

RATIONAL DECISION-MAKING IN A COMPLEX WORLD: TOWARDS AN INSTRUMENTAL, YET EMBODIED, ACCOUNT

Ragnar VAN DER MERWE

ABSTRACT: *Prima facie*, we make successful decisions as we act on and intervene in the world day-to-day. Epistemologists are often concerned with whether rationality is involved in such decision-making practices, and, if so, to what degree. Some, particularly in the post-structuralist tradition, argue that successful decision-making occurs via an existential leap into the unknown rather than via any determinant or criterion such as rationality. I call this view radical voluntarism (RV). Proponents of RV include those who subscribe to a view they call Critical Complexity (CC). In this paper, I argue that CC presents a false dichotomy when it conceives of rationality in Cartesian – i.e. ideal and transcendental – terms, and then concludes that RV is the proper alternative. I then outline a pragmatist rationality informed by recent work in psychology on bounded rationality, ecological rationality, and specifically embodied rationality. Such a pragmatist rationality seems to be compatible with the tenets of post-structuralism, and can therefore replace RV in CC.

KEYWORDS: voluntarism, bounded rationality, ecological rationality, embodied rationality, complexity

Introduction

An important question in epistemology relates to how successful decision-making is possible when we act on or intervene in the world. Is there perhaps some nomological principle – some norm of rationality – that guides us? Or, is there no such norm; successful decision-making results from an act of unbridled volition? How we answer this question has significant import for, not only philosophical inquiry, but also our practical socio-political affairs. If a norm of rationality exists, then we should presumably let it determine our decisional practices. Surely, we want our decisions to be rational. A norm of rationality could however be considered constraining and exclusionary; it may conflict with putative desirables like human freedom and diversity. In this paper, I aim to contribute towards a resolution in this debate.

Epistemologists in the so-called post-modern tradition often maintain that successful decision-making can occur in the absence of rationality (see Searle 1977; Derrida 1978; Habermans 1990; Foucault 2001). Exemplary of this view is a post-structuralist approach to complexity theory called Critical Complexity (CC).¹ Proponents of CC include notably Paul Cilliers, Rika Preiser, and Minka Woermann. CC draws on both complexity theory and Derrida's post-structural semantics to argue that the world's manifest complexity radically overdetermines rational decision-making. When we act on or intervene in the world, there are no non-contextual, non-provisional norms – *viz.* criteria or constraints – that can determine our choices. For CCists, we are nonetheless ethically compelled to act on and intervene in the world (Woermann and Cilliers 2012; see also Derrida 1999). Despite the absence of determinant norms, successful decision-making is possible through an *existential leap* forwards into the unknown. We can think of such a leap as an act of pure will or volition in the face of radical uncertainty caused by the world's overwhelming complexity.

Let us say, for example, that I am walking to work and a panhandler asks me for money. There is a moment when I must decide what to do: stop to give the panhandler some money or look the other way and continue walking. For CCists, RV dictates that my choice cannot be a strictly rational one. I *will* decide one way or the other, and then act accordingly, but this decision will be the product of a kind of unanalysable volitional compulsion rather than determined by any prescriptive principles. In this context, for principle P to *determine* decision D is for P to force or dictate D. Or, more aptly, for principle P to determine decision D is for P to play a necessary (if not sufficient) role in D. P is then primary (if not alone) in realising or instantiating D.

Specific to our discussion, we can say that rationality determines some decision-making activity if it plays the primary affective role (amongst sundry 'affectors') in the outcome of that decision-making activity. So, my decision to help or not help the panhandler is rational if rationality determines the outcome of that decision. CCists would deny this. Following Derrida, decision-making is not determined in this way. As mentioned, an existential leap forwards instead plays the primary affective role in the outcome of some decision. I will call this post-structural take on decision-making *radical voluntarism* (RV). I introduce and explicate CC and RV in section 1. I also argue that RV does not describe how we *de facto* make successful decisions. Were RV correct, we should behave in a random and erratic fashion whenever faced with two or more choices in some actional or interventive encounter with complexity. This is however not what we witness.

¹ Following Cilliers (1998), I take post-structuralism to be a kind of post-modernism.

Instead, we seem to quite easily make successful decisions day-to-day as we navigate our complex world.²

In section 2, I cash out *successful* decision-making in terms of agents attaining goals. My decision regarding the panhandler, for example, will be successful to the degree that my resultant action (give or ignore) is concordant with my pertinent goals. Perhaps, I will give if I have previously found token acts of kindness towards strangers emotionally rewarding and I am feeling emotionally drained. Perhaps, I will ignore if I am concerned for the general well-being of society and I have heard experts urge people not to give money to panhandlers. Our successful day-to-day decisions can be perfectly rational if rationality is understood in this deflated way. That is, if rationality is understood in *pragmatist* – i.e. naturalised and instrumental – terms. In developing such a pragmatist rationality, I draw on recent work in psychology on instrumental rationality, ecological rationality, and specifically embodied rationality. Originally outlined in Spellman and Schnall (2009), embodied rationality has been little discussed in the philosophical literature (Gupta 2021 is a notable exception), and my co-opting of it for pragmatist ends should therefore make a novel contribution to epistemology.

