Rational Monism and Rational Pluralism

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We can draw a distinction between two sorts of consequentialist theories of rational choice. On one side are expected value theory, conditional expected value theory, minimax, maximin, regret minimization, and the other forms of *rational monism*. On the other side are the various forms of *rational pluralism*, none of which enjoy much familiarity. Rational monism is much more commonly defended. But, for reasons I adduce below, I believe that consequentialists in the business of developing a theory of rational choice should reject rational monism in favor of rational pluralism.

1 Rational Monism *v.* Rational Pluralism

The dispute between rational monists and rational pluralists is, at bottom, a dispute about an analogical claim in metaethics. To put the analogical claim in its proper context, it will be helpful to remind ourselves about consequentialism and its reductive ambitions.

According to consequentialism—or anyway, according to the sort of consequentialism I will be discussing here—the realization of value is all that fundamentally matters.[1] The deontic, therefore, is reducible. Every normatively significant deontic notion somehow reduces to facts about value and its realization.

[1] See *e.g.* Bentham (1961[1789]), Mill (1988[1861]), Moore (1903;1912) and Ramsey (1990[1926]).

Now, strictly speaking, there is a form of consequentialism for every normative domain. Moral consequentialism is the view that, within the moral sphere, the realization of moral value is all that fundamentally matters. Epistemic consequentialism is the view that, within the epistemic sphere, the realization of epistemic value is all that fundamentally matters. To better connect with the existing literature on rational choice, I will focus on prudential consequentialism. When I say *value*, I will mean prudential value. When I say that an agent is *permitted* or *required* to do something, I will mean that the agent is prudentially permitted or required to do that thing. But the dispute between rational monists and rational pluralists has nothing specifically to do with prudence. It's a dispute about the reductive structure of consequentialism, and thus it generalizes. The very considerations that should convince prudential consequentialists to be rational pluralists should, I think, likewise convince consequentialists in other normative domains to be rational pluralists.

There are at least two parts to the reductive task facing consequentialists because there are at least two families of normatively significant deontic notions. There are *objective* permissions and requirements and also *rational* (sometimes called 'subjective') permissions and requirements.[2] The distinction between the two is made vivid by examples like the following:[3]

> *Boxes like Miners.* There are three opaque boxes, arranged left-to-right. The agent, who cares only about money, must choose exactly one. The agent knows that the middle box contains $9. Of the other two boxes, she knows that one contains $0 and that the other contains $10. But she is uncertain whether the left or right box contains $10, and divides her credence equally between the two hypotheses. (In fact, the right box contains $10.)

An agent facing *Boxes like Miners* is objectively required to take the right

[2]The claim that there are both objective and rational permissions is not entirely uncontroversial; see *e.g.* [redacted], Kolodny and MacFarlane (2010), and Thomson (2008).

[3]Adapted from Parfit (MS).

box and rationally required to take the middle box.

An adequate consequentialist reduction of *objective* permissions and requirements is already at hand—indeed, much of the attraction to consequentialism lies in the simplicity of the account of objective permissions and requirements it offers. According to consequentialists, whenever an agent faces a decision, each of the agent's options has an *actual value*, which is the value that would be realized if the agent were to choose the option, and both objective permissions and objective requirements reduce to actual value maximization. It is helpful to think of the reduction as proceeding in two stages. First, objective requirements reduce to objective permissions: an agent is always objectively required to choose some objectively permissible option. Objective permissions then reduce to the maximization of actual value: whenever an option is objectively permissible, it is so in virtue of maximizing actual value. For example, in *Boxes like Miners*, if we equate dollars and units of value, the actual values of choosing the left, middle, and right boxes are, respectively, 0, 9, and 10. And according to consequentialists, that's what *makes* choosing the right box objectively required.

Reducing *rational* permissions and requirements is harder. From the outset I am going to assume that the reduction takes the same basic shape. Rational requirements reduce to rational permissions: an agent is always rationally required to choose some rationally permissible option. And rational permissions reduce to the maximization of some quantity: whenever an option is rationally permissible, it is so in virtue of maximizing some quantity.[4]

But the hard-to-answer question remains: what quantity, or quantities, feature in the reduction? What must an option maximize in order to be made rationally permissible?

It is here that we find the dispute between rational monists and rational pluralists. According to rational monists, there is some quantity that stands

[4] For reasons discussed in §6.3, it is the *stable* maximization, not the *mere* maximization, of a quantity that makes options rationally permissible. But, for now, we can ignore stability.

to objective permission as actual value stands to rational permission. The following metaethical analogy can be completed:

actual value : objective permission :: ____ : rational permission

Actual value is the *universal objective-maker*. Objective permissions *always* reduce to the maximization of actual value. According to rational monists, some special quantity Q is the *universal rational-maker*. Rational permissions always reduce to the maximization of *it*.

Of course, rational monists disagree with one another about what the universal rational-maker is. Some think it's expected value.[5] Others think it's conditional expected value,[6] or maximin value,[7] or risk-adjusted expected value.[8] The in-house dispute among rational monists has filled many books and journal articles. But what unifies rational monists is the contention that *some* quantity is the universal rational-maker.

