our focus to the human domain. To extract the meaning from the concept in question, we have utilised the pragmatist method – namely the pragmatic maxim – supported by empirical findings in neurobiology, experimental philosophy (x-phi), and social, cognitive, and comparative psychology. This strategy, the cornerstone of classical pragmatism, is grounded in its efficiency in elucidating the concept's meaning based on its consequential impact on experience. In addition to "the space of reasons," we have examined a couple of the most frequently invoked arguments in the philosophy of animal minds, which were shaped by philosophical ponderings about the alleged specificity of FW, including "rationality," the "higher-order desires" and "the possibility of doing otherwise." These are aimed at underscoring the uniqueness of human decision-making processes. Properties postulated by each of these claims prove to be either a) inadequate

[3] Hereafter, we refer to "nonhuman animals" simply as "animals."

[4] We find the first and second kinds of conceptualisations as the distilled versions of the third. The folk source, in turn, is itself an expression of the experienced authorship of action on which the folk concept of FW has been constructed.

[5] This family of views (including some neopragmatic stances) generally agrees to the behaviouristic portrayal of animals as passive creatures merely registering stimuli (sensing) and reacting to them – beasts exhibit behaviours, while humans are able to reflect and ask about reasons, and therefore, they act. But see, for example, Susan Hurley, "Animal Action in the Space of Reasons," *Mind & Language*, vol. 18, no. 3 (2003): 231–257, accessed June 20, 2024, https://doi.org/10.1111/1468-0017.00223; Nicholas Griffin, "Brandom and the Brutes," *Synthese*, vol. 195, no. 12 (2018): 5521–5547, accessed June 2, 2024, https://doi.org/10.1007/s11229-017-1460-6. See also *Of Rats and Men I*.

means for characterising putative human uniqueness, b) turn out to be pervasive in nature, or c) merely superficially correspond with the cognitive processes underlying the actual course of conduct-shaping and the decision-making in *Homo sapiens*.

We unveiled the anthropodenialistic philosophical foundations underlying beliefs in the FW, which presuppose that only humans have the advanced cognitive prerequisites necessary for its possession. This finding, when coupled with the recognition of the unconvincing empirical support for the existence of FW and the culturally idiosyncratic character of the notion itself, as well as the lack of consistent experiential consequences from FWB manipulations, has led us to conclude that this concept, as it currently stands, when applied to other species, fits the definition of anthropofabulation.[6] The abovementioned observations have prompted us to challenge the conventional, human-centric views on FW's ontology, particularly those entrenched in Western philosophical and theological traditions. Concurrently, throughout the previous paper, we have highlighted the presence of complex cognitive mechanisms in animals, as exemplified by rats. We have mentioned several recently discovered cognitive abilities in rodents demonstrating remarkable similarities to some features of human reasoning and decision-making.

In the conclusion of our first paper, we have argued for relinquishing the overemphasis on the FW category due to its negligible explanatory power and the detrimental consequences it reinforces, which manifest themselves in providing justifications for upholding exploitative practices towards animals. Unsubstantiated clinging to this concept also appears harmful to human societies, as it seems to violate the "is implies can" principle, albeit not in the manner Kant addressed it.[7] Above all, insisting on the significance of the FW as a demarcation criterion for the ontological separation of species leads to unrealistic expectations in the moral domain. They cannot be met either by traditional or – even more – by gradual concepts of moral agency, such as the one proposed by Mark Rowlands. Therefore, we advocate for a more inclusive description of agency that transcends the confines of anthropocentric exceptionalism. We suggest a way of reconstructing the notion of the sense agency as the proxy of the experiential source of the postulated FWB while bypassing the concept of FW itself.

[6] Anthropofabulation is the practice of assigning to one's species some extremely sophisticated cognitive trait that does not exist or cannot be proven to exist while subsequently asserting that other animals do not possess it. Therefore – it is claimed – they cannot have other features that would allegedly depend upon the postulated cognitive trait. See Cameron Buckner, "Morgan's Canon, Meet Hume's Dictum: Avoiding Anthropofabulation in Cross-Species Comparisons," *Biology & Philosophy*, vol. 28, no. 5 (2013): 853–871, accessed January 27, 2025, https://doi.org/10.1007/s10539-013-9376-0.

[7] We formulate this objection as sparingly as possible – FW violates the first law of thermodynamics.

As we argue in this article, such a goal can be achieved by adopting a bottom-up approach from the first principles that leverage the conceptual scaffolding offered by the unorthodox threads in the philosophy of biology and the most promising theoretical avenues of contemporary cognitive science, backed with experimental findings of other species' cognitive abilities (in our case, rodents). The proposed reconstruction facilitates the unified conceptual grasp of both human and non-human entities as agents acting on the basis of the fundamental principle, which can be seen as a prerequisite for the emergence of agency experience from the brain–body–environment transactions. Ultimately, in the long run, we aim to conceptually fortify the moral subject category posited over a decade ago by Mark Rowlands in his thought-provoking book *Can Animals Be Moral?*[8]

In the present paper, we continue the tour embarked upon in the first part, aiming to jaunt further into the naturalistic realm of the philosophy of mind. This part of the triptych is an intermediate link between the first part, devoted to the critique of FW, and the third part, which will focus on analysing the constitutive features of advanced agents. We aim to uncover a distinctive interpretation of the adjective "free," recently reimagined in cognitive science within the broader framework of "the pragmatic turn."[9] It now lies at the heart of a revolutionary, action-oriented paradigm, which is rallying researchers under the Free-Energy Principle (FEP) banner and charting a transformative course in the modern understanding of sentience.[10] Before we proceed, however, we need to tackle some methodological caveats and one misconception. There are currently vivid debates around the neurobiological

[8] Mark Rowlands, *Can Animals Be Moral?* (New York: Oxford University Press, 2012).

[9] Andreas Engel et al., "Where's the Action? The Pragmatic Turn in Cognitive Science," *Trends in Cognitive Sciences*, vol. 17, no. 5 (2013): 202–209, accessed August 19, 2023, https://doi.org/10.1016/j.tics.2013.03.006; Matthew Crippen and Jay Schulkin, *Mind Ecologies: Body, Brain, and World* (New York: Columbia University Press, 2020); Fausto Caruana and Italo Testa, "The Pragmatist Reappraisal of Habit in Contemporary Cognitive Science, Neuroscience, and Social Theory: Introductory Essay," in *Habits: Pragmatist Approaches from Cognitive Science, Neuroscience, and Social Theory*, eds. Fausto Caruana and Italo Testa (Cambridge: Cambridge University Press, 2022), 1–37; Andreas Engel, Karl Friston, and Danica Kragic, eds., *The Pragmatic Turn: Toward Action-Oriented Views in Cognitive Science* (Cambridge, Massachusetts: The MIT Press, 2016); Mark Johnson, "Pragmatism, Cognitive Science, and Embodied Mind," in *Pragmatism and Embodied Cognitive Science. From Bodily Intersubjectivity to Symbolic Articulation*, eds. Roman Madzia and Matthias Jung (Berlin: Walter de Gruyter, 2016), 101–125; Daniel Williams, "Pragmatism and the Predictive Mind," *Phenomenology and the Cognitive Sciences*, vol. 17, no. 5 (2018): 835–859, accessed August 20, 2023, https://doi.org/10.1007/s11097-017-9556-5; for arguments about the existence of more extended roots of pragmatism in cognitive science see Shaun Gallagher, "Pragmatism and Cognitive Science," in *Routledge Companion to Pragmatism* (New York: Routledge, 2023), 239–251.

[10] Literally, see Giovanni Pezzulo, Thomas Parr, and Karl Friston, "Active Inference as a Theory of Sentient Behavior," *Biological Psychology*, vol. 186 (2024): 108741, accessed January 27, 2025, https://doi.org/10.1016/j.biopsycho.2023.108741.

realism of this theoretical framework that are out of the scope of this paper.[11] In this regard, we embrace Hilary Putnam's pragmatic no-miracle argument. He argued that it would be a miracle for a scientific theory to be instrumentally and predictively successful if it were not tracking the truth, at least to some degree.[12] We are following here Deweyan naturalistic approach to the nature–culture dichotomy.[13] On this basis, we find miracles to be a component of misdirected cultural rationalisation practices and culture as a whole to be a form of realisation of natural needs; thus, we are inclined to reject "miraculous" explanations, as miracles play no causal role outside of cultural phenomena. We are therefore inclined to treat these theories as at least approximating reality, given their explanatory power.

Nonetheless, we will not discuss FEP empirical support or distract the reader by examining differences between various approaches to this framework,[14] be they pure-

[11] For further discussions, see Inês Hipólito and Thomas van Es, "Enactive-Dynamic Social Cognition and Active Inference," *Frontiers in Psychology*, vol. 13 (2022): 855074, accessed March 10, 2024, https://doi.org/10.3389/fpsyg.2022.855074; Jeffrey S. Bowers and Colin J. Davis, "Bayesian Just-so Stories in Psychology and Neuroscience," *Psychological Bulletin*, vol. 138, no. 3 (2012): 389–414, accessed March 10, 2024, https://doi.org/10.1037/a0026450; Ned Block, "If Perception Is Probabilistic, Why Does It Not Seem Probabilistic?," *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, vol. 373, no. 1755 (2018): 20170341, accessed March 11, 2024, https://doi.org/10.1098/rstb.2017.0341; Hanti Lin, "Bayesian Epistemology," in *The Stanford Encyclopedia of Philosophy*, eds. Edward N. Zalta and Uri Nodelman, 2023rd ed. (Metaphysics Research Lab, Stanford University, 2023), accessed March 11, 2024, https://plato.stanford.edu/archives/win2023/entries/epistemology-bayesian/; Michael Rescorla, "A Realist Perspective on Bayesian Cognitive Science," in *Inference and Consciousness*, eds. Anders Nes and Timothy Chan, first edition (London; New York: Routledge, 2020), 40–73; Catherine Legg and André Sant'Anna, "Pragmatic Realism: Towards a Reconciliation of Enactivism and Realism," *Phenomenology and the Cognitive Sciences*, vol. 20 (2024), accessed March 12, 2024, https://doi.org/10.1007/s11097-024-09959-w; Majid Davoody Beni, "Reconstructing Probabilistic Realism: Re-Enacting Syntactical Structures," *Journal for General Philosophy of Science*, vol. 51, no. 2 (2020): 293–313, accessed March 12, 2024, https://doi.org/10.1007/s10838-018-9426-z; Michał Piekarski, "Incorporating (Variational) Free Energy Models into Mechanisms: The Case of Predictive Processing Under the Free Energy Principle," *Synthese*, vol. 202, no. 2 (2023): 58, accessed March 12, 2024, https://doi.org/10.1007/s11229-023-04292-2.