In section 3, I outline how my pragmatist rationality might be incorporable into CC. CC associates rationality with the kind of Cartesian or transcendental and deterministic rationality that flourished in 18th century epistemology. Given the putative deficiencies of this view, CC concludes that RV is the proper alternative. I argue that this presents a false dichotomy between two extremes (see also van der Merwe 2021). Thinking of rationality in pragmatist terms may permit CCists to embrace the idea that we are capable of rational decision-making without abandoning the core tenets of post-structuralism. As per embodied rationality, we can ‘ground’ successful decision-making in the sensory-motor capabilities we employ during goal-attainment, where ‘grounds’ is cashed out in suitably weak naturalised terms, rather than in metaphysically constitutive terms. In explicating what he calls “embodied heuristics,” Gerd Gigerenzer (2021) invokes the example of a baseball outfielder catching a flyball. The outfielder does not perform anything like a mathematical calculation related to measurements of height, distance, mass, acceleration, and like. Instead, she follows what Gigerenzer calls the “gaze heuristic:” “Fixate your eyes on the ball, run, and adjust your speed so that the angle of gaze remains constant” (2021, 5). To engage in rational (i.e. goal-attaining) decision-making, the outfielder need only have the ability to (1) hold her gaze on

² It is debatable whether the world as a whole is complex or only parts of it (see Ladyman and Wiesner 2021 for an overview of the debate). For the purposes of this paper, I will anyhow follow CC in supposing that the world as a whole is complex (presumably by degrees).

the ball, (2) run, and (3) adjust her running speed. The gaze heuristic, says Gigerenzer, is thus *embodied* in the outfielders sensory-motor capabilities.³ This embodiment is what I will call ‘grounding.’

This paper centres around notions of decision-making and rationality. These are, of course, big topics. My aim here is not to settle once-and-for-all the nature of decision-making and rationality, nor to offer necessary and sufficient conditions for their instantiation. Following CC, I am instead specifically concerned with actional decision-making in the face of complexity; that is, decisions that precede some action or intervention in our complex world. Many of our actional decisions involve an encounter with complexity in some or other form. Examples include seemingly mundane tasks like choosing what groceries to buy (in the complex economic system) or choosing to cross the road (in the complex traffic system).

For the purposes of this paper, I take decision-making to involve the actual moment an agent makes some choice in the face of some variety of alternatives, and not the moment/s immediately prior to or proceeding such a choice. When I choose whether to give to or avoid the panhandler, for example, there is presumably a moment – an instant in time – where I transition from a cognitive state of non-decision to one of decision-made. This moment is the moment of *choice*, and it is where CC considers RV to apply.⁴ A choice occurs immediately posterior to mental deliberation (*viz.* contemplation and prediction) and immediately prior to physical action (*viz.* tactile engagement with the world). Our concern is thus with the liminal moment where the former transitions to the latter. I, for example, deliberate the panhandler’s request; I make a choice; and then act accordingly. I argue that this transition from deliberation to action does not occur via Cartesian rationality nor via RV, but rather via a kind of pragmatist rationality.⁵ I will call this *experiential rationality*. Experiential rationality is closely related to embodied rationality, but differs by incorporating the philosophical notion of grounding (or ‘grounding’).⁶

³ Hawks and bats likewise utilise the gaze heuristic while intercepting prey during flight (Gigerenzer 2021, 7-9).

⁴ Arguably, decision-making is ongoing rather than contained in an instant. We are constantly updating our decisional states as we navigate the world. For the sake of argument, I will nonetheless grant CC that decision-making occurs in an instant.

⁵ There may be other ways that successful decision-making occurs. The two options of (1) rationality (whether of the Cartesian or pragmatist kind) and (2) RV do not necessarily exhaust the possibilities. However, since CCists specifically contrast RV with rationality, I will attempt to defend rationality, and then argue for its compatibility with post-structuralism.

⁶ It should be apparent that the pragmatism I have in mind here is inspired by the so-called

Also note the following provisos. I will gloss over much of the nuance related to the similarities and differences between bounded rationality, ecological rationality, and embodied rationality (see however the collection in Viale 2021 for the status of the current debate). This is because my aim is simply to draw support from embodied rationality, and not to develop a detailed psychology (or physiology for that matter) of rational decision-making. Further, although my aim is prescriptive in advising CCists to adopt experiential rationality, my account of rational decision-making is itself descriptive. I aim to explicate how human agents *de facto* utilise rationality in their successful decision-making practices, and not necessarily how they ought to do so. I also take rationality to be a capacity exercised by an individual agent. Social or collective rationality is thus a special application of, rather than constitutive of, rationality. Social or collective rationality is individual rationality exercised in a social context. Note also that I will not argue for whether and/or how rational decision-making may be specifically related to belief, knowledge, understanding, and truth. Although important in their own right, these issues are not our direct concern here (see however the collection in Knauff and Spohn 2021 for the status of the current debate).

In section 4, I engage with a possible response: CCists may claim that we should embrace *aporetic* logic – a kind of post-structural dialetheism – instead of my pragmatist rationality. In response, I argue that aporetic logic creates more problems than it solves.

1. Critical Complexity (CC) and Radical Voluntarism (RV)

My goal in this section is to briefly outline CC and its post-structural understanding of successful decision-making. I emphasise CC's criticism of the claim that rationality can serve as a norm for decision-making and that the proper alternative – RV – involves an existential leap into the unknown. I proceed as follows. Firstly, I briefly outline a key Derridean notion – *différance* – that is foundational to CC's view (section 1.1). Secondly, I explicate CC's criticism of rationality (section 1.2). Lastly, I critique RV (section 1.3).

experience pragmatism of e.g. Putnam, McDowell, and Misak rather than the *linguistic* pragmatism of e.g. Davidson, Brandom, and Price (see Misak 2014; Levine 2019 ch. 1; van der Merwe forthcoming for more on this distinction).