According to rational pluralists, like me,[9] there is no quantity that stands to rational permission as actual value stands to objective permission. The analogy above is bunk. Of course, *consequentialism* is true. Whenever an option is rationally permissible, it's made so by maximizing some quantity. But no quantity is the *universal* rational-maker. On one occasion it might be the maximization of Q_1 that makes options rationally permissible; on another occasion it might be the maximization of Q_2 that makes options rationally permissible, in which case the Q_1-values of options will have no bearing on what the agent is rationally permitted to choose.

[5]See *e.g.* Hammond (1988), Joyce (1999; 2012; forthcoming), Lewis (1981), von Neumann and Morgenstern (1944), Pettigrew (2015), Ramsey (1990[1926]), Savage (1954), Skyrms (1982; 1984; 1990), Sobel (1994), and Stalnaker (1981).

[6]See *e.g.* Ahmed (2014a), Eells (1982), and Jeffrey (1965; 1983).

[7]See *e.g.* Rawls (1971).

[8]See *e.g.* Buchak (2013).

[9]I distinguish a wide form of rational pluralism from a narrow form—see §2—and defend both. The wide form is fairly widely accepted; the narrow form is almost universally rejected. But there are some other narrow rational pluralists; see *e.g.* Robinson (dissertation) and Weirich (1988; 2004). (For a discussion of a very different sort of "decision-theoretic pluralism," see Bales (2018).)

The essay below has a negative part and a positive part. The negative part is contained in §§2–5. By combining some recent work in decision theory with some metaethical considerations, I will argue that no form of rational monism is tenable. The positive part is contained in §§6–8. Many forms of rational pluralism are messy. They are unsystematic, or they involve incommensurate values, or they posit some sort of unexpected context-sensitivity. But the form of rational pluralism that I seek to defend is systematic and principled. I believe that what makes a quantity a rational-maker on a given occasion is being the best quantity that can guide the agent on that occasion, and, as we'll see, the form of rational pluralism that I seek to defend arises naturally from this metaethical hypothesis.

2 The Generalized Miners Problem

It is often assumed that the theory of rational choice divides neatly into two subfields. There is the theory of rational choice for *ideal* agents, who have unlimited powers of deduction and introspection, and then there is the theory of rational choice for *nonideal* agents. Later I will question whether this division is quite as deep or neat as it's typically taken to be. But, for now, let's take the division on board.

We then can distinguish two forms of rational monism. The *wide* form is unrestricted. It says that there is some quantity Q such that, whenever an agent faces a decision, it is the maximization of Q that makes options rationally permissible. The *narrow* form is restricted to ideal agents. It says that there is some quantity Q such that, whenever an ideal agent faces a decision, it is the maximization of Q that makes options rationally permissible.

If rational monism is to be defended on grounds of simplicity, then there's reason to favor the wide form, since the narrow form is not significantly simpler than the most plausible forms of rational pluralism.

But, that said, the wide form seems easy to refute. We can refute it, it seems, simply by taking the quantity that is alleged to be the universal rational-maker and (to coin a new term) *minerize-ing* it: constructing a case that stands to it as *Boxes like Miners* stands to actual value.

For example, I am convinced that what makes choosing the middle box rationally permissible in *Boxes like Miners* is the maximization of some sort of expected value. Suppose that I'm right, and let X be the relevant quantity. The following case, in which there is a nonideal agent with unlimited powers of introspection but limited powers of deduction, minerizes X:[10]

> *The Fire*. The fire alarm rings and the agent, a firefighter, hurries onto the truck. On the ride over she deliberates. There are three doors into the building, arranged left-to-right. The agent, who cares only about saving lives, must enter the building via one of the three doors. Since she does not know the exact distribution of residents in the building, she does not know which option will result in the most rescues. Based on her credences about the distribution of residents, she calculates the X-value of each option and writes the value on a note card. After exiting the truck and attaching the water hose, she races toward the burning building. She reaches into her pocket, but the note card is gone. Time is of the essence! She knows that all of the residents will die in the time it would take her to recalculate the X-values of the options. She knows that the current X-values of the options are what they were when she calculated them, since she knows that her credences about the distribution of residents are unchanged. But she cannot fully remember the results of her calculations. She remembers that the X-value of entering through the middle door is 9. Of the other two options, she remembers that one has an X-value of 0 and that the other has an X-value of 10. But she cannot remember which option has which X-value, and divides her credence equally between the two hypotheses. (In

[10]This example, from [redacted], adapts an example from Kagan (2018). For related discussion, see *e.g.* Feldman (2006) and Weirich (2004).

fact, entering through the right door has an X-value of 10, as the lost note card attests.)

The agent facing *The Fire* is rationally required to enter via the middle door, even though she knows for certain that doing so does not maximize X. Therefore, if the maximization of X is what makes options rationally permissible in *Boxes like Miners*, the wide form of rational monism stands refuted. And notice that we can replace X with any minerizable quantity. What this argument—*the generalized miners problem*—establishes is that the wide form of rational monism is hopeless if the quantity at its center is minerizable.

Since I am convinced that the maximization of a minerizable quantity sometimes *is* what makes options rationally permissible, I am going to set the wide form of rational monism aside and focus on the narrow form, which is both more commonly defended and also more plausible. I will return to nonideal agents in §8. But, until then, I'll set them aside.