[12] Due to lack of space, we will not rummage into the intricacies of Putnam's multi-threaded struggle with realism, stopping here: Hilary Putnam, *Mathematics, Matter and Method*, Reprint edition (Cambridge/New York: Cambridge University Press, 1975/2008).

[13] For the goals of our triptych, the most consequential feature of Dewey's soft naturalism is his rejection of this classic philosophical divide and his recognition of the latter as an element of the former, see Pentti Määttänen, "Philosophical Naturalism," in *Mind in Action: Experience and Embodied Cognition in Pragmatism*, ed. Pentti Määttänen, Studies in Applied Philosophy, Epistemology and Rational Ethics (Cham: Springer International Publishing, 2015), 1–14.

[14] For discussions on this topic, see Ryan Smith, Karl J. Friston, and Christopher J. Whyte, "A Step-by-Step Tutorial on Active Inference and Its Application to Empirical Data," *Journal of Mathematical Psychology*, vol. 107 (2022): 102632, https://doi.org/10.1016/j.jmp.2021.102632; Rowan Hodson, Marishka Mehta, and Ryan Smith, "The Empirical Status of Predictive Coding and Active Inference," *Neuroscience and Biobehavioral Reviews*, vol. 157 (2024): 105473, https://doi.org/10.1016/j.

ly formal, neurocentric, embodied or world-involving versions.[15] Weighting between different kinds of enactivism does not preoccupy us here either.[16] Lastly, we do not intend to get tangled in the dispute over whether an organism should be explicated literally or metaphorically as a mechanism or a process. As Chris Fields and Michael Levin note (in a pragmatic spirit), this dichotomy offers limited usefulness. Viewed through the lens of the FEP, both description forms can be regarded as complementary theoretical constructs.[17] At times, we casually employ the former conceptual frame for simplicity, albeit, in line with the pragmatist processual anti-essentialism, we lean towards agency-oriented process metaphysics, to which we will be pointing.[18]

A controversy we briefly address here from the pragmatist perspective relates to the role of representations in cognition (also referred to as "Representation Wars").[19] We need to comment on this because of the (neo)pragmatic traits of radical enactivists, who are indeed in the business of combatting representation-involving explanations.[20] Granting our appreciation for their efforts to elucidate simple forms of cognition through teleofunctionalism and dynamical systems theory,[21] our central reservation for their campaign is that by rejecting representationalism in its

neubiorev.2023.105473; Kathryn Nave, *A Drive to Survive: The Free Energy Principle and the Meaning of Life* (London: The MIT Press, 2025).

[15] See Miguel A. Sepúlveda-Pedro, *Enactive Cognition in Place. Sense-Making as the Development of Ecological Norms* (London: Palgrave Macmillan, 2023); Micah Allen and Karl J. Friston, "From Cognitivism to Autopoiesis: Towards a Computational Framework for the Embodied Mind," *Synthese*, vol. 195, no. 6 (2018): 2459–2482, accessed January 27, 2025, https://doi.org/10.1007/s11229-016-1288-5.

[16] See Shaun Gallagher, *Embodied and Enactive Approaches to Cognition* (Cambridge: Cambridge University Press, 2023).

[17] Chris Fields and Michael Levin, "Thoughts and Thinkers: On the Complementarity Between Objects and Processes," *Physics of Life Reviews*, vol. 52 (2025): 256–273, accessed January 27, 2025, https://doi.org/10.1016/j.plrev.2025.01.008.

[18] See Daniel J. Nicholson, "Reconceptualizing the Organism From Complex Machine to Flowing Stream," in *Everything Flows: Towards a Processual Philosophy of Biology*, eds. Daniel J. Nicholson and John Dupré, first edition (Process Philosophy of Biology, Oxford: Oxford University Press, 2018), 139–166.

[19] See Daniel Williams, "Predictive Processing and the Representation Wars," *Minds and Machines*, vol. 28, no. 1 (2018): 141–172, accessed August 27, 2023, https://doi.org/10.1007/s11023-017-9441-6; Andy Clark, "Predicting Peace: The End of the Representation Wars," in *Open MIND*, eds. Thomas Metzinger and Jennifer M. Windt, vol. 7 (Frankfurt am Main: MIND Group, 2015), 1–7, accessed August 24, 2023, https://doi.org/10.15502/9783958570979; Adrian Downey, "Predictive Processing and the Representation Wars: A Victory for the Eliminativist (via Fictionalism)," *Synthese*, vol. 195, no. 12 (2018): 5115–5139, accessed August 24, 2023, https://www.jstor.org/stable/26750669.

[20] Daniel Hutto and Erik Myin, *Radicalizing Enactivism: Basic Minds without Content* (Cambridge: The MIT Press, 2013); Daniel D. Hutto and Erik Myin, *Evolving Enactivism: Basic Minds Meet Content* (Cambridge: The MIT Press, 2017).

[21] We omit discussion about teleofunctionalism; enactivist threads will appear through both papers; for a deeper dive into it, see Sepúlveda-Pedro, *Enactive Cognition in Place*, 55–87.

entirety for non-languaging creatures, they offer little in return (Ur-intentionality or directedness as a basic form of contentless cognition). As a result, it seems as though radical enactivists, lacking the resources to explain agency,[22] reinstate the Davidsonian divide into empty-minded animals and *Homo sapiens* equipped with representational capacities due to natural language. At this point, without going into details, we emphasise our satisfaction with the olive branch extended by Karl Friston, Andy Clark and Axel Constant.[23]

Finally, before we continue, we must mention a misconception exposed by recent advancements in evolutionary biology. It originates from the key assumption of 20th-century orthodoxy, Modern Evolutionary Synthesis (MES), which posits that organisms are reactive machines determined by genetic programs.[24] Decades after the completion of the Human Genome Project, it turns out that genes are nothing of the sort.[25] They are primarily involved in producing proteins, which, by default, adhere to the set of physicochemical principles, contingently constraining paths of developmental self-organisation.[26] If we look for the really passive component of organisms, we will find it in the genome, as it is an information storage. It is not even a code; it is a template. On the basic level, complex molecular structures surrounded by a semi-permeable fat membrane encompassing *milieu intérieur* are active, which means that organisms shaped by an evolutionary history as dynamic wholes are the sources of action[27].

[22] Radical enactivism rejects the concept of biological autonomy. That makes artificial, human-made machines and self-organising biological systems indistinguishable.

[23] The authors noted that within active inference, representations can be viewed both as cognitive structures and, more dynamically, as processes of organisms' active involvement in their environment, see Axel Constant, Andy Clark, and Karl Friston, "Representation Wars: Enacting an Armistice Through Active Inference," *Frontiers in Psychology*, vol. 11 (2021), accessed August 24, 2023, https://www.frontiersin.org/articles/10.3389/fpsyg.2020.598733.

[24] For the recent anti-genocentric take on biology, see Peter A. Corning et al., eds., *Evolution 'on Purpose': Teleonomy in Living Systems*. Vienna Series in Theoretical Biology (Cambridge: The MIT Press, 2023).

[25] See Kevin N. Laland et al., *Proceedings of the Royal Society B: Biological Sciences*, vol. 282, no. 1813 (2015), accessed August 24, 2023, 20151019, https://doi.org/10.1098/rspb.2015.1019; Eva Jablonka and Marion J. Lamb, *Inheritance Systems and the Extended Evolutionary Synthesis* (Cambridge: Cambridge University Press, 2020); Raymond Noble, *Understanding Living Systems*, first edition (Cambridge, United Kingdom–New York: Cambridge University Press, 2023); Peter A. Corning et al., eds., *Evolution 'on Purpose': Teleonomy in Living Systems*, Vienna Series in Theoretical Biology (Cambridge, Massachusetts: The MIT Press, 2023); Philip Ball, *How Life Works: A User's Guide to the New Biology* (London: Picador, 2024).

[26] The physicochemical principles of energy minimisation, the hydrophobic effect, and electrostatic interactions guide protein self-organisation. Additionally, it uses chaperones to aid in maintaining the dynamics of protein structures.

[27] For an overview of the concept of *milieu intérieur*, see Douglas J. Lanska, "Bernard, Claude," in *Encyclopedia of the Neurological Sciences (Second Edition)*, eds. Michael J. Aminoff and Robert B. Daroff (Oxford: Academic Press, 2014), 413–416.