1.1 Derrida's Notion of *Différance*

At the heart of Derridean post-structuralism is the claim that we can never truly capture the meaning of a linguistic sign or network of signs in a semantic system such as a language. This is because of “*différance*.”

For Derrida (e.g. 1982; 1988), a semantic system has no centre, no locus or ground of meaning. Instead, following Saussure (1974), meaning is constituted by the many differences between signs making up the system. Meaning is generated by the endless and iterative interaction of these differences. Deviating from Saussure, Derrida however attributes the source of this meaning-generation to *différance*. The notion of *différance* is notoriously difficult to define. We can nonetheless think of it as an ontologically significant, yet ethereal and nebulous, kind of oscillation or “movement” (as Derrida puts it) that both creates and destroys semantic differences. *Différance* should be understood as both noun and verb, both present and absent. *Différance*, says Derrida, is

the systematic play of differences, of the traces of differences, of the spacing by means of which elements are related to each other. This spacing is the simultaneously active and passive... (1981, 27).

Différance plays or “dances” between signs. It produces, or rather *is* the production of, fleeting instances of meaning, meaning that is always elusive to epistemic capture (Derrida 1981; see also Cilliers 1998 ch. 3; Woermann 2016 ch. 3).⁷

Following Derrida, CCists consider meaning to be generated by, but not grounded in, the play of *différance*. According to de Villiers-Botha and Cilliers,

meaning is not static or final – it is always deferred... The sign is produced by the system, but at the same time the meaning that is generated for it through the process of *différance* reverberates through the system, influencing other signs (2010, 31).

The meaning in a semantic system cannot be codified into an ordered nomological structure. Meaning is never fully present to an epistemic inquirer; there is no ‘transcendental signified.’ The force of *différance*, says Woermann, “destroys the... possibility of saturated meaning” (2016, 100). Meaning is necessarily provisional; it cannot be “closed;” closure of meaning is always “deferred.”

⁷ In the context of complexity theory, Woermann thinks of *différance* as “the play of disorder... and entropy” within a complex system (2016, 64)

1.2 CC on Rationality

CC takes the ungroundedness of meaning to have wide-reaching implications for knowledge, truth, and – most importantly for our purposes – decision-making. Since knowledge, truth, and decision-making rely on capturing the meaning of concepts, they are – like meaning – prone to *différance*'s disruptive influence. Given the play of *différance*, decision-making is never determined or calculable. There are no transcendental criteria or constraints – e.g. an ideal of rationality – that we can fix on to secure certainty (Woermann and Cilliers 2012). Derrida's semantics dispels the Cartesian dream that the “world can be made rationally transparent and can yield objective and universal knowledge” (Woermann 2016, 88; see also Cilliers 2000b). On CC's account, our decisional actions are inescapably arational.

Note that CC is specifically against what Woermann (2016) calls a “strong” or “modernist” rationality, i.e. rationality that serves as an infallible, yet epistemically accessible, guide to decision-making. On such a Cartesian view,

agents are believed to make decisions based on reasonable [i.e. rational] principles and calculations, and the trajectory from decision to outcome is viewed in terms of a linear causality (Woermann 2016, 126; see also Woermann et al. 2018).

However, because of

the non-closure of meaning... our decisions and actions cannot be objectively described. Instead, we must engage in contingency, alterity, and the over-determinations that characterise our contexts (all of which involve judgement and sense-making that surpass calculation and pure rational argumentation) (Woermann 2016, 8).

This engagement involves RV.

1.3 RV: A Leap into the Unknown

According to Woermann, we undergo a “terrible experience of undecidability” prior to acting on or intervening in the world (2016, 180). When engaging in decision-making, we must, says Derrida, “go through an ordeal of undecidability in order to decide. So, to that extent the result, by definition, is unpredictable, unknown” (Derrida in Cilliers et al. 2016, 173; see also Human 2016). This ordeal results from the absence of any determinants for decision-making, e.g. norms of rationality. Consequently, “in order for a decision to be a decision it has to go through a moment when irrespective of what you know, you make a leap into the decision” (Derrida 1999, 280). The outcome of my decision regarding whether to give to versus ignore a panhandler is then radically uncertain. I cannot appeal to

rationality or similar principles during decision-making; I must “just do it” (as Nike marketers like to say).

That said, Derrida and CC do recognise that we somehow make decisions that lead to successful actions on and interventions in the world. For Derrida and CC, we do so – we overcome the ordeal of undecidability – through the leap mentioned above. This leap is blind in the sense that it occurs independent of any determining criterion or constraint. It is also unanalysable and unquantifiable using traditional – i.e. modernist – methods, yet it somehow propels us from undecidability to decidability. Without the ‘invisible hand’ of rationality, we experience a moment of pure will – a moment of compulsion, rather than guidance – towards some course of action. This is RV, and, according to Derrida, it “not only threatens a break with science in the strict sense, but with philosophy as ontology, as knowledge...” (Derrida in Cilliers et al. 2016, 173). My decision regarding the panhandler is then supposed to involve an ordeal of undecidability that results in a leap to action, a leap that is *au fond* arational. The same putatively applies to all decisions and actions we make in our complex world, even those involving everyday activities like buying groceries and crossing the road (I discuss in section 4 why CCists cannot draw a distinction between cases where RV applies versus cases where it does not).