3 Two Rules for Reducing

Having (temporarily) set nonideal agents aside, we can make the dispute between rational monism and rational pluralism more precise by appealing to some familiar formalism. In the usual way, let's represent an (ideal) agent facing a decision with a *decision problem*, which we will take to be an ordered quadruple, $\langle C, u, A, K \rangle$.

The first coordinate, C, is the agent's *credence function*, which maps each proposition to a real number on the unit interval and thereby represents the degree to which the agent believes the proposition. Here and throughout, I assume the realist view that credences are among the agent's fundamental psychological states.[11]

[11] For more on the dispute between instrumental and realist views of credences, see *e.g.* Eriksson and Háyek (2007), List and Dietrich (2016), and Pettigrew (2019).

The second coordinate, u, is the *utility function*, which maps each possible world to a real number and thereby represents the value of that world being actual. If we were interested in moral consequentialism, $u(w)$ would be the degree to which the actuality of world w is morally good. Since we are focusing on prudential consequentialism, $u(w)$ is the degree to which the actuality of world w is prudentially good, i.e., the degree to which the decision-making agent finds w desirable. I assume the same realist view of utilities that I assume of credences.

The third coordinate, $A = \{a_1, a_2, ..., a_n\}$, is the set of *options*, which are propositions that the agent can make true by deciding. I assume that options are always mutually exclusive, jointly exhaustive, and finite in number.

The fourth and final coordinate, $K = \{k_1, k_2, ..., k_m\}$, is the set of *dependency hypotheses*, which are propositions that fully specify how things do and do not depend causally on the agent's decision.[12] I assume that dependency hypotheses are mutually exclusive, jointly exhaustive, finite in number, and compossible with each option.

Taken as a whole, then, a decision problem $d = \langle C, u, A, K \rangle$ represents an (ideal) agent of type $\langle C, u \rangle$ facing a decision of type $\langle A, K \rangle$.

If D is the set of decision problems, then consequentialists, on account of their reductive ambitions, are committed to two metaethical functions that have D as their domain.

The first, which will not be important for our purposes, is *the rule for reducing objective permission*, a function that maps each decision problem to the quantity the maximization of which makes options objectively permissible relative to that decision problem. Now, in principle, a dispute between monists and pluralists could arise here. Objective monists would claim that the rule for reducing objective permission is a constant function, and objective pluralists would disagree. But I will ignore this dispute and assume, here and throughout, that the rule for reducing objective permission maps every decision problem to actual value.

[12] *Cf.* Lewis (1981) and Skyrms (1982).

The second function is *the rule for reducing rational permission*, a function that maps each decision problem to the quantity the maximization of which makes options rationally permissible relative to that decision problem. This is the function that gives precision to our dispute. Rational monists believe that this function is constant, and rational pluralists, like me, disagree.

It is worth pausing here to say more precisely what I take quantities to be.

Let $W = \{w_1, w_2, ..., w_i\}$ be the set of possible worlds, and, for simplicity, assume that W is finite. A *mathematical quantity* is any function that maps decision problems to functions that map option-world pairs to real numbers. In other words, if Z is a mathematical quantity and $d = \langle C, u, A, K\rangle$, then Z maps d to some function that maps each $\langle a, w\rangle$ to a real number. There are many ways to partition mathematical quantities into quantities, but, for our purposes, a coarse-grained partition will suffice. I will take mathematical quantities to be equivalent when they have the same maximizational structure. If Z is mathematical quantity, let $Max(Z, w, d)$ be the set of options that maximize Z at $\langle w, d\rangle$. Two mathematical quantities, Z_1 and Z_2, are equivalent, then, just if, for any $\langle w, d\rangle$, $Max(Z_1, w, d) = Max(Z_2, w, d)$.

More simply, then, a quantity can be thought of as a function that maps each $\langle w, d\rangle$ to the set of options that maximize the quantity relative to $\langle w, d\rangle$. What rational monists and rational pluralists disagree about is whether any quantity, in this sense, is the universal rational-maker.

4 Independent Monism

4.1 V-monism and U-monism

The two most commonly defended forms of rational monism are V-monism and U-monism. (V-monism is sometimes called 'conditional expected value theory' or 'evidential decision theory', and U-monism is sometimes called 'expected value theory' or 'causal decision theory'.) Both V and U can be defined in terms of actual value, which, itself, can be defined using the formalism above.

Since dependency hypotheses fully specify how things the agent cares about do and do not depend causally on the agent's decision, the actual value of an option depends only on which dependency hypothesis holds. Let ak be the conjunction of option a and dependency hypothesis k. Every ak-world has the same utility, so let $u(ak)$ be $u(w)$, for some ak-world, w. The actual value of a at any k-world is then equal to $u(ak)$.

The V*-value* of a—that is, the conditional expected value of a—is the agent's expectation of the actual value of a, conditional on a:

$$V(a) = \sum_K C(k|a)u(ak).$$

According to V-monists, the rule for reducing rational permission maps every decision problem to V.