Setting aside the controversies surrounding the shortcomings of the MES, especially its mechanistic metaphors, teleophobia, overemphasis on genetics and lack of interest in insights from various related fields such as developmental biology, ecology, and epigenetics, let us look at the examples straightforwardly relevant to the reconstruction of agency, provided by one of the prominent FEP-AIN figures. As developmental/synthetic biologist Michel Levin and his team have demonstrated by creating functional, self-organising robot-like entities (xenobots and anthrobots) without altering their genetic makeup – evolution did not develop programs or blueprints for individual species to solve particularities of the environments they would inhabit.[28] Instead, at the basic biochemical level, evolution creates problem-solving agential material (or active matter), which can be creative enough to solve encountered problems in an unstable environment.[29] Thus, the praeludium

[28] Levin, who adopts the frameworks proposed by the FEP and AIN and an extended version of Dennett's "intentional stance," is a leading researcher in synthetic biology. His accomplishments in this field include the creation of xenobots (biological autonomous entities) from frog cells and, most recently, anthrobots from human lungs (epithelium cells). The latter are biobots that self-organise, autonomously navigate (display cilia-powered movement), and accelerate the repair of human brain cells. Levin's achievements are amongst the most potent arguments for the framework discussed in the paper. See Douglas Blackiston et al., "A Cellular Platform for the Development of Synthetic Living Machines," *Science Robotics*, vol. 6, no. 52 (2021): eabf1571, accessed December 1, 2023, https://doi.org/10.1126/scirobotics.abf1571; Gizem Gumuskaya et al., "Motile Living Biobots Self-Construct from Adult Human Somatic Progenitor Seed Cells," *Advanced Science*, vol. 30 (2023): e2303575, accessed December 1, 2023, https://doi.org/10.1002/advs.202303575; Michael Levin, "Bioelectric Networks: The Cognitive Glue Enabling Evolutionary Scaling from Physiology to Mind," *Animal Cognition* (2023), accessed December 2, 2023, https://doi.org/10.1007/s10071-023-01780-3.

[29] Currently, in the expanding field of extended evolutionary synthesis, which is meant to substantially upgrade, if not replace, the classical evolutionary synthesis paradigm, the eco–evo–devo framework is being developed. Within this approach, studies on collective behaviour are of particular interest. According to it, biological phenomena are intrinsically of multiscaled nature. That means that events on the microscale inside cells, adaptive behaviour of single organisms on mesoscales, and phenomena appearing on the macroscale (e.g., natural selection and niche construction) are influenced simultaneously on diverse spatiotemporal scales by biological systems existing in their respective environments. See Raymond Noble et al., "Biological Relativity Requires Circular Causality but Not Symmetry of Causation: So, Where, What and When Are the Boundaries?," *Frontiers in Physiology*, vol. 10 (2019), accessed November 26, 2023, https://www.frontiersin.org/articles/10.3389/fphys.2019.00827; Simona Ginsburg and Eva Jablonka, "Evolutionary Transitions in Learning and Cognition," *Philosophical Transactions of the Royal Society B: Biological Sciences*, vol. 376, no. 1821 (2021): 20190766, accessed November 27, 2023, https://doi.org/10.1098/rstb.2019.0766. The FEP theoreticians are subscribing themselves to this paradigm shift, Daniel Ari Friedman et al., "Active Inferants: An Active Inference Framework for Ant Colony Behavior," *Frontiers in Behavioral Neuroscience*, vol. 15 (2021): 647732, accessed December 5, 2023, https://doi.org/10.3389/fnbeh.2021.647732; Chris Fields and Michael Levin, "Scale-Free Biology: Integrating Evolutionary and Developmental Thinking," *BioEssays*, vol. 42, no. 8 (2020): 1900228, accessed December 5, 2023, https://doi.org/10.1002/bies.201900228; Michael Levin, "Technological Approach to Mind Everywhere: An Experimentally-Grounded Framework for Understanding Diverse Bodies and Minds," *Frontiers in Systems Neuroscience*, vol. 16 (2022), accessed

of the story we will retrace here begins with the law of least action and with the molecular particles suspended in the stochastic medium (water), which shapes the flow of their Brownian motions.[30] How does this lead to a full-fledged agency? In this paper, we will try to reconstruct the process of agency formation, starting from the primary forms of life.

The paper's structure is as follows: first, we elucidate the relationship between classical pragmatism and "the pragmatic turn" in cognitive science to justify the adopted (pragmatist) method of approaching FEP in general. The subsequent section lays the foundations for our arguments. It unfolds with an introduction to FEP's theoretical framework and the first of the two primary theories entailing it – (embodied) predictive processing (PP). The second FEP's corollary – active inference (AIN) will be introduced in the closing article, dedicated to reconstruction of the advanced form of agency. Our endeavour in two "reconstruction papers" (*Of Rats and Men II and III*) is conceptually supported by Henry Potter and Mitchell's account of naturalised agency (NA). In this part, we present the first four of their criteria. The reason for this move is such that, conceptually speaking, both paths (FEP and NA) resonate, providing the grounds for a more inclusive grasp of the agency's origins and function, although Potter and Mitchell's subsequent four criteria fit more vividly to more complex agents. In this section, we highlight, through the lens of modern theoretical biology, pivotal concepts related to agency, such as autonomy, value, meaning, normativity, the reason for action, and agent causality, as well as those derived from the classical intentional terms (beliefs, desires) but in the depiction of predictive and embodied frameworks. These notions are vital for a nuanced comprehension of agency within the FEP and serve as essential tools for tightening the gap between animal and human agents. We end by briefly discussing the merits of upholding these terms in an agency explication, as supported by FEP's conceptual scaffolding.

December 6, 2023, https://www.frontiersin.org/articles/10.3389/fnsys.2022.768201; Patrick McMillen and Michael Levin, "Collective Intelligence: A Unifying Concept for Integrating Biology Across Scales and Substrates," *Communications Biology*, vol. 7, no. 1 (2024): 378, accessed April 1, 2024, https://doi.org/10.1038/s42003-024-06037-4. In this context, Levin formulated the concept of "Scale-Free Cognition," proposing that the individuality of the biotic agents arises at every level of the organisation from their inherent ability to pursue goals. For a recent overview on developments in biology see Ball, *How Life Works: A User's Guide to the New Biology*.

[30] See Ville R. I. Kaila and Arto Annila, "Natural Selection for Least Action," *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*, vol. 464, no. 2099 (2008): 3055–3070, accessed June 16, 2023, https://doi.org/10.1098/rspa.2008.0178. For a case of relatively complex epitome pre-life goal-oriented dynamics, see István Lagzi et al., "Maze Solving by Chemotactic Droplets," *Journal of the American Chemical Society*, vol. 132, no. 4 (2010): 1198–1199, accessed June 15, 2023, https://doi.org/10.1021/ja9076793.

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Cognition Is for Action: A Pragmatist Silhouette of the Pragmatic Turn

In the term "pragmatic turn," denoting a relatively young phenomenon in cognitive sciences, the adjective "pragmatic" (from Greek πρᾶγμα, πρᾱγμᾰτος – act, deed, affair, concrete reality) does not, in itself, necessarily direct the reader towards its philosophical roots. This lack of explicit linkage leaves the contours of its theoretical mould somewhat in shadow. Consequently, before proceeding, it is worthwhile to retrace this movement's bonds with pragmatist philosophy. Doing so will provide us with the fundamental intuitions that will serve as the bedrock for the ideas we shall draw upon throughout the remainder of this three-part article.

In our view, the pragmatist flavour of "the pragmatic turn" is most accurately captured in Richard Menary's essay *Pragmatism and the Pragmatic Turn in Cognitive Science*.[31] The author emphasises that the central theme of classical pragmatism, which views cognition as being primarily in service of action, predates contemporary positions in the cognitive sciences. Also, modern embodied approaches – most notably canonical enactivism – converge with pragmatist views by departing from the treatment of cognition as structured solely through "head-made" computations on rich representational (symbolic) content. This demonstrates a significant overlap with the pragmatist tradition. Moreover, Menary identifies several ideas about the nature of cognition within action-focused orientations that grow from the insights of Charles Sanders Peirce and John Dewey.[32] These concepts are reflected not only in embodied cognition but also in the so-called Bayesian brain and related processual FEP theories (PP and AIN) that underpin this and the following paper.

Menary has distinguished three such tenets. Firstly, he notes that for theorists of the "pragmatic turn," contrary to internalist views, thinking/cognition is structured, and at least partially constituted, by the organism's sensorimotor interactions with its environment. This idea is grounded in Dewey's seminal critique of the linear stimulus-response model,[33] and resonates with his concept of the transaction between an organism and its surroundings.[34] Secondly, the development of cognitive

[31] Richard Menary, "Pragmatism and the Pragmatic Turn in Cognitive Science," in *The Pragmatic Turn: Toward Action-Oriented Views in Cognitive Science*, eds. Andreas K. Engel, Karl J. Friston, and Danica Kragic (The MIT Press, 2016), 215–234.

[32] For some reason, Menary omits the contributions of William James and George Herbert Mead.

[33] John Dewey, "The Reflex Arc Concept in Psychology," *Psychological Review*, vol. 3, no. 4 (1896): 357–370, accessed March 10, 2024, https://doi.org/10.1037/h0070405.

[34] It should be noted that classical pragmatists did not reject the sole notion of representation in this respect but were sceptical toward its Cartesian overintellectualised pictorial depictions in mainstream philosophy of the time.

abilities is built upon inferential mechanisms primarily used to explore the environment from the level of perception, a thread traceable to Peirce's ideas of semiotics embedded in the principle of continuity (synechism).[35] Thirdly, as a complex form of employing cognitive mechanics, the inquiry process is a direct extension of the explorative activity that primarily serves to resolve encountered practical problems through epistemic foraging. This orientation towards problem-solving as a source of thought is a hallmark of the pragmatist angle on cognition. As classical pragmatists perceived it, the problem-solving process (thinking) originates from the brain–body's responses to the emergence of states of uncertainty in contexts salient for the organism. States of uncertainty are triggered by rising ambiguity regarding the nature of one's relationship with the world (irritating doubts). The intrinsic need to mitigate such states constitutes the basis for motivation to act and activates the aforementioned mechanisms.