Importantly, for CC, RV introduces *freedom*. According to Woermann and Cilliers, rationality is radically overdetermined by the world’s complexity, and “it is these overdeterminations that generate freedom...” (2012, 455). We are not bound by decisional principles or linear rules for action; instead, we are the existential deciders of our modal future. For CC, this kind of freedom also has unavoidably *ethical* implications. According to Preiser et al., the “ethical moment is situated in the moment in which we take the leap from that which is known to that which is uncertain or unknown” (2013, 271). This moment “is born once we enter into the gap of the infinite abyss that is created by the limits of our models”, i.e. the limits of our capacity to capture meaning (Preiser et al. 2013, 271). For CC, the loss of meaning introduces freedom, and freedom introduces ethics. This because with freedom comes *responsibility* (Derrida 2002; Cilliers, 2005; Woermann, 2016). The decisional leap at the core of RV is inherently ethical given its nondeterminate nature. We cannot defer accountability for the consequences of our decisions onto self-extrinsic factors, such as norms of rationality.

However, what exactly this decisional leap – this “ethical moment” – entails remains largely mysterious on CC’s account. Why do we decide one way rather than another at any given moment? Attempting to answer this question would

presumably introduce the kind of criterial or constraining norms RV rules out.⁸ But, one naturally wonders how *successful* decision-making is possible if all decisions ultimately result from RV rather than from being principled by or grounded in something more exacting, something like rationality. If there are no discernible norms for decision-making, how is it that we can make decisions that generate a preferable or beneficial, rather than aberrant or random, outcome? Today, for example, I decided to get out of bed, I decided to come to work,⁹ and I then decided to continue writing this paper where I left off yesterday. These are just three of the countless decisions I made today that most would agree are successful on any non-trivial definition of ‘success’ (I argue in section 3 that we should think of ‘success’ in this context in terms of goal-attainment). I further made these decisions without anything outwardly resembling Derrida’s “ordeal of undecidability” or Woermann’s “terrible experience of undecidability.” In fact, I performed these decisions without much contemplation or effort at all.

As we act on and intervene in the world moment-to-moment we repeatedly make decisions that are *prima facie* successful. However, this should be impossible were RV correct. Without some minimal determinant/s for decision-making, we should mostly make erratic or arbitrary decisions proceeded by random or akratic actions. Yet, this is not what we outwardly experience nor what we witness in the behaviour of others. CC seemingly cannot account for how and why we function successfully moment-to-moment as decision-making agents despite the world’s evident complexity.

2. Experiential Rationality: Naturalised, Instrumental, and Embodied

I have outlined CC and its alternative to rational decision-making: RV. I have also argued that RV insufficiently accounts for our everyday decision-making practices.

Edgar Morin – who has partly inspired CC (Woermann 2016) – endorses freedom, but also recognises the need for decisional norms or what he calls “determinations.” “Free action,” he says, “depends upon the knowledge and utilization of determinations (constants, structures, laws)” (Morin 2008, 114). Determinations are “conditions” for decision-making:

Freedom also presupposes two conditions. To begin with, there is an internal condition, involving the cerebral, mental, and intellectual ability to consider a situation and establish choices and chances of success. Then there are external

⁸ Derrida does at times suggest that there is a kind of quasi-theological force operant in the world, a force that can compel our ethical decisions (see Derrida in Cilliers et al. 2016). CCists do not follow Derrida in this regard, however.

⁹ I decided not to give to the panhandler, by the way.

conditions which render the choices possible (Morin 2008, 78).

Morin's internal condition equates to what we would normally call rationality: our capacity for rationality grants us the ability to "consider a situation and establish choices and chances of success." Morin's external conditions are states of the world 'out there' independent of us: what we might call "facts" or "states of affairs." My concern in this paper is specifically with Morin's internal condition. While acknowledging its presence, CC does not consider any such internal condition to be determinate of decision-making. RV, rather than rationality, plays the primary affective role in the outcome of some decision-making activity.

In this section, I outline a pragmatist conception of rationality that is potentially incorporable into CC. Such a pragmatist rationality should, on the one hand, constrain decision-making without the rigidity of Cartesian rationality; and, on the other hand, allow for some degree of decisional freedom without the laxity entailed in RV. To be a pragmatist kind of rationality, rationality must, I propose, satisfy two conditions:

C1: *Naturalised*, in the sense of taking into the account the Darwinian insight that human agents – including their cognitive faculties – are the product of biological evolution. Being a cognitive ability, rationality is therefore a product of biological evolution.¹⁰ Like other human faculties, rationality must 'emerge' somehow in both ontogeny and phylogeny.¹¹ Rationality is a natural outcome of our Darwinian genealogy, as are hunger, desire, and similar physiological processes (see also Campbell 1974; Dennett 1995; Wilke and Todd 2010).

C2: *Instrumental*, in the sense of being centred around goal-attainment, where attaining a goal involves getting something we want (see Goldman 1970, ch. 4; Okasha 2018, ch. 7). Some decision-making activity is therefore rational when its outcome aligns with some pertinent goal, a goal that is consistent with the kind of goals human agents tend to have (i.e. not aberrant goals premised on psychotic, hyper-emotional, or self-destructive tendencies, for example¹²).

A kind of rationality that satisfies C1 and C2 involves neither a top-down executive commander of decision-making (as Cartesians might suggest) nor being

¹⁰ See Okasha (2018 ch. 6) for an informative discussion on how rationality may have evolved by natural selection (see also Godfrey-Smith 2002). Gigerenzer and Sturm (2012) argue at length that rationality can be both descriptively *and* normatively naturalised.