The U*-value* of a—that is, the expected value of a—is the agent's (unconditional) expectation of the actual value a:

$$U(a) = \sum_K C(k)u(ak).$$

According to U-monists, the rule for reducing rational permission maps every decision problem to U.

Now, I, myself, reject both V-monism and U-monism. I think that Newcomb problems are counterexamples to V-monism, and I think that unstable problems—such as Bostrom's (2001) *Meta-Newcomb*, Egan's (2007) *Psychopath Button*, and Ahmed's (2014b) *Dicing with Death*—are counterexamples to U-monism.[13] And, as we will see in §4.4, if I am right—if Newcomb problems are counterexamples to V-monism and unstable problems are

[13] Other discussions of Newcomb problems and/or unstable problems include: [redacted], Ahmed (2012; 2014a; 2014b; forthcoming), Artnzenius (2008), Bales (2018), Bassett (2015), Briggs (2010), Eells (1982), Eells and Harper (1991), Gallow (MS), Gibbard and Harper (1978), Gustafsson (2011), Hare and Hedden (2016), Horgan (1981), Hunter and Richter (1978), Jeffrey (1983), Joyce (1999; 2012; forthcoming), Lewis (1981), Nozick (1969), Oddie and Menzies (1992), Rabinowicz (1988; 1999), Skyrms (1982; 1984; 1990), Stalnaker (1981), Wedgwood (2013), Weirich (1985; 1988; 2004), and Wells (forthcoming).

counterexamples to U-monism—then *many* forms of rational monism that otherwise might have seemed promising can be shown to be extensionally inadequate.

4.2 Newcomb Problems

Given the set of dependency hypotheses, we can define strict K-domination: option a_i *strictly K-dominates* option a_j, relative to credence function C, just if every k to which C assigns nonzero probability is such that $u(a_i k) > u(a_j k)$.

Two principles that connect strict K-domination and rational choice then suggest themselves. The first is stronger:

> ***K*-Elimination**: If, relative to an agent's credence function, option a_i strictly K-dominates option a_j, then it is not rationally permissible for the agent to choose option a_j.

The second is weaker:

> ***K*-Selection**: If, relative to an agent's credence function, option a_i strictly K-dominates every other option, then the agent is rationally required to choose option a_i.

In Newcomb problems, V-monism violates both. Here's the classic Newcomb problem:

> *Newcomb.* There is a transparent box and an opaque box. The agent, who cares only about money, has two options. She can take only the opaque box, or she can take both boxes (a_1 or a_2). The transparent box contains \$1,000. The opaque box contains either \$0 or \$1,000,000, depending on a prediction made yesterday by a reliable predictor. If the predictor predicted that the agent would take both boxes, the opaque box contains \$0. If the predictor predicted that the agent would take only the opaque box, the opaque box contains \$1,000,000. The agent knows all of this.

Taking both boxes strictly K-dominates taking only the opaque box, and thus strictly K-dominates every other option.[14] But V-monism recommends taking only the opaque box:

$$V(a_1) \approx (0)(0)+(1)(1,000,000) = 1,000,000 > V(a_2) \approx (1)(1,000)+(0)(1,001,000) = 1,000.$$

It seems clear to me that an agent facing *Newcomb* is rationally required to take both boxes, so I deem V-monism inadequate.[15]

Notice that U-monism validates both K-domination principles. An option that is strictly K-dominated never maximizes U, and an option that strictly K-dominates all other options always uniquely maximizes U. Hence, U-monism correctly handles *Newcomb*.

4.3 Unstable Problems

But U-monism is also inadequate. We can draw a distinction between stable and unstable decision problems. If C is an agent's credence function, let C^a be the agent's credence function conditional on a. A decision problem $d = \langle C, u, A, K\rangle$ is *stable* just if there is some $a \in A$ that maximizes U both relative to d and relative to $d^a = \langle C^a, u, A, K\rangle$, and *unstable*, otherwise.[16] Though I am inclined to think that U-monism correctly handles stable decision problems, I am convinced that some unstable decision problems are counterexamples. For example:[17]

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[14]Let k_0 and $k_\$$ be the propositions that the opaque box contains \$0 and \$1,000,000, respectively, and let a_1 and a_2 be the options of taking only the opaque box and both boxes, respectively. Then, $u(a_1k_0) = 0 < 1,000 = u(a_2k_0)$, and $u(a_1k_\$) = 1,000,000 < 1,001,000 = u(a_2k_\$)$.

[15]For an extended defense of two-boxing, see [redacted].

[16]Notice that whether a decision problem is stable, in this sense, does not supervene on the decision matrix.

[17]This example, which appears in [redacted], is a variation on Ahmed's (2014b) *Dicing with Death*. It's assumed that the agent is unable to randomize their choice. As noted in [redacted], if we transform *The Frustrater* into a sequence of choices—first a choice between a_E and eliminating a_E, and then a choice, if a_E is eliminated, between a_A and

The Frustrater. There is an envelope and two opaque boxes, A and B. The agent, who cares only about money, has three options. She can take box A, box B, or the envelope (a_A, a_B, or a_E). The envelope contains \$40. The two boxes together contain \$100. How the money is distributed between the boxes depends on a prediction made yesterday by the Frustrater, a reliable predictor who seeks to frustrate. If the Frustrater predicted that the agent would take box A, box B contains \$100. If the Frustrater predicted that the agent would take box B, box A contains \$100. If the Frustrater predicted that the agent would take the envelope, each box contains \$50. The agent knows all of this.