[35] Synechism (from the Greek συνεχής) is an anti-Cartesian metaphysical doctrine positing the inherent continuity of everything that exists (today, we might describe it as 'recursive'). Peirce rejected the notion of absolute individuality and discreteness, instead emphasising relational interdependence as an essential feature of reality. In his view, the universe exists as a whole that contains all of its parts; none of these is completely separate from the others, nor do they determine one another, just as the whole does not fully determine its parts. This claim points to Peirce's conception of tychism, which could be considered a metaphysical forerunner of the quantum theory. The elements of the continuity (including processes, ideas, and mechanisms for cognition) constantly increase their complexity and interconnectedness with other elements in the process of semiosis, while generality is characterised by an irreducible relational power that mediates and unifies the relationships among its components. Consequently, through the lens of synechism, all phenomena can be seen as parts of a single process unfolding along a continuous spectrum. The notion of continuity explains the ability of living entities to cognise the world – they cope with worldly structures by virtue of having evolved embedded within them. For analysis of relations between synechism, extended evolutionary synthesis, bioengineering and active inference, see Ahti-Veikko Pietarinen and Vera Shumilina, "Synechism 2.0: Contours of a New Theory of Continuity in Bioengineering," *BioSystems* (2025), accessed February 8, 2025, 105410, https://doi.org/10.1016/j.biosystems.2025.105410. Here, we can also find relevant connections with some core inspirations of Karl Friston's principle. When Hermann von Helmholtz proposed the unconscious inference hypothesis in the mid-19th century, it was widely dismissed by philosophers. The dominant philosophical perspective of the time treated the inferential process as necessarily conscious and representational; hence, the bold assertion that the inference commences at perception, beyond the subject's control, was deemed absurd. Among the few philosophers to take Helmholtz's proposal seriously were pragmatists, who discussed it at length. Their take on perception and inference can be seen as a particular instance of drawing upon synechism within Peirce's theory of signs (semiotics). What is of importance to us is that Peirce regarded perception as an interpretative process of formulating hypothetical inferences about unperceived features of the perceived objects; in other words, he viewed perceptual judgment as a primary form of abductive inference – a kind of reconciliation of understanding with available data. We will return to this idea later. For further discussion, see, Evelyn Vargas, "Perception as Inference," in *Peirce on Perception and Reasoning: From Icons to Logic*, eds. Kathleen A. Hull and Richard Kenneth Atkins (London–New York: Routledge, 2017), 14–24.

Already in such a condensed form, an essential advantage of these contemporary efforts to fathom the nature of the mind is *prima facie* revealed – the application of a pragmatist framework can effectively obliterate traditional dichotomous stances toward human and other animals' cognitive processes. This can be observed within "the pragmatic turn," as most theorists associated with this movement do not *a priori* separate human from non-human forms of cognition. Hence, the convergence of classical pragmatist and modern theoretical perspectives on the nature of cognitive processes presents us with an opportunity to reframe the notion of agency with the help of the FEP as its most influential theoretical construct.

The Hitchhiker's Guide Through the Free-Energy Principle

Due to its rapid expansion, the Free Energy Principle (FEP) is not easy to nail down; it resembles a somewhat moving target in many respects. Therefore, for brevity, we will not engage in particulars of current discussions surrounding it. Instead, we intend to track the FEP's notion of agency from a biological angle. In general, FEP is a system-theoretic framework compatible with the extended evolutionary synthesis.[36] It integrates insights from a wide-ranging spectrum of overlapping fields, including thermodynamics,[37] the Helmholtzian theory of perceptual inference, Bayesian mechanics, predictive coding, cybernetics, machine learning, the dynamical systems approach, niche construction, psychophysics and embodied cognition.[38]

[36] See footnotes 25, 28, and 29.

[37] Thermodynamics is a branch of physics that studies the laws and principles governing energy exchange between systems. The free energy principle is primarily based on the interpretation of the second law of thermodynamics, also known as the law of entropy. It states that in an isolated closed system, thermodynamic processes lead to an increase in entropy, a measure of disorder or randomness. It is the only fundamental law that takes into account a temporal factor in the form of the arrow of time. Recently, a second law – parallel to the law of entropy – has been hypothesised to exist, with the arrow of time pointing in the opposite direction. The so-called law of increasing functional information extends evolutionary processes beyond life to all physical systems. Intriguing as this thread may be, it is beyond the scope of the article. See Michael L. Wong et al., "On the Roles of Function and Selection in Evolving Systems," *Proceedings of the National Academy of Sciences*, vol. 120, no. 43 (2023): e2310223120, https://doi.org/10.1073/pnas.2310223120.

[38] The 4E paradigm, fully committed to the anti-Cartesian models of cognition, encompasses four aspects of mind traditionally overlooked by classical cognitivism. According to 4E cognition, the mind, along with thought and meaning, is (1) embodied (shaped by the body), (2) embedded in worldly situations (social processes), (3) enacted through interactions with the world, (4) it is not just in the head. It is extended (it is partly offloaded into the environment). See Mark L. Johnson and Jay Schulkin, *Mind in Nature: John Dewey, Cognitive Science, and a Naturalistic Philosophy for Living* (Cambridge,

Rather than seeking to supplant existing theoretical frames, it aims for their holistic integration and has, to date, exhibited remarkable capacities in this enterprise. The FEP itself is not an empirical proposition – its proponents, when explaining it, often draw parallels to the theory of evolution, which does not apply directly to particular cases but instead provides an invaluable explanatory lens for understanding the underlying processes themselves.[39] In this vein, it could be regarded as an extension of Hamilton's fundamental principle of least action to encompass all biotic systems.[40]

While the FEP mainly aspire to explain human cognitive processes, it is often supported with illustrations from non-human cases, which allows it to be applied to animals as targets of analysis as well, because, as we mentioned before – contrary to the mainstream philosophical tradition – it does not *a priori* establish boundaries between *Homo sapiens* and other animals. It is scale-free, which means that the same fundamental principle underlies every level of organisation – from molecules to cells and from neural networks to psychology and even societies.[41] It also

Massachusetts: The MIT Press, 2023). The inflation of Es in the embodiment paradigm can easily be regarded as diluting the concept of cognition, especially when considering the possibility of adding even more Es, like "ecological E," "emotional E," "enculturated E," or even – taking into account the predictive component of mind – "expectative E." Another way to think about it would be to consider whether the "extended E" could not devour the rest of them. However, we will not discuss this problem in the paper; suffice it to say that the 4E paradigm encompasses a much broader range of aspects than just algorithms (computation) or brain tissue (implementation) when explicating cognitive processes. For discussion, see Andrzej Dąbrowski, "Ucieleśnione poznanie – założenia, tezy i wyzwania," *Argument: Biannual Philosophical Journal*, vol. 11, no. 1 (2021): 13–32, accessed August 21, 2023, https://argument.up.krakow.pl/article/view/9069.

[39] Thomas Parr, Giovanni Pezzulo, and Karl Friston, *Active Inference: The Free Energy Principle in Mind, Brain, and Behavior* (New York: The MIT Press, 2022), 8.

[40] The principle of least action from which all laws of physics can be derived states, in short, that in nature, energy differences are minimised in the least time. FEP makes a stronger claim, as it is a normative principle. There are strong arguments in favour of the thesis that, in terms of simplicity, FEP is the most powerful principle that has so far been developed to unify the description of complex structures, ranging from molecules to minds, see Inês Hipólito, "A Simple Theory of Every 'Thing'", *Physics of Life Reviews*, vol. 31 (2019): 79–85, https://doi.org/10.1016/j.plrev.2019.10.006.

[41] Fields and Levin, "Scale-Free Biology: Integrating Evolutionary and Developmental Thinking," 36–59. McMillen and Levin, "Collective Intelligence"; Paul B. Badcock et al., "Applying the Free Energy Principle to Complex Adaptive Systems," *Entropy*, vol. 24, no. 5 (2022): 689, accessed April 11, 2024, https://doi.org/10.3390/e24050689; Paul B. Badcock, Karl J. Friston, and Maxwell J. D. Ramstead, "The Hierarchically Mechanistic Mind: A Free-Energy Formulation of the Human Psyche," *Physics of Life Reviews*, vol. 31 (2019): 104–121, accessed April 10, 2024, https://doi.org/10.1016/j.plrev.2018.10.002; Samuel P. L. Veissière et al., "Thinking Through Other Minds: A Variational Approach to Cognition and Culture," *Behavioral and Brain Sciences*, vol. 43 (2020): e90, accessed April 10, 2024, https://doi.org/10.1017/S0140525X19001213. There are also propositions for extending FEP to the quantum level, see Chris Fields et al., "A Free Energy Principle for Generic Quantum Systems," *Progress in Biophysics and Molecular Biology*, vol. 173 (2022): 36–59, accessed November 15, 2023, https://doi.org/10.1016/j.pbiomolbio.2022.05.006.

embraces the continuity of the life-mind thesis, hence converging particularly with the enactive approach and classical pragmatism (see footnote 31).[42] These, among many others, can be incorporated into the description of an agent's goal-oriented behaviour, regardless of the species to which she belongs.[43] FEP strives to grasp the processes governing self-organising living systems as reciprocally coupled with their environments and thus taken as a single unit of explanation.[44] It supports itself with robust mathematics,[45] albeit its non-mathematical formulation is surprisingly frugal in foundational assumptions.[46] Throughout history, the problem of defining life has tormented philosophers and scientists alike, and a satisfactory solution has yet to be found. In short, up until recently, it has been customary to ask what features complex systems must have to be considered alive. However, it is now apparent that

[42] Wanja Wiese and Karl Friston, "Examining the Continuity Between Life and Mind: Is There a Continuity Between Autopoietic Intentionality and Representationality?," *Philosophies*, vol. 6, no. 1 (2021): 18, accessed August 7, 2023, https://doi.org/10.3390/philosophies6010018. For a more cognitivist approach to the continuity thesis, see Michał Piekarski, "Spór o ciągłość życia i umysłu. Argumenty na rzecz kognitywizmu," *Argument: Biannual Philosophical Journal*, vol. 11, no. 1 (2021): 71–91, accessed August 20, 2023, https://doi.org/10.24917/20841043.11.1.4. It is not to say, there are no controversies regarding the unification of the enactive approach and FEP; for critical analysis, see Ezequiel Di Paolo, Evan Thompson, and Randall Beer, "Laying Down a Forking Path: Tensions Between Enaction and the Free Energy Principle," *Philosophy and the Mind Sciences*, vol. 3 (2022), accessed December 12, 2023, https://doi.org/10.33735/phimisci.2022.9187.