¹¹ How exactly this kind of emergence might occur is not our concern here (see however the collection in Bedau and Humphreys 2008).

¹² Such aberrant goals are the exception rather than the norm. Kenrick and Giskevicius (2013 ch. 6) and Buss (2019 ch. 10) argue nonetheless that some risk-taking behaviour can serve an evolutionary adaptive function.

lost in a sea of semantic overdetermination (as CCists suggest). It is instead a natural product of decision-making processes employed during goal-attainment.

I now discuss some contemporary theories of rationality that align with and inspire the kind of pragmatist rationality I have in mind. I focus on psychological accounts of rationality developed by Steven Pinker (section 2.1) and Gerd Gigerenzer (section 2.2). Most important for our purposes is a recent derivative of Gigerenzer's view that has come to be known as *embodied rationality* (section 2.3).

2.1 Pinker's Instrumental Rationality

Pinker thinks of rationality primarily in instrumental terms. Rationality, he says, equates to “the ways an intelligent agent ought to reason, given its goals and the world in which it lives” (Pinker 2021 ch. 1 para. 14 emphasis removed; see also Haselton et al. 2009; Broome 2013; Kenrick and Griskevicius 2013).¹³ Rationality is also neither reducible to deductive logic nor does it answer to some presiding meta-rationality (Pinker 2002). Instead, the rational operations our minds perform are foundational on our biological neural hardware. Rationality is ongoing as we engage in and overcome real-life, sometimes messy, worldly decision-making challenges (see also Campbell 1974; Churchland 1987).

In response to celebrated demonstrations of supposedly widespread human irrationality (e.g. Ariely 2008; Thaler and Sunstein 2008; Kahneman 2011), Pinker shows how measures of irrationality drop significantly when tasks designed to highlight irrationality are reframed in ways that align with our everyday concerns, rather than being contrived in artificial scenarios specifically designed to fool our decision-making capabilities (see also Gigerenzer 2008; Haselton et al. 2009; Spellman and Schnall 2009; Kenrick and Griskevicius 2013). Dan Mercier and Hugo Sperber (2017) argue that, since rationality must have evolved by natural selection, it is unlikely to be systematically maladaptive (see also Wilke and Todd 2010). Although our reasoning (*viz.* rational inquiry) sometimes falters, it is generally reliable in helping us attain of the kind of generic goals that human beings tend to pursue (see also Haselton et al. 2009; Pinker 2010; Buss 2019; Edis and Boudry 2019). These generic goals include environmental navigation, thirst and hunger satiation, social cooperation, and the like.

So-called cognitive illusions – the gambler's fallacy, confirmation bias, priming, framing effects, and similar errors of reasoning – do not demonstrate that we are irrational or even mostly irrational. “They lead to incorrect answers, yes,

¹³ Giovanni Rolla states necessary and sufficient conditions for rationality in instrumental terms: “S is a rational agent iff S is able to achieve a specific goal through the exercise of the relevant capabilities in suitable conditions” (2016, 20).

but they are often correct answers to different and more useful questions” (Pinker 2021 ch. 1, the moral from cognitive illusions section, para. 8; see also Godfrey-Smith 1996, 2002). Granted, we are sometimes prone to irrationality, but this must be the exception rather than the norm, otherwise our generic decision-making activities should largely fail (recall section 1.3). Most of us however regularly and reliably make goal-attaining decisions – i.e. successful decisions – such as those involved in grocery buying and road-crossing.

2.2 Gigerenzer’s Ecological Rationality

Gigerenzer’s *ecological rationality* or what he calls “rationality for mortals” is an extension of Herbert Simon’s (1983; Newell and Simon 1972) much-discussed *bounded rationality*. Bounded rationality, says Gigerenzer,

is the study of how humans and other animals rely on heuristics to achieve their goals in situations of uncertainty. It differs from axiomatic rationality, which asks whether humans conform to logical principles [as in the Cartesian approach] (2021, 1).

Such heuristics compose an “adaptive toolbox” for successful decision-making. They are “fast and frugal” rules-of-thumb of the sort we should expect imperfect biological beings to employ. We are not angels; our cognitive capabilities have been tinkered together in a kludgy and piece-meal fashion by natural selection over millennia.

Heuristics, says Gigerenzer, “work in real-world environments of natural complexity... where an optimal strategy is often unknown or computationally intractable” (2008, 8 emphasis removed; see also Gigerenzer and Selton 2002; see Gigerenzer and Sturm 2012, 247-251 for a list of typical heuristics). Gigerenzer uses the example of playing chess. We play chess using a kind of intuitive reasoning, and sometimes play it very well, without having to calculate all possible outcomes and without making a blind decisional leap at every move. Some sort of ‘algorithm’ is running – some sort of ‘calculation’ is going on – but this only approximates anything like an ideal Cartesian rationality (Gigerenzer and Brighton 2009; Gigerenzer and Sturm 2012; see also Vlerick and Broadbent 2015). As Giovanni Dosi and colleagues put it,

[h]uman agents tackle every day, with varying degrees of success, highly complex and ‘hard’ (in the sense of computability theory) problems with their highly limited computational capabilities... we cannot handle more than a very limited number of the overwhelming number of interdependencies that characterize our world, but nevertheless we go along, sometimes decently well, with simple but useful representations and simple but effective heuristics (2021, 493).