If we equate dollars and units of value, then, no matter what the agent's credences are, $U(a_E) = 40$ and $U(a_A) + U(a_B) = 100$. So, no matter what the agent's credences are, a_A and/or a_B maximize U. It seems clear to me, however, that an agent facing *The Frustrater* is rationally required to take the envelope, so I deem U-monism inadequate.

One can *argue* that an agent facing *The Frustrater* is rationally required to take the envelope by appeal to a "why ain'cha rich?" argument. (I'm not sure an argument is needed. I think the intuition is sufficiently strong and clear. But, still, an argument can be given.) A "why ain'cha rich?" argument is an inference to the best explanation.[18] It starts from the observation that one manner of choosing leads to greater long-run wealth than does another, and it alleges that what best explains this difference in long-run wealth accumulation is the irrationality of the second manner of choosing. There are

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a_B—U-monism recommends choosing a_E. But: (1) this is a different decision problem, so the counterexample to U-monism remains; (2) it may not be permissible for the agent to divide their choice into a sequence of choices, since we may add the assumption that the Frustrater punishes any agent who does so; and (3) we want a treatment of *The Frustrater* that applies equally to two-option unstable problems, such as Egan's *Psychopath Button*, which, of course, cannot be divided into a sequence of choices. Thanks to [redacted] for discussion on this point.

[18] *Cf.* Wells (forthcoming).

many "why ain'cha rich?" that I reject. For example, one-boxers end up wealthier than do two-boxers, and some one-boxers allege that what best explains the relative paucity of two-boxers is the irrationality of two-boxing. I think that this claim made by one-boxers is false. One-boxers enjoy greater circumstantial fortune. They almost always choose between $1,000,000 and $1,001,000, in a room that contains at least $1,000,000, whereas two-boxers almost always choose between $0 and $1,000, in a room that contains no more than $1,000. What best explains the relative paucity of two-boxers is this difference in circumstantial fortune, not any fact about rationality. But, when we turn to *The Frustrater*, the situation is different. Envelope-takers and box-takers enjoy the same circumstantial fortune. (They both make their choice in a room that contains exactly $140, for example.) Yet envelope-takers end up wealthier than do box-takers. I do not have enough space in this essay to fully defend the claim that what best explains the relative paucity of box-takers is the irrationality of box-taking, but I do, in fact, accept that explanatory claim.[19] In my view, whereas the relative paucity of two-boxers does not tell against the rationality of two-boxing, the relative paucity of box-takers does tell strongly (maybe even decisively) against the rationality of box-taking.

Unstable problems do not just make trouble for U-monism; as it turns out, they also make trouble for K-domination principles. The weaker principle, K-Selection, is safe and should be accepted. If, relative to d, there is an option that strictly K-dominates every other option, then d is guaranteed to be stable. But the stronger principle, K-Elimination, is challenged (and refuted, I think) by examples like the following:[20]

> *The Semi-Frustrater*. There are two opaque boxes, one white and one black. The agent has four options. She can point to either box with either hand (a_{RW}, a_{LW}, a_{RB}, or a_{LB}). One of the

[19] Ahmed (forthcoming) gives a fuller defense of this "why ain'cha rich?" argument for envelope-taking.

[20] This example is from [redacted].

> boxes contains \$0 and the other contains \$100. The agent receives the contents of whichever box she points to. Which box contains which sum depends on a prediction made yesterday by the Semi-Frustrater, a predictor who seeks to frustrate. If the Semi-Frustrater predicted that the agent would point to the black box, the white box contains \$100. If the Semi-Frustrater predicted that the agent would point to the white box, the black box contains \$100. There are two left-right asymmetries. First, the agent will receive an extra \$5 if she points to a box with her right hand. Second, because the Semi-Frustrater scans only half of the agent's brain (the half that controls motor movement on the right-hand side of the body), the Semi-Frustrater is a 90%-reliable predictor of right-handed box-pointings and only a 50%-reliable predictor of left-handed box-pointings. The agent knows all of this.

Each right-handed option strictly K-dominates the corresponding left-handed option. The two relevant dependency hypotheses are k_W, the proposition that the white box contains \$100, and k_B, the proposition that the black box contains \$100, and:

$$u(a_{LW}k_W) = 100 < 105 = u(a_{RW}k_W);$$

$$u(a_{LW}k_B) = 0 < 5 = u(a_{RW}k_B);$$

$$u(a_{LB}k_W) = 0 < 5 = u(a_{RB}k_W); \text{ and}$$

$$u(a_{LB}k_B) = 100 < 105 = u(a_{RB}k_B).$$

But, nevertheless, it seems clear to me that the rationally permissible options are the two left-handed options. (I think the intuitions in *The Frustrater* and *The Semi-Frustrater* stand and fall together.) So I reject K-Elimination.