[43] For a full-blown approach in terms of inclusiveness, see Levin, "Technological Approach to Mind Everywhere." Such an inclusive treatment of the concepts of desire and belief raises much controversy despite its effectiveness in explanation and prediction, see Daniel Dennett, *The Intentional Stance* (Cambridge, Mass.: MIT Press, 1989). It is a powerful approach for designing experiments in, for example, synthetic biology; see Michael Levin and Daniel Dennett, "Cognition All the Way Down," *Aeon* (2020), 1–14, accessed August 21, 2023, https://aeon.co/essays/how-to-understand-cells-tissues-and-organisms-as-agents-with-agendas. At this point, we do not prejudge the legitimacy of applying of the intentional stance "all the way down." However, it will be sufficient to say that the current controversy is about attributing these concepts to relatively simple biological systems. In comparative psychology and social and affective neurosciences, this practice regarding animals closer to us in terms of cognition is becoming increasingly common, and the FEP framework can accelerate this process. We focus on these contexts in the article.

[44] As John Dewey proposed back in the day, see John Dewey and Arthur Bentley, *Knowing and the Known* (Boston: The Beacon Press, 1949).

[45] For mathematical formulation, see Christopher Buckley et al., "The Free Energy Principle for Action and Perception: A Mathematical Review," *Journal of Mathematical Psychology*, vol. 81 (2017): 55–79, accessed August 21, 2023, https://doi.org/10.1016/j.jmp.2017.09.004.

[46] Friston distinguished two explanatory distinctive paths – the high road (answers to fundamental biological imperatives can be found in mathematical, variational principles) and the low road – Bayesian (that starts from Kantian intuitions, Helmholtz unconscious inference, Shannon information theory, or predictive coding). While both roads meet at embodiment, see Parr, Pezzulo, and Friston, *Active Inference*, 15–62, the latter path seems to overlook the role of the environment, see Karl J. Friston, "Beyond the Desert Landscape," in *Andy Clark and His Critics*, eds. Matteo Colombo, Elizabeth Irvine, and Mog Stapleton (New York: Oxford University Press, 2019), 174.

life cannot be accurately described by listing some specific traits that living entities possess, such as replication, metabolism or susceptibility to selective evolutionary pressures, even though these criteria are still widely invoked at the operational level.[47] Karl Friston, the living legend in neuroscience, approached the problem pragmatically and, by inverting the question, shifted the model from reactive to proactive. At the outset, he revealed his fundamental ontological commitment by stating that "Things exist" just as "Living (self-organising, autopoietic) systems exist."[48] But while "things" dissipate inertly, living systems, at least temporally, endure. The question then arose: "What must such systems do to persist over time?" And here is the answer: "Such systems must actively resist the natural tendency towards moving to thermodynamically high entropy states."[49]

The central tenet of Friston's principle is that organisms maintain themselves by continually seeking states in which their free-energy – uncertainty about the viability of conditions they are in – is minimised. Yet, to sustain this process, organisms must form expectations that are prone to be violated. In practice, FEP implies an adaptive necessity for biological entities to track and anticipate environmental (exteroceptive) changes to minimise the uncertainty (surprisal) of their internal (interoceptive) states.[50] Friston's departure point reverberates Dewey's approach to

[47] For example, the most common NASA definition describes life as "a self-sustaining chemical system capable of Darwinian evolution," adding little to our understanding of the phenomenon, see Steven A. Benner, "Defining Life," *Astrobiology*, vol. 10, no. 10 (2010): 1021–1030, accessed February 10, 2024, https://doi.org/10.1089/ast.2010.0524. Nowadays, however, a more general property of biological systems is regaining attention – from the most basic level, they selectively explore their environment, including their bodies, in search of the components (humidity, appropriate temperature and nutrients) that are important for them – they mean something. Due to this ability, they can exchange energy with the environment for the benefit of their duration in time. In other words, living systems are homeostatic "generators of meaning," see Ball, *How Life Works,* 6. The FEP is also predicated on this observation. We will return to this remark later.

[48] Autopoietic systems (autopoiesis Greek αὐτοποίησις, self-production) are those which are organisationally independent (autonomic), operationally closed, bounded from the environment, and continuously acting to maintain their structural and functional integrity, see Humberto Maturana and Francisco Varela, *Autopoiesis and Cognition: The Realization of the Living*, first edition (Dordrecht–Boston: D. Reidel Publishing Company, 1980). We should add here that from the perspective of the processual philosophy of biology, "things" as such do not exist. "Things" "are abstractions from an ever-changing reality. Reality consists of a hierarchy of intertwined processes." (Johannes Jaeger, "Forward," in *Everything Flows*, xi. "Autopoietic systems"). They are, therefore, bundles of semi-autonomous processes.

[49] A recollection of Spinoza's *unaquaeque res, quantum in se es, in suo esse perseverare conatur* ("to exist – to be a thing in itself – is to try to persevere in one's being") comes to mind here, which is also one of the main ideas behind Antonio Damasio's approach to the phenomenon of life.

[50] Surprisal – initially an information-theoretic concept, mathematically expressed as negative log-probability – refers to the internal evaluation of how improbable sensory data are relative to the predictions of a given model produced by the system. In short, it quantifies the unexpectedness of a given occurrence for the system. However, in practical terms, surprisal is computationally intractable:

life, who, in his influential work, *Experience and Nature*, attempted to discriminate between living and inanimate matter, writing:

> [E]mpirically speaking, the most obvious difference between living and non-living things is that the activities of the former are characterized by needs, by efforts which are active demands to satisfy needs, and by satisfactions […]. By need is meant a condition of tensional distribution of energies such that the body is in condition of uneasy or unstable equilibrium. By demand or effort is meant the fact that this state is manifested in movements which modify environing bodies in ways which react upon the body, so that characteristic pattern of active equilibrium is restored. By satisfaction is meant this recovery of equilibrium pattern, consequent upon the changes of environment due to interactions with the active demands of organisms.[51]

Causal isolation from the outside world with a membrane, which FEP captures with a statistical device called (ergodic) Markov blankets,[52] allows living organisms to extract free energy from the environment (in Erwin Schrödinger's terms, to feed upon "negative entropy") and convert it into work,[53] making them biologically

an organism cannot hold exhaustive knowledge of the external dynamics, from which it derives sensory experiences. Hence, in information-theoretic terms, variational free-energy – which serves as an upper bound on surprise – becomes relevant. It can be understood as a function of two principal sources of information for an organism: 1) surprisal (mapped onto action) and 2) the Kullback-Leibler divergence measuring the difference between what was expected and what has been sensed (mapped onto perception). This measure serves as a proxy for the amount of experienced surprise. The averaged quantity of variational free-energy within the system facilitates the evaluation of discrepancies between predictions and observations, see Karl Friston and Klaas Stephan, "Free-Energy and the Brain," *Synthese*, vol. 159, no. 3 (2007): 417–458, accessed August 22, 2023, https://doi.org/10.1007/s11229-007-9237-y; Karl Friston, "The Free-Energy Principle: A Unified Brain Theory?" *Nature Reviews Neuroscience*, vol. 11, no. 2 (2010): 127–138, accessed August 22, 2023, https://doi.org/10.1038/nrn2787; Karl Friston, Jérémie Mattout, and James Kilner, "Action Understanding and Active Inference," *Biological Cybernetics*, vol. 104, no. 1–2 (2011): 137–160, accessed August 5, 2023, https://doi.org/10.1007/s00422-011-0424-z. Of course, elementary organisms do not expect anything *per se*; they merely behave as though they did, through existential submission to Friston's principle. More complex organisms follow the same principle but use increasingly robust means for that – e.g., neural networks, which means they enact much more than just simple "as if" Bayesian "beliefs."

[51] John Dewey, *Experience and Nature* (New York: Dover Publications, 1925/2022) in Johnson and Schulkin, *Mind in Nature*, 35.

[52] Markov blanket is not merely a statistical tool. It is "a necessary attribute of a universe that can be carved into 'things' (that are distinct from other 'things')," and these can exist over a timescale as long as they are ergodic, see Friston, "Beyond the Desert Landscape," in *Andy Clark and His Critics*, 176.