Gigerenzer's heuristics are similar to what Leda Cosmides and John Tooby call "reasoning instincts." Reasoning instincts "make certain kinds of inferences just as easy, effortless, and 'natural' to humans as spinning a web is to a spider or building a dam is to a beaver" (Cosmides and Tooby 1994, 330). Reasoning instincts employ a kind of fallible and adaptive Darwinian reasoning. Like other animals, we follow intuitive rules-of-thumb of the sort that proved useful to our ancestors, and that can be successfully applied to much of our modern environment (see Dennett 2009; Haselton et al. 2009; Kenrick and Griskevicius 2013; Mercier and Sperber 2017; Pinker 2021; Mastrogiorgio et al. 2022). Heuristic-based decision-making is rational *qua* rationality understood in a suitably naturalised and instrumental way.

A philosophical question nonetheless remains regarding what *grounds* rationality. We want to ground rationality since (as argued in section 1.3) successful decision-making requires constraint/s. If successful decision-making involves rationality, then rationality cannot be a *laissez-faire* matter, otherwise success would be arbitrary (in the way RV seems to imply). Grounding in philosophy is conventionally understood in metaphysical terms. According to Ricki Bliss and Kelly Trogdon metaphysical grounding is "a form of constitutive (as opposed to causal or probabilistic) determination or explanation" (2021, np). Some superficial phenomenon of interest is constitutively – i.e. necessarily – determined or explained by some more fundamental grounding base, e.g. simples, dispositions, bare particulars, or similar fundamentalia. This is not the kind of grounding that applies to my pragmatist rationality, *viz.* experiential rationality. As I outline in sections 2.3 and 3, a pragmatist kind of grounding – or 'grounding' – is provisional and contextual in that it applies to biological agents making everyday decisions here and now. It does apply to generic agents (including AI systems and aliens perhaps) engaged in (Turing machine-like) decision-making *simpliciter*. As we will see, experiential rationality is naturalistically 'grounded' in those *sensory-motor capabilities* we instrumentally employ during goal-attainment.

2.3 Embodied Rationality

Although psychologists do not usually invoke the philosophical notion of grounding, we can think of proponents of embodied rationality as seeking to ground rationality in the *sensory-motor capabilities* we employ when engaged in successful actions on and interventions in the world. Sensory-motor capabilities are those biological bodily skills employed in receiving sensory information from the world and then generating an appropriate motor response. As mentioned, grounding rationality in sensory-motor capabilities will involve a weak, naturalised, and instrumental kind of grounding – 'grounding' – rather than a

strong metaphysically constitutive kind of grounding. Rationality – *viz.* the utilisation of reasoning heuristics – is ‘grounded’ specifically in those motor-sensory capabilities we employ during goal-attainment. Central to experiential rationality is the idea that such a ‘grounded’ rationality determines successful decision-making (where ‘determination’ recall involves playing the primary affective role in the outcome of a decision, and ‘success’ is cashed out in terms of goal-attainment).

In arguing for embodied rationality, Antonio Mastrogiorgio and Enrico Petracca note that Gigerenzer’s ecological rationality treats heuristics as “formal rules for information processing,” rules that are “implemented through ‘computer programs’” in the mind (2016, 225). This, they argue, is inconsistent with a Darwinian understanding of human cognition, where cognition should be non-algorithmic and kludgy (see also Kauffman 2019; Mastrogiorgio et al. 2022). Embodied rationality is an attempt to overcome this ostensible deficiency in Gigerenzer’s view.

As the name suggests, embodied rationality holds that the body plays a central role in rational inquiry. According to Mastrogiorgio et al., embodied rationality

invites us to abandon a third person rationality (where cognitive processes can be expressed as objectified, algorithmic rules for information processing) and calls into account the biological realm... [E]mbodied rationality emphasizes the constitutive dependence of heuristics on the human body and in particular on the sensory-motor system... [C]ognitive processes can be understood precisely as they are grounded on the sensory-motor system, and not prescinding from it [sic] (2022, 12; see also Rolla 2016; Gupta 2021).

‘Demoting’ rationality from the transcendental to the natural in this way renders it, not only compatible with Darwinism, but also potentially incorporable into CC. CCists reject any notion of a transcendental (i.e. Cartesian) rationality, but can potentially embrace the weaker suggestion that rationality is embodied or ‘grounded’ in the sensory-motor system (I argue to this effect in section 3).

Influenced by proponents of embodied rationality, Gigerenzer (2021) has recently suggested that his reasoning heuristics be thought of as “embodied heuristics.” Embodied heuristics are “rules of thumb that exploit specific sensory and motor capacities in order to facilitate high-quality decisions in an uncertain world” (Gigerenzer 2021, 2). And the “ecological rationality of a heuristic is measured by the degree to which it can attain a goal” (Gigerenzer 2021, 5). This intimates at the kind of naturalised and instrumental rationality entailed in what I am calling experiential rationality. Ecological rationality further

analyzes the match between the adaptive toolbox of an individual or species, and the environment. A *match* refers to the likelihood that a given heuristic achieves a given goal in a given environment (Gigerenzer 2021, 4 original emphasis).