It is worth noting that V-monism correctly handles both of these unstable problems, recommending the envelope, in *The Frustrater*,[21] and the two left-

[21] $V(a_A) \approx (1)(0) + (0)(50) + (0)(100) = 0$; $V(a_B) \approx (1)(0) + (0)(50) + (0)(100) = 0$; and $V(a_E) = (1)(40) = 40$.

handed options, in *The Semi-Frustrater*.[22]

4.4 Against Independent Monism

Of course, one can always bite the bullet. An inveterate V-monist might insist that an agent facing *Newcomb* is rationally required to take only the opaque box, and an inveterate U-monist might insist that an agent facing *The Frustrater* is not rationally permitted to take the envelope—intuitions to the contrary be damned.[23] But whether we want to go in for this sort of bullet-biting depends in part on how attractive the intuition-accommodating alternatives are. So, at least for the time being, I propose that we take the intuitions at face value, and thus take V-monism and U-monism to stand refuted.

If we take the intuitions at face value, then we can prove an important limitative result.[24] Say that a quantity is *independent* if its comparative relations holds independently of alternatives. Height is an example. If x and y are two people in a room and x is taller than y, then x continues to be taller than y, no matter who enters or exits the room.

When an object maximizes an independent quantity, it continues to do so upon the elimination of alternatives. For example, if x is the tallest person in the room, then she continues to be the tallest, no matter who else exits the room.

Most familiar quantities—height, mass, age, wealth, velocity, brightness, actual value, U, and V, just to mention a few—are independent quantities, and almost every form rational monism on offer is centered on some independent quantity or other. But given two principles that connect strict K-domination to rational choice, we can prove that rational permission is not coextensive with the maximization of any independent quantity. The

[22] $V(a_{RW}) = (0.9)(5)+(0.1)(105) = 15$; $V(a_{RB}) = (0.9)(5)+(0.1)(105) = 15$; $V(a_{LW}) = (0.5)(0) + (0.5)(100) = 50$; and $V(a_{LB}) = (0.5)(0) + (0.5)(100) = 50$.

[23] For an inveterate defense of V-monism, see *e.g.* Ahmed (2014a). For an inveterate defense of U-monism, see *e.g.* Harper (1996) and Joyce (2012; forthcoming).

[24] The proof in this subsection draws on Ahmed (2012).

principles are K-Selection, the weaker of the K-domination principles above, and:

> K**-Permission**: It is sometimes rationally permissible for an agent to choose an option that is strictly K-dominated relative to the agent's credence function.

I take K-Permission to be established by cases like *The Semi-Frustrater*.

The proof is then straightforward. Take any example in which an agent is rationally permitted to choose an option that is strictly K-dominated relative to the agent's credence function. For instance, take *The Semi-Frustrater*. If Q-monism is true, then, since the left-handed options are the rationally permissible options, $Q(a_{LW})$ and $Q(a_{LB})$ are equal to one another and exceed both $Q(a_{RW})$ and $Q(a_{RB})$.

Now eliminate all but two of the agent's options, keeping a K-dominated option that is rationally permissible for the agent to choose and an option that K-dominates it. For example,

> *The Demi-Semi-Frustrater*. Everything is the same as in *The Semi-Frustrater*, except that the agent is unable to point to the black box.

If Q is independent, then, relative to the *The Demi-Semi-Frustrater*, $Q(a_{LW})$ exceeds $Q(a_{RW})$. Hence, according to Q-monism, the agent facing *The Demi-Semi-Frustrater* is rationally required to point left-handedly. But this claim contradicts K-Selection, since, in *The Demi-Semi-Frustrater*, pointing right-handedly to the white box strictly K-dominates every other options available to the agent.[25]

It follows, then, that rational permission is not coextensive with Q-maximization. And since Q was chosen arbitrarily, the conclusion generalizes. If, as I believe, K-Permission and K-Selection are both true, then

[25] *The Demi-Semi-Frustrater* is just another Newcomb problem, so the very considerations that convince us that rationality requires two-boxing in *Newcomb* should likewise convince us that rationality requires pointing right-handedly in *The Demi-Semi-Frustrater*.

rational permission is not coextensive with the maximization of any independent quantity.

This limitative result can be stated more clearly with the help of a bit of terminology. Call any form of rational monism centered on an independent quantity, an *independent monism*. Every independent monism verifies the following principle:[26]

> **Alpha**: For any decision problem $d = \langle C, u, A, K\rangle$, if $a \in A$ is rationally permissible relative to d, and $a \in A' \subset A$, then a is rationally permissible relative to $d' = \langle C, u, A', K\rangle$.

Our limitative result, then, is this: Alpha is false, and thus every form of independent monism is extensionally inadequate. If we take the intuitions about Newcomb problems and unstable problems at face value, then the only hope for rational monism is some form of *dependent monism*.

5 Dependent Monism

5.1 V-ratificationism

The most familiar theory that falsifies Alpha is *V-ratificationism*.[27]

Let's say that option a is *ratifiable*, relative to decision problem $d = \langle C, u, A, K\rangle$, just if a maximizes U relative to $d^a = \langle C^a, u, A, K\rangle$, and *non-ratifiable*, otherwise. (Recall that C^a is C conditionalized on a.) According to V-ratificationism, options are lexically ordered by ratifiability, and then ranked by their respective V-values. Hence, if any option is ratifiable, the rationally permissible options are the options that maximize V among the ratifiable options, and if no option is ratifiable, the rationally permissible options are the options that maximize V, *simpliciter*.