[53] In other words, "negative entropy" consists of local eddies of order which can form as long as overall entropy increases, see Erwin Schrödinger, *What Is Life?: With Mind and Matter and Autobiographical Sketches* (Cambridge/New York: Cambridge University Press, 1944/1992), 46–47.

autonomous but not fully separated. According to Friston, although the organism's environment is volatile, it typically maintains a predictable degree of recurrences, which can be captured and learned. In Bayesian terms, these statistical regularities facilitate the formation of stable priors leading to predictions about the world. Here lie the roots of learning – in the congruence between the structure of an organism and the dynamics of the eco-niche it inhabits.[54]

On the basic biological level, organisms continually generate predictions about their current conditions relative to their preferred states, accounting for changes in pressure, temperature, light, food availability, and affordances for actions. These estimations enable them to maintain stability in a constantly changing environment by driving organisms back to their preferred homeostatic steady states and keeping them close to phenotypically established priors (akin to cybernetic "set points," enabling stability through constancy).[55] This coupling is crucial for thriving as well, as it allows organisms not only to restore their homeostasis and avoid potential threats but also to actively pursue, anticipate, and adjust to more favourable states from the egocentric perspective, a concept known as allostasis (stability through change, anticipatory control) or homeodynamics (second-order control).[56]

The above raw outline of the FEP indicates that an immediate linkage between world-directedness and the imperative of preserving homeodynamic integrity is

[54] This also aligns with Dewey's notion of harmony, Peircean Synechism, and Ashbyan's statement about the necessity of isomorphism between evolved biological architectures and the statistic structure of the world modelled by them.

[55] Formalistically speaking, all biotic systems must frequently revisit some corresponding to their homeostatic integrity repertoire of attracting sets of states (*random dynamical attractors*). Attractor is a concept derived from chaos theory, resembling the Peircean notion of *habit*. It describes the tendencies of entities to keep revisiting states they occupied before. This tendency can be described mathematically as probability density. From the observer's point of view, the existence of such systems is equivalent to the high likelihood of finding them in various timescales in particular states. The probability distribution of finding biological systems in certain states corresponds, in turn, to *ergodic density* interpreted in terms of information-theoretic entropy or uncertainty. Relatively stable instances of observed states of a given kind of organism (its ergodicity) constitute its particular phenotype.

[56] We must note that "homeostasis" is a far more robust concept than simple "metabolism" (Greek μεταβολή – change). It is a crucial concept here, as for the living, striving to maintain it is the primordial mechanism of resistance to entropy, see Johnson, "Pragmatism, Cognitive Science, and Embodied Mind"; Antonio Damasio, *Dziwny porządek rzeczy*, trans. Andrzej Jankowski (Poznań: Rebis, 2018: 36–66). For a more robust analysis of homeo- and allostasis in the context of Friston's principle, see Jesse Bettinger and Karl Friston, "Conceptual Foundations of Physiological Regulation Incorporating the Free Energy Principle and Self-Organized Criticality," *Neuroscience & Biobehavioral Reviews*, vol. 155 (2023): 105459, accessed December 3, 2023, https://doi.org/10.1016/j.neubiorev.2023.105459. See also: Andrew W Corcoran and Jakob Hohwy, "Allostasis, Interoception, and the Free Energy Principle: Feeling Our Way Forward," in *The Interoceptive Mind: From Homeostasis to Awareness*, eds. Manos Tsakiris and Helena De Preester (Oxford: Oxford University Press, 2019), 272–292.

a fundamental feature of life.[57] This mutual coupling holds even for the simplest of biotic systems, though evolutionarily speaking, the crucial events for the emergence of basic agency, which we are interested in here, came with the appearance of organisms equipped with mitochondria (eukaryotes) and, subsequently, multicellular creatures with multimodal sensorimotor control. The range of possible actions and goals to be pursued has rapidly extended for these creatures. Biological entities with the propensity for goal-directed movement driven by homeostatic imperative also acquired the ability to selectively approach and move away from specific stimuli in much more convoluted explore–exploit loops.[58] These life forms began to internally register (value) increasingly nuanced aspects of their surroundings regarding what is good or bad (satisficing or surprising) for their persistence and to act accordingly to what those categories entail. In other words, there has been a transition from simply sensing the environment to perceiving its salient aspects; creatures started to bestow meaning to their sensory information (sense-making in enactivist terms). By reconfiguring relevant data into objects and events with meanings and acting on them, they began, therefore, to constitute their *Umwelten*. Therein lies the source of biotic motivation and intrinsic normativity, as creatures realise implicit faculty to act for reasons.[59] The latter claim can be deemed controversial as it describes organisms as genuine moderators of values in their worlds, an attribute often denied to animals other than our species, at least by many philosophers. Therefore, it calls for further theoretical justification.

Agency Naturalised – First Steps of the Stroll from the First Principles[60]

To address this issue, we borrow and expand upon converging with the processual metaphysics of biology conceptual proposal from Henry Potter and Kevin Mitchell, the torchbearers of the contention about organisms' reason-grounded behaviour.[61]

[57] Karl J. Friston et al., "Action and Behavior: A Free-Energy Formulation," *Biological Cybernetics*, vol. 102, no. 3 (2010): 227–260, accessed December 11, 2023, https://doi.org/10.1007/s00422-010-0364-z.

[58] Paul Cisek, "Evolution of Behavioural Control from Chordates to Primates," *Philosophical Transactions of the Royal Society B: Biological Sciences*, vol. 377, no. 1844 (2021): 20200522, accessed March 10, 2024, https://doi.org/10.1098/rstb.2020.0522.

[59] Kevin J. Mitchell, *Free Agents: How Evolution Gave Us Free Will* (Princeton/Oxford: Princeton University Press, 2023), 273–274. See also Sepulveda-Pedro, *Enactive Cognition in Place*, 95–100.

[60] With this title, we obviously follow Jakob von Uexküll's path.

[61] Along with such process metaphysicians as John Dupré and Daniel J. Nicholson.

Their analysis is distinctively beneficial for the task of basic agency reconstruction undertaken in this paper. In the article *Naturalising Agent Causation* (NA), they challenged reductionist explanations of agency in the philosophy of biology (horizontal/vertical reductionism and external determinism), which limits the possibility of grasping causal agency by reducing the procedure of explication to the lowest levels of physical description, linear workings of the selected discrete subsystems, or external determinants.[62] The researchers asked whether it is possible to identify conditions an organism must meet to be justifiably recognised as possessing causal agency – that is, to be a genuine originator of change in the environment it inhabits. In their view, biotic systems can only be described in such terms if their organisation is understood in a non-reductive way. They outlined eight convergent biologically plausible criteria characterising systems capable of agential causality, which, at the same time, are consistent with the physicalist approach (physicalistically definable components realise them). Although Potter and Mitchell did not directly refer to FEP, their proposition neatly converges with this conceptual framework. Below, we briefly sketch the first four criteria for treating a system as a causal agent.

The first criterion is thermodynamic autonomy. The system must demonstrate the ability to remain in a thermodynamic non-equilibrium steady state with the environment *via* self-organisation, self-regulation and maintenance of internal states in defiance of push from external forces.[63] The second is persistence, which requires an organism to possess the ability to uphold structural and functional continuity over time despite being subjected to constant change and outside influences. It is feasible because life is not identical to the physical material it absorbs and excretes to last, and organisms possess no fixed central control over these internal processes. They are self-maintaining patterns of activities separated from the environment with a membrane (i.e., a Markov blanket), within which they constantly juggle their material substrate, trading it with the outside (they are thermodynamically open). As Hans Jonas has put it: "The exchange of matter with the environment is not a peripheral activity engaged by a persistent core: it is the total mode of continuity (self-continuation) of the subject of life itself."[64] In other words, a living being can be justifiably described as a process, not "a thing," or, more precisely, a living being happens to be a temporally stable cluster of multiple intertwined self-sustaining processes.

The third criterion is endogenous activity – the system should be able to initiate internal activities regardless of direct external stimuli. Such biomechanics

[62] Henry D. Potter and Kevin J. Mitchell, "Naturalising Agent Causation," *Entropy*, vol. 24, no. 4 (2022): 1–18, accessed March 20, 2024, https://doi.org/10.3390/e24040472.

[63] For an organism to be "in a non-equilibrium steady state" means that it must remain thermodynamically distinct from its surroundings.

[64] Hans Jonas, *The Phenomenon of Life: Toward a Philosophical Biology* (Evanston: Northwestern University Press, 1966), 76.

becomes possible because (at a certain stage of phylogenesis) organisms begin to differentiate distinct features of encountered stimuli informationally. The sensory data become subject to interpretation within the sensorium; objects and events gain varying meanings for an organism regarding their expected value, leading to autonomous internal homeodynamics. From those internal processes, in turn, the need for further exploration emerges, manifesting itself in progressively nuanced world-directedness. A being persisting over time in a fluctuating environment gains relative independence from external pressures, expressing it in actions that are, to a degree, externally independent (although indirectly influenced by the outside). Holistic integration, the fourth criterion, indicates the importance of the relational integration of the system's elements. The organism has to be treated not as a passive data recipient composed of parts but as a goal-oriented entity – an active information seeker. Subsystems within the body operate at multiple levels simultaneously, in parallel, relationally, holistically, and context-dependently. Therefore, their causal activity can be conceived, in principle, only from the perspective of the entire organism. On every level of organisation, the parts exist for the whole, just as the whole exists for the parts.[65]

These standards, while presenting the universal basis for agency of biotic organisms at a relatively low level of organisation, provide a justification for the reuse of many concepts historically considered to mark human uniqueness, including *telos*, interpretation, value, meaning, and reason for action. In the following paper, we will introduce four further criteria crafted by Potter and Mitchell and discuss in greater detail FEP's perspective on the biomechanics of agents equipped with more robust nervous systems.[66] For the time being, let us return to the first of two theories arising from the FEP to illustrate how brained bodies implement it and how agents' cognitive activity is organised around this principle.

From Meaning-Making to Predictavores

Amidst the process of rapid development of the concept of agency in the modern philosophy of biology, at least its three main interpretations within the FEP framework have emerged: the rationalistic Helmholtzian reading based on the notion of

[65] Potter and Mitchell, "Naturalising Agent Causation," 4–8. See Peircean Synechism.