As mentioned in the introduction, a baseball outfielder catching a flyball is an apt example. Recall that the outfielder does not perform any formal calculations when catching the ball. Instead, she simply follows what Gigerenzer calls the “gaze heuristic:” “Fixate your eyes on the ball, run, and adjust your speed so that the angle of gaze remains constant” (2021, 5). Rationality plays a central role in such processes; it is embodied in the sensory-motor capabilities the outfielder employs during goal-attainment (see also Gallagher 2018). For Gigerenzer, the relevant sensory-motor capabilities are part of both our phylogenetic and ontogenetic endowment. Phylogenetically, they are a product of Darwinian evolution (see also Jonsson and von Hofsten 2003; Mastrogiorgio and Petracca 2016). We obviously did not evolve to catch flyballs, but the ability to do so is an *exaptation* from capabilities our ancestors employed during activities like hunting for food (Gigerenzer 2021; see also Kauffman 2019; Mastrogiorgio et al. 2022). Regarding ontogeny, Amitabha das Gupta states that

an infant acquires her capacity to reason based on her embodied experience which she attains due to the interplay of certain bodily structures or modalities along with certain emotive elements... Reason [*viz.* rationality] thus emerges out of embodied experience (2021, 14).

Gupta thus invokes a suitably weak (i.e. naturalised), rather than a strong, sense of emergence that is consistent with experiential rationality (see O’Connor 2021 for more on the distinction between weak and strong emergence). In both phylogeny and ontogeny then, rationality (weakly) emerges from human beings’ everyday sensory-motor interactions with the world. Embodied rationality thus satisfies C1: *Naturalised*. Further, rationality does not obtain in any old sensory-motor capabilities. Sensory-motor capabilities must be of the right sort, the sort employed during goal-attainment (e.g. catching a fly-ball). Embodied rationality thus satisfies C2: *Instrumental*.

Embodied rationality also allows us to constrain or ‘ground’ rationality in a way that is compatible with C1 and C2. Experiential rationality differs from embodied rationality in emphasising the role of the philosophical notion of grounding (or ‘grounding’ when suitably pragmatized). When it comes to decision-making then, experiential rationality states as follows:

Successful actional or interventive decision-making is rational to the degree that it utilises reasoning heuristics, where reasoning heuristics render rationality ‘grounded’ in those sensory-motor capabilities we employ during goal-

attainment.¹⁴

I now argue that experiential rationality is compatible with CC (and therefore presumably with post-structuralism more generally).

3. Merging Experiential Rationality with CC

We have seen how recent work in psychology suggests that rationality can be naturalised and instrumental. I have called this kind of rationality experiential rationality. Experiential rationality allows for some decisional freedom in that we can pursue variable goals (excluding aberrant goals, as per C2) and we may employ a variety of heuristics in attaining those goals. Experiential rationality is also fallible to the degree that we *qua* biological agents are fallible (goal-attainment via randomness or lucky guesses will however be arational). Experiential rationality also allows that we can be rational by degrees (Gigerenzer 2021) (I will not give an account of degrees of rationality here however). Most importantly, experiential rationality circumvents RV by ‘grounding’ – i.e. constraining – rationality, and this is done without invoking Cartesian-style transcendental norms. Rationality is ‘grounded,’ but not grounded.

As outlined in section 1, CC is averse to strict deterministic rules or norms for decision-making and to the idea that we can get an epistemic fix on meaning, knowledge, or truth to secure certainty. Pragmatists mostly share this aversion. CC however thinks that the proper alternative is RV, which, as I have argued, cannot account for how we *de facto* make decisions day-to-day. Meaning, knowledge, truth, and decision-making may be overdetermined (to varying degrees) by the world’s complexity, but this does not necessarily imply RV. A properly pragmatized notion of rationality can potentially succeed where RV fails. As argued, we regularly and reliably employ reasoning heuristics during successful goal-attainment despite the world’s evident complexity.

As far as I can tell, experiential rationality is compatible with the post-structuralist implications of Derrida’s semantics. To incorporate experiential rationality into CC, CCists need simply accept the following putative truism:

Decision-making is performed by Darwinian agents and is therefore constrained by biology to some degree.

This notion of being “constrained by” is what I have referred to as ‘grounded,’ and “biology,” in this context, refers specifically to agents’ sensory-motor capabilities

¹⁴ This suggests that non-human animals are capable of rationality to the extent that they employ experiential rationality (see however Okasha, 2018 ch. 6 for an overview of the debate around whether animals are capable of rationality).

employed during goal-attainment. Nothing here involves Cartesian norms or epistemic certainty. Experiential rationality's compatibility with CC is particularly noticeable if we rephrase the above claim in the following conditional form:

If decision-makers are Darwinian agents, then decision-making will be constrained by biology to some degree.

Experiential rationality is therefore a rationality specific to Darwinian agents like us. To say that decision-making is not constrained by biology to some degree is to contradict Darwinism. This is because, as mentioned, our cognitive faculties are evolved, and therefore fallible biological kludges. When it comes to decision-making, we are not free to defy our Darwinian constitution. We cannot decide to levitate or spontaneously combust, for example; or, if we did, the relevant decisional effort would fail, it would be unsuccessful. The choices (and resultant actions or interventions) we are capable of making are limited to what biological agents, like us, are *de facto* capable of. And the goals we pursue are limited to those that non-aberrant biological agents *de facto* pursue and can *de facto* attain (as per C2). It is in this sense that experiential rationality is naturalised and instrumental while also invoking constraints on decision-making. This contradicts RV where decision-making is unbounded. Thus, if CCists accept the putative truism stated in the above conditional, then they must give up RV.

Experiential rationality has notable elements of contextuality and provisionality. It is however not *radically* contextual and provisional in the way that RV is. Experiential rationality is contextual and provisional in the sense that it applies to Darwinian agents like us engaged in decision-making here and now,¹⁵ and not to agents *simpliciter* (recall section 2.2). Accepting experiential rationality does not commit us to universal claims about rationality. It is instead a more modest attempt to describe the way we engage in successful decision-making related to actions on and interventions in the world.