There are different ways to understand V-ratificationism, but, for our purposes, it will be helpful to understand it as a particular form of dependent

[26] *Cf.* Sen (1970).
[27] *Cf.* Jeffrey (1983).

monism.[28] The math here isn't important, but let me lay it out anyway. We can bound and normalize the V-values of options by taking their arctangent and dividing by π. We can then add a *ratifiability score*: if a is ratifiable (relative to $d = \langle C, u, A, K \rangle$) then let $r(a) = \frac{1}{2}$, and if a is nonratifiable (relative to d) then let $r(a) = -\frac{1}{2}$. We then can define the J-value of option a (relative to d) as follows:

$$J(a) = \frac{\tan^{-1}(V(a))}{\pi} + r(a).$$

The J-values of nonratifiable options lie on the open interval $(-1, 0)$ and are ordered by their V-values, and the J-values of ratifiable options lie on the open interval $(0, 1)$ and are ordered by *their* V-values. Hence, so long as we care only about the ordinal rankings of options in terms of choiceworthiness, we can take V-ratificationism to be J-monism.

There are some familiar virtues of V-ratificationism. Unlike any form of independent monism, V-ratificationism validates both K-Selection and K-Permission.[29] Moreover, it gives the correct verdicts in all of the cases above: it recommends two-boxing in *Newcomb*, pointing right-handedly in *The Demi-Semi-Frustrater*, taking the envelope in *The Frustrater*, and pointing left-handedly in *The Semi-Frustrater*.

But V-ratificationism also has some vices. It admits of counterexamples and—like every form of dependent monism, I think—is metaethically dubious. The metaethical vice is the more important one, but let me start with a counterexample.

[28]We can also formulate V-ratificationism as a form of rational pluralism, but I will ignore the pluralistic formulation. The monistic and pluralistic formulations of V-ratificationism do not differ extensionally, but they do differ metaethically—see §5.3. And both admit of counterexamples—see §5.2 and §7.1.

[29]If an option K-dominates every other option, then it is the only ratifiable option, and hence, according to V-ratificationism, the only rationally permissible option.

5.2 A Counterexample to V-ratificationism

The most familiar counterexample to V-ratificationism exploits the lexical ordering of options.[30] V-ratificationism predicts that ratifiable options are always more choiceworthy than nonratifiable options. But that prediction is wrong, as the following example, adapted from Skyrms (1984), makes clear:

> *Three Shells.* There are three shells, A, B, and C. The agent, who cares only about money, must choose exactly one (a_A, a_B, or a_C). How much money is contained in each shell depends on a prediction made yesterday by a reliable predictor. If the predictor predicted that the agent would choose shell A, then A contains \$5, B contains \$0, and C contains \$0. If the predictor predicted that the agent would choose shell B, then A contains \$0, B contains \$9, and C contains \$10. If the predictor predicted that the agent would choose shell C, then A contains \$0, B contains \$10, and C contains \$9. The agent knows all of this.

Choosing shell A is the only ratifiable option. Hence, according to V-ratificationism, an agent facing *Three Shells* is rationally required to choose A, no matter what credences she has. But that's wrong. If, at the time of decision, the agent is confident that she will choose A, then she is rationally required to choose A, since she's then confident that A contains \$5 and that the other two shells are empty. But if the agent is not confident that she will choose shell A, then it is not even rationally permissible for her to do so. *Contra* V-ratificationism, ratifiable options are not, merely by virtue of being ratifiable, more choiceworthy than nonratifiable options.

5.3 Other Forms of Dependent Monism

There are other forms of dependent monism on offer. Wedgwood (2013) defends what we might call B-monism, where:

[30] For a second counterexample to V-ratificationism, see §7.1.

$$B(a) = \sum_K (C(k|a)(u(ak) - \frac{\sum_A u(ak)}{\#A})).$$

Gallow (MS) defends what we might G-monism, where:

$$G(a_i) = -1 \times (\max_{a_j \in A}(\sum_K C(k|a_i)u(a_jk)) - \sum_K C(k|a_i)u(a_ik)).$$

Neither makes much progress over V-ratificationism: *Three Shells* is a counterexample to both.[31]

But examples and counterexamples can only get us so far. V-ratificationism (a.k.a. J-monism), B-monism, and G-monism are just three forms of dependent monism. There are uncountably many others. And given *optimism*—the claim, which I accept,[32] that there is a determinate fact of the matter

[31] In *Three Shells*, no matter what the agent's credences are:

$B(a_A) = \sum_K (C(k|a_A)(u(ak) - \frac{\sum_A u(ak)}{\#A})) \approx (1)(5 - \frac{5}{3}) + (0)(0 - \frac{19}{3}) + (0)(0 - \frac{19}{3}) = \frac{10}{3}$;

$B(a_B) = \sum_K (C(k|a_B)(u(ak) - \frac{\sum_A u(ak)}{\#A})) \approx (0)(0 - \frac{5}{3}) + (1)(9 - \frac{19}{3}) + (0)(10 - \frac{19}{3}) = \frac{8}{3}$.