[66] Recently, a research team in Japan has proven the validity of the FEP and AIN by using sensory manipulations on the rat's living embryonic neural networks and matching the observed self-organisation process to the predictions of their model. See Takuya Isomura et al., "Experimental Validation of the Free-Energy Principle with in Vitro Neural Networks," *Nature Communications*, vol. 14, no. 1 (2023): 4547, accessed August 29, 2023, https://doi.org/10.1038/s41467-023-40141-z.

unconscious perceptual inference,[67] sometimes captured in the metaphor of a brain, "as a scientist;"[68] the Ashbyan cybernetic depiction, which relates to the control of homeostatic variables;[69] and a broader, more nuanced ecological, enactive, and affordance-based account of skilled intentionality.[70] Each has its own merits, but whether and to what degree these approaches complement or contradict each other remains to be determined.[71] Regardless, as a potentially unifying theory for biology, cognitive science, and brain function,[72] the FEP and its corollaries (PP and AIN) offer a promising avenue for a coherent explanation of agency and volition, one that, in our view, underscores the superfluousness of reverting to the concept of the FW in explanatory practices.

The process theories under FEP, known as predictive processing (PP) and active inference (AIN), seek to detail the computational dimension of the biomechanics of cognition. In this paper, we focus briefly on the former. PP, already a well-established theory, easily accommodates neural network models and the functional anatomy of the reward system while simplifying the Rescorla–Wagner model and the Reinforcement Learning theory (RL).[73] It posits that the brain is primarily in

[67] Karl Friston, James Kilner, and Lee Harrison, "A Free Energy Principle for the Brain," *Journal of Physiology-Paris*, no. 100 (2006): 70–87, accessed August 17, 2023, https://doi.org/10.1016/j.jphysparis.2006.10.001; Friston, "The Free-Energy Principle;" Andy Clark, "Whatever Next? Predictive Brains, Situated Agents, and the Future of Cognitive Science," *Behavioral and Brain Sciences*, vol. 36, no. 3 (2013): 181–204, accessed August 23, 2023, https://doi.org/10.1017/S0140525X12000477.

[68] Jelle Bruineberg, Julian Kiverstein, and Erik Rietveld, "The Anticipating Brain Is Not a Scientist: The Free-Energy Principle from an Ecological-Enactive Perspective," *Synthese*, vol. 195, no. 6 (2018): 2417–2444, accessed August 24, 2023, https://doi.org/10.1007/s11229-016-1239-1.

[69] Anil Seth, "A Predictive Processing Theory of Sensorimotor Contingencies: Explaining the Puzzle of Perceptual Presence and Its Absence in Synesthesia," *Cognitive Neuroscience*, vol. 5, no. 2 (2014): 97–118, accessed August 24, 2023, https://doi.org/10.1080/17588928.2013.877880.

[70] Jelle Bruineberg, "Active Inference and the Primacy of the 'I Can'," eds. Thomas Metzinger and Wanja Wiese, *Philosophy and Predictive Processing*, vol. 5 (2017): 1–18, accessed August 20, 2023, https://doi.org/10.155027/9783958573062.

[71] For example, each of the mentioned approaches can describe (approximate) one level of depth or dimension of the cognitive dynamics, although a rationalistic one would be the ideal level, absent in nature.

[72] This does not mean that theories tracing FEP are best candidates for unification without controversies. See, for example, Paweł Gładziejewski, "Mechanistic Unity of the Predictive Mind," *Theory & Psychology*, vol. 29, no. 5 (2019): 657–675, accessed August 2, 2023, https://doi.org/10.1177/0959354319866258.

[73] In contrast to model-free Rescorla–Wagner and other RL approaches that differentiate between model-free and model-based strategies, the FEP offers a more straightforward account of learning processes by treating action and perception as a form of inference. By modelling inherent uncertainty estimation in the generative model – assessing expected free-energy for a given policy – FEP dispenses with the need to update a separate value function to guide behaviour. Rescorla–Wagner and RL were mentioned in the previous paper, see Słuszkiewicz, "Of Rats and Men I," 30–31.

the business of prediction.[74] According to this account, although the basis for prediction lies in homeostatic control (homeostatic imperative), autonomous reflexes, and primary drive states, the actual use of its potential is inextricably linked to the evolutionary revolution mentioned earlier. Namely, from this point, multicellular organisms not only acted for the maintenance of their internal milieu. They soon acquired the ability to engage in spatially extensive goal-oriented movement across their niches, which entailed the necessity for sensorium development and sensorimotor coordination of the body tied to this new skill.[75]

For Rodolfo Llinás, an originator of the prediction imperative hypothesis,[76] the prototypical example of the brain's servant role in this venture is the marine invertebrate sea squirt (*Ascidiacea*). This chordate, probably the ancestor of vertebrates, forms the primitive brain (cerebral ganglia) coupled with the precursor of the visual apparatus (statocyst, a light-sensitive patch of skin) only in one phase of the development cycle, during which it must find a spot to settle on the sea substrate. After accomplishing this goal, most of this implementing a primitive action–perception loop structure is absorbed (digested). According to Llinás, the sea squirt life cycle compellingly demonstrates the thesis that brains are the exclusive property of creatures equipped with sensorium for purposive movements.[77] Behind their evolutionary success lies the predictive aptitude of their ephemeral nervous system for selecting action opportunities and avoiding threats.[78] More than two decades ago, in *I from Vortex: From Neurons to Self*, he wrote:

> The nervous system has evolved to provide a plan, one composed of goal-oriented, mostly short-lived predictions verified by moment-to-moment sensory input. This allows a creature to move actively in a direction according to an internal reckoning – a transient sensorimotor image – of what may be outside.[79]

[74] Andy Clark, *Surfing Uncertainty: Prediction, Action, and the Embodied Mind* (New York: Oxford University Press, 2019).

[75] See Giovanni Pezzulo, Thomas Parr, and Karl Friston, "The Evolution of Brain Architectures for Predictive Coding and Active Inference," *Philosophical Transactions of the Royal Society B: Biological Sciences*, vol. 377, no. 1844 (2022): 20200531, accessed August 19, 2023, https://doi.org/10.1098/rstb.2020.0531.

[76] The prediction imperative states that the nervous system's global function is geared towards implementing intelligent motricity; see Rodolfo R. Llinás and Sisir Roy, "The 'Prediction Imperative' as the Basis for Self-Awareness," *Philosophical Transactions of the Royal Society B: Biological Sciences*, vol. 364, no. 1521 (2009): 1301–1307, accessed August 25, 2023, https://doi.org/10.1098/rstb.2008.0309.

[77] In line with the FEP's evolutionary approach to cognitive ontogenesis, see Giovanni Pezzulo, Thomas Parr, and Karl Friston, "The Evolution of Brain Architectures for Predictive Coding and Active Inference."

[78] Rodolfo R. Llinás, *I of the Vortex: From Neurons to Self*, Reprint edition (Cambridge London: Bradford Books, 2002), 15–17.

[79] Ibidem, 18.

Species with a permanent need for movement guided by extended sensory perception achieved an advantage over stationary and inert organisms, securing plenty of evolutionary time for their primary neural action-perception loops to evolve into a variety of sensorimotor brain circuits. Extensive multimodal sensory capacities enabled information sampling from a distance, lengthening predictive abilities while making them more nuanced. Even some seemingly negligible aspects of new perceptual capacities, such as infinitesimal temporal shifts between an object of perception and the formation of internal percept (patterns of neuronal activation), have contributed to the developmental acceleration of neuronal structures due to the necessity of compensating for the delay in receiving, processing and integration of information from various modalities to synchronise the experiential flow. Hierarchical organisation on the level of neural implementation has emerged. This, in turn, allowed for the construction of increasingly detailed internal models of the surroundings, enabling more accurate predictions based on the evaluation of percepts and, eventually, the pursuit of higher-order goals.

To thrive in dynamic environments, increasingly complex creatures must continuously (and unconsciously) assess proximal probability distributions over worldly states that could cause their sensations. They need this to anticipate incoming sensory inputs based on previous experiences (priors or beliefs). This mechanics involves updating world models under the implicitly predictive hierarchical generative model of the self and surroundings. The generative model simulates possible sensory experiences given identified deviations between produced top–down predictions of expected sensory inputs and incoming bottom–up sensory data.[80] In organisms with developed central nervous systems, the critical mechanism for realising PP is prediction-error minimization (PEM), operating at every neural level. Higher levels continuously generate predictions based on previously received signals and pass them downstream, whereas lower levels confront those with incoming data and compute discrepancies between the two. Results are then sent upstream

[80] The hierarchical generative model includes prior beliefs and likelihood functions for generating updated beliefs (i.e., posteriors) based on incoming sensory observations. Descending higher-level predictions minimises error signals ascending from lower levels, thus updating the model. Top–down predictions originate from prior beliefs formed by previous experiences, based on which higher levels of processing attempt to assess the likelihood of the nature of upcoming experiences. The lowest levels of the hierarchy (e.g., in the brainstem) consist of closed loops of reflex arcs responsible for basic predictions (e.g., proprioception, interoception). A similar process of iterative exchanges of predictions and error signals occurs at the cortical level between its layers. Higher levels of processing hierarchy formulate progressively more time-extended, generalised, abstract and conscious predictions, though for all of it to work smoothly, the main signals that matter are those indicating errors in the past predictions weighted by their salience or reliability (precision-weighted); see Thomas Parr et al., "The Computational Neurology of Movement under Active Inference," *Brain: A Journal of Neurology*, vol. 144, no. 6 (2021): 1799–1818, accessed April 1, 2024, https://doi.org/10.1093/brain/awab085.

as error signals, leading to updates of beliefs (posteriors, inferences) and reshaping future predictions (i.e., "changing mind"). The PP can thus be viewed as a form of model-based Bayesian statistical inferential processing – or, more precisely, an approximation thereof. Over longer timescales, this approach involves variational Bayesian inference, which entails the ongoing updating of probabilities regarding future bodily and worldly states in light of new evidence and accumulated experience.[81] That way, unlike the mainstream philosophical tradition and first-generation cognitive science, the image of the cognising mind receives the gift of dynamics. In Andy Clark's metaphor:

> We are not cognitive couch potatoes idly awaiting the next 'input,' so much as proactive **predictavores** – nature's own guessing machines forever trying to stay one step ahead by surfing the incoming waves of sensory stimulation.[82]

In sum, the PP provides essential elements constituting a modern approach to cognitive processes. It also places intentional terms in a theoretical, mathematically laden framework. This is how it incorporates perception and indicates its direct connection to action. Yet, another theory is needed for a full-blown explanation of action–perception loops: an active inference account. We will turn to it in the ensuing paper. At this point, we need to address the question of the relevance of the presented framework for interpretations of animal cognition.