In sum, experiential rationality may be fairly easily incorporable into CC. CCists would have to give up RV, but this seems a relatively small price to pay all things considered.

I now engage with a possible objection. CCists may claim that a suitable alternative to both Cartesian rationality and RV is not experiential rationality, but rather what might be called *aporetic* rationality.

¹⁵ Including perhaps so-called higher non-human animals (recall footnote 14).

4. Possible Response: Aporetic Rationality

According to Oliver Human, CC “harbours a somewhat ironic dimension” (2016, 53 fn. 9). This is its endorsement of what Woermann calls an “aporetic logic,” a logic that embraces paradoxes and contradictions (2016, 67-81; see also Derrida 1988, 116). Aporetic logic is a kind of post-structural dialethism where one ostensibly deals with “uncertainty through the use of reason... defined as a wager between the calculable and the incalculable” (Human and Cilliers 2013, 34). Such a wager involves making decisions based on mutual considerations of antithetical or contradictory concepts. Woermann (2010) refers to this as “both/and” logic. We must think both yes and no, both random and predictable, both P and $\sim P$ (Woermann 2016, 118; see also Hurst 2010, 243-246). Here, logical contradiction can be the locus of epistemic illumination rather than a dead-end for inquiry (as so-called analytic philosophers might suppose). Aporetic logic, says Andrea Hurst, calls for a “new paradigm of complexity that enables us to think in terms of mutually negating opposites joined in relations of co-implication” (2010, 241). According to Preiser et al.,

the logic of [CC-style] thinking proposes a type of thinking that necessitates a double movement... It suggests that the concept and its counterpart (the *yes* and the *no*) are thought simultaneously (2013, 269 original emphases; see also Woermann 2016, 68-71).

CCists may claim that aporetic logic can be employed in successful decision-making instead of experiential rationality.

The problem is that CCists do not explain how exactly we are to simultaneously think in terms of “mutually negating opposites,” in terms of “the yes and the no.” It is questionable whether we can simultaneously think antithetical or contradictory concepts. Attempting to do so would presumably involve concurrently holding both concepts in conscious awareness. I am not sure if this can be done. A colleague who teaches introductory logic to undergraduates asks her students to think of a square circle. One or two students always claim to be capable of the task. Yet, on interrogation, they turn out to be either thinking of a square on top of a circle or thinking ‘square’ then ‘circle’ then ‘square’ then ‘circle’ etc. They are not thinking ‘square’ and ‘circle’ at the same time. The task is designed to show that certain things are a priori impossible. Now, ‘square’ and ‘circle’ are, of course, not antithetical concepts, but this anecdote does suggest that we just cannot think certain things. Antithetical concepts (P and $\sim P$) are plausibly even harder to think simultaneously than ‘square’ and ‘circle.’ Try to simultaneously think ‘square’ and ‘ \sim square’ for example. I predict certain failure (thinking of a shimmering or a faded square does not count). CCists however claim

to be, not only capable of simultaneously thinking P and \sim P, but also advise others to do so. The problem is that they do not explain how exactly this task is to be performed, nor how it is that they can do it while others cannot.

CCists also cannot claim that rationality applies in certain circumstances but not in others (recall section 1.3). At times, CCists distinguish between what they call *general* complexity and *restricted* complexity (approximately the standard distinction between genuinely complex systems versus merely complicated systems [see Poli 2013]). As Woermann et al. put it,

[i]n the restricted paradigm, complexity is treated as a problem that can be overcome (complex problems are understood as complicated problems); whereas in the general paradigm, complexity is treated as an ontological fact, which holds certain epistemological and cognitive implications for the manner in which we deal with complexity (2018, 5; see also Cilliers 2010).

It may then be tempting for CCists to state that rationality only applies when we deal with restricted complexity, while RV applies when we deal with general complexity.

Drawing such demarcations is however at odds with the implications of *différance*. According to Derrida, *différance* disrupts all (non-provisional/non-heuristic) distinctions. We need to isolate meaning to draw demarcations, and *différance* ruins all attempts to do so (recall section 1.1) (Derrida 1988, 116; Woermann 2016, 173-176; see also Human and Cilliers 2013). Post-structuralism disallows meaningful delineation between one domain and another (Woermann et al. 2018, 7-10); that is, meaningful delineation between general complexity and restricted complexity (see also Hurst 2010). Claiming that there are two separate domains – one amenable to rationality and the other to RV – violates post-structuralism’s own taboo on such demarcations. On the post-structuralists’ own account, *différance* should render rationality as radically contingent and contextual as RV. Hence, the need to give up RV.

Conclusion

According to Morin, rationality “never has the ambition to exhaustively hold the totality of reality in a logical system,” yet it is “our only trustworthy instrument of knowledge...” (2008, 47). I have argued along similar lines that there are no universal and exacting norms for decision-making, but we *qua* biological agents are nonetheless constrained in our decision-making practices by rationality properly pragmatized. I have called this experiential rationality, and it seems consistent with (at least, some of) the tenets of post-structuralism. It is therefore potentially incorporable into CC.

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Although CCist's criticisms of Cartesian rationality are on point, their alternative – RV – overemphasises the role of undecidability and freedom in our actional and interventive encounters with complexity. I have argued that we should instead think of rationality in this context as the successful utilisation of embodied heuristics. Doing so 'grounds' rationality in the sensory-motor capabilities we employ during goal-attainment. It also renders rationality responsible for the kind of successful actional and interventive decisions we make day-to-day despite the world's evident complexity.

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