$B(a_C) = \sum_K (C(k|a_C)(u(ak) - \frac{\sum_A u(ak)}{\#A})) \approx (0)(0 - \frac{5}{3}) + (0)(10 - \frac{19}{3}) + (1)(9 - \frac{19}{3}) = \frac{8}{3}$; and

Following Gallow (MS), let $E(a_i|a_j) = \sum_K C(k|a_j)u(a_i)$. Then $G(a_i) = -1 \times (\max_{a_j \in A} E(a_j|a_i) - E(a_i|a_i))$. In *Three Shells*, no matter what the agent's credences are: $E(a_A|a_A) \approx 5$, $E(a_A|a_B) \approx 0$, $E(a_A|a_C) \approx 0$, $E(a_B|a_A) \approx 0$, $E(a_B|a_B) \approx 9$, $E(a_B|a_C) \approx 10$, $E(a_C|a_A) \approx 0$, $E(a_C|a_B) \approx 10$, and $E(a_C|a_C) \approx 9$. Hence

$G(a_A) \approx -1 \times (5 - 5) = 0$;

$G(a_B) \approx -1 \times (10 - 9) = -1$; and

$G(a_C) \approx -1 \times (10 - 9) = -1$.

An example discussed in §7.1 is also a counterexample to both B-monism and G-monism. See note 46.

[32] The most sustained argument against optimism is Briggs' (2010). Briggs argues that any adequate decision theory must verify two principles—a Pareto principle and a self-sovereignty principle—and then proves that no decision theory can verify both . I think that an adequate decision theory must *falsify* both: the Pareto principle is refuted by *The Semi-Frustrater*, and the self-sovereignty principle is refuted by *Three Shells*.

about which options are rationally permissible relative to every $\langle w, d \rangle$—there is bound to be *some* form of dependent monism that is extensionally adequate. Indeed, we can construct an extensionally adequate form of dependent monism as follows:

> Let g be a function that maps each decision problem to the set of world-option pairs that are rationally permissible. Hence, $\langle a, w \rangle \in g(d)$ if and only if a is rationally permissible at $\langle w, d \rangle$. Let a mathematical quantity, Z_g, be defined as follows. If $\langle a, w \rangle \in g(d)$, then $Z_g(d)(\langle a, w \rangle) = 1$, and if $\langle a, w \rangle \notin g(d)$, then $Z_g(d)(\langle a, w \rangle) = 0$. If Q_g is the quantity that contains Z_g, then Q_g-maximization is coextensive with rational permission.

We can also, of course, construct any number of extensionally adequate forms of rational pluralism.

The extensional equivalence between an extensionally adequate form of dependent monism and an extensionally adequate form of rational pluralism does not expunge the deep and important disagreement between them. According to dependent monism, there is some quantity that stands to rational permission as actual value stands to objective permission: some (complicated) quantity is the universal rational-maker. By contrast, according to rational pluralism, some (simple) quantities are occasional rational-makers, and no quantity is the universal rational-maker. But since both of these theories are extensionally adequate, we cannot settle the disagreement between them simply by appeal to examples and counterexamples.

5.4 The Problem of Consequentialist Credentials

Instead, the disagreement is to be settled on metaethical grounds. I favor rational pluralism over dependent monism because I believe that rational pluralism has two important metaethical advantages.

The first will emerge only when we return to nonideal agents. Nonideal agents cannot be guided by complicated quantities; they can be guided only by simple quantities. A quantity cannot be a rational-maker if it cannot guide the given agent on the given occasion. So, when we try to give an overarching theory of rational choice, which applies equally to ideal and nonideal agents, there is reason to prefer a view on which simple quantities are occasional rational-makers to a view on which a complicated quantity is the universal rational-maker.

But, for now, put the first metaethical advantage aside.

The second advantage applies even to the theory of rational choice for ideal agents, and arises from the reductive ambitions of consequentialism. A consequentialist who claims that it is the maximization of Q that makes options rationally permissible relative to decision problem d must be able to provide a consequentialist explanation for why it is the maximization of Q, specifically, and not some other quantity, that makes options rationally permissible. We are owed some story about how we get from consequentialism—the claim that the realization of value is all that fundamentally matters—to the claim that Q-maximization is what makes options rationally permissible relative to d. We can call this explanatory task, *the problem of consequentialist credentials.* My second reason for favoring rational pluralism is that I think it's better positioned to answer the problem of consequentialist credentials.

The usual way of trying to answer the problem of consequentialist credentials is by proving a representation theorem.[33,34] In a representation theorem, some formal conditions are identified and alleged to be requirements on ra-

[33]Some representative quotations:

> The fundamental source for the normative force of expected utility theory lies in what are known as *representation theorems*... (Bermúdez 2009: 30).
>
> The standard method for justifying any version of expected utility theory involves proving a *representation theorem*... (Joyce 1999: 4).

Note, however, that there are other proposed ways of trying to solve the problem of consequentialists credentials; see *e.g.* Hammond (1988).

[34]For an interesting, orthogonal critique of using representation theorems to answer the problem of consequentialist credentials