From the Basic Agency Towards Intentionality

Avoiding intentional vocabulary when explaining animal behaviour has a long history in animal research. Things may change with the adoption of the framework presented in this article. However, the FEP can also be seen as leading to a form of nihilistic eliminativism. Indeed, for some time, there has been growing concern about the potential destructive power of the FEP, particularly concerning the terminological implications of embracing the PP conceptual frame. The core of the dispute revolves around the status of concepts such as "value" and "reward," and crucially "belief" and "desire." The unease flows from Friston's ontology, which *prima*

[81] Clark, *Surfing Uncertainty*; Andy Clark, *The Experience Machine: How Our Minds Predict and Shape Reality* (New York: Pantheon, 2023); Jakob Hohwy, *The Predictive Mind* (Oxford: Oxford University Press, 2014); Anil Seth, *Being You: A New Science of Consciousness* (London: Penguin Publishing Group, 2021).

[82] Clark, *Surfing Uncertainty*, 52.

facie may prompt one to think that these concepts are becoming redundant.[83] This, in turn, leads to the paradoxical question of whether the Quinean "desert landscape" that unfolds after being subjected to this draining vortex is indeed desirable. The discussion stems, *inter alia*, from the idea that, according to PP, "there is no essential difference between goals or desires and beliefs or predictions"[84] with "desired outcomes [being] simply [...] those that an agent believes [predicts] *a priori*, it will obtain."[85] This course seems to put intentional vocabulary in jeopardy.

However, from a pragmatist vantage point, "the garden of explanations" should be pluralistic, especially in such an enormously intricate subject as the mind. It does not have to be guarded by an ontologically over-committed landscaper who vigorously dulls Ockham's razor on every pod. The reasons a meadow blooms are multifaceted – they are grounded primarily in the generosity of the soil, the efficiency of vegetational roots, and the charity of the sun, not merely in the observer's aesthetic sensitivity. Therefore, it might be argued that the threat of an eliminativistic rotary mower is exaggerated. On the contrary, embracing FEP's minimal assumptions (existence as ergodicity encapsulated within Markov blankets), along with its process theories emerging from this existential desert, allows for the reconstruction and enrichment of many concepts from the ground up – from mathematical formulations to the psychological level. As a result, FEP broadens the scope of application for intentional schemes.[86] It appears even more capable, as both sets of intentional concepts – belief–desire, and prediction–error signal – are tied to similar directions of fit (agent–to–world and world–to–agent),[87] thereby realising the same impera-

[83] Andy Clark, "Beyond Desire? Agency, Choice, and the Predictive Mind," *Australasian Journal of Philosophy*, vol. 98, no. 1 (2020): 1–15, accessed January 27, 2025, https://doi.org/10.1080/00048402.2019.1602661.

[84] Sander Van de Cruys, Karl J. Friston, and Andy Clark, "Controlled Optimism: Reply to Sun and Firestone on the Dark Room Problem," *Trends in Cognitive Sciences*, vol. 24, no. 9 (2020): 680–681, accessed August 20, 2023, https://doi.org/10.1016/j.tics.2020.05.012.

[85] Thomas H. B. FitzGerald, Raymond J. Dolan, and Karl Friston, "Dopamine, Reward Learning, and Active Inference," *Frontiers in Computational Neuroscience*, vol. 9 (2015), accessed August 15, 2023, https://www.frontiersin.org/articles/10.3389/fncom.2015.00136.

[86] Ryan Smith, Maxwell J. D. Ramstead, and Alex Kiefer, "Active Inference Models Do Not Contradict Folk Psychology," *Synthese*, vol. 200, no. 2 (2022): 81, accessed August 16, 2023, https://doi.org/10.1007/s11229-022-03480-w.

[87] See John R. Searle, *Intentionality: An Essay in the Philosophy of Mind*, first edition (Cambridge: Cambridge University Press, 1983). Contrary to claims of analytical tradition, which is highly logocentric, if one takes advances in neuroscience seriously, it seems evident that "the direction of fit" does not need to take propositional (as language-carried) form. It has been demonstrated recently that the language network, although helpful, plays a secondary role in cognitive processes, see Evelina Fedorenko, Steven T. Piantadosi, and Edward A. F. Gibson, "Language Is Primarily a Tool for Communication Rather than Thought," *Nature*, vol. 630, no. 8017 (2024): 575–586, accessed July 14, 2024, https://doi.org/10.1038/s41586-024-07522-w. We will have something to add to the "concepts as contents" of propositional thought in the next paper.

tive through progressively more sophisticated means.[88] In the latter set of concepts, whether we are dealing with a belief state or a desire is determined by the precision weighting assigned to the generative model by the agent: if the evidence (error signals) is more precise for the system, the generative model adapts to fit the world (through change of mind, belief actualisation, or sense-making); if the predictions' precision is higher, the agent will strive to fit the world to the model by enacting predictions (by acting upon the world to bend it). The first option characterizes PP, and the second is AIN.[89] The upshot is that traditional conceptual schemes involving beliefs and desires can remain essential tools for cognitive explanations – not only for humans but also for other animals – due to the intuitive simplicity of PP and AIN, making explanatory practices more accessible. Nowadays, even the most renowned cautious scholars regarding animal minds, such as Cecilia Heyes, recognise this.[90] We will dive in more detail into the intentional terminology in *Of Rats and Men III*.

Conclusion

In the paper, we utilised an anti-reductive approach rooted in the intuitions of classical and contemporary pragmatist philosophers to reconstruct the concept of basic agency. We analysed it through the lens of the most influential yet unorthodox

[88] See Damasio, *Dziwny Porządek Rzeczy*, 67–100.

[89] The eco-enactive interpretation of PP offers an interesting solution in this context. Internal bodily states include "first priors" (phenotypically congruent observations) that must remain within stable ranges. The system registers deviations from these observations – prediction-error signals – as affective states with default priority in the processing hierarchy (the "drama of embodiment"). Therefore, the foundation of desires, conceived as conative (motivational) states aimed at grasping affordances (external action possibilities), is anchored in affect. Its constitutive dimensions – arousal and valence – modulate the degree of precision through implicit interpretations of interoceptive information regarding the organism's current departures from homeostatic equilibrium or the trajectories of its anticipated future deviations (allostasis). Incidentally, this depiction illustrates that desires, while conforming to the PP schema, do not require "propositional attitudes." See Julian Kiverstein, Mark Miller, and Erik Rietveld, "Desire and Motivation in Predictive Processing: An Ecological-Enactive Perspective," *Review of Philosophy and Psychology* (2024), accessed January 27, 2025, https://doi.org/10.1007/s13164-024-00757-6.

[90] The researchers proposed that, in order to maintain the belief–desire distinction within the PP framework – thus enabling an explanation of motivational states – one should interpret deep temporal models (encompassing both short-term and long-term predictions) as if predictions about the current state of the world correspond to beliefs, while predictions about the agent's possible future actions correspond to desires. See Daniel Yon, Cecilia Heyes, and Clare Press, "Beliefs and Desires in the Predictive Brain," *Nature Communications*, vol. 11, no. 1 (2020): 4404, accessed August 29, 2023, https://doi.org/10.1038/s41467-020-18332-9.

contemporary theories in cognitive science, combined with insights from the modern process metaphysics of biology. From this perspective, we aimed to demonstrate that several concepts traditionally attributed solely to humans – such as goal-directedness (reason-groundedness), meaning (sense-making), value, normativity, and intentional concepts (desires and beliefs – can be derived from the normative principle of life itself. These aspects of simple agency emanate from the homeostatic and predictive imperatives that, *seriatim*, progressively underpin the complex biotic implementation of the primary organising principle for living beings, namely the free energy principle (FEP). They originate from the biotic need to resist the tendency towards approaching high entropy states in the ever-changing environments into which a living being, conceived as a teleonomic functional whole, is immersed.

We contend that FEP resembles a universal directive underlying natural dynamics and that capacity to respond to it is constitutive of life – crucial for the survival and flourishing of all organisms. Concurrently, successful attunement to environmental challenges gives rise to a distinctive cluster of agency features. We argue that adopting this approach allows us to transcend the traditional human–animal dichotomy. By applying renewed conceptual schemes to describe agential behaviour, one can both identify similarities and recognise the complexity and diversity of cognitive phenomena across species – without resorting to fanciful, anthropodenialistic abstractions.

However, our journey does not end here. In the following article, we will continue reconstructing agency along the paths embraced in the first paper (*Of Rats and Men I*). Our goal is to retrace the properties of advanced agency through the lens of the second corollary of FEP, namely active inference (AIN). This theory aims to elucidate decision-making processes directly linking perception with action and the world; as such, it is indispensable for grasping the more sophisticated aspects of being an agent. In this task, we will focus on empirical examples drawn from rodents (i.e., rats), though we do not dogmatically close the door to other life forms.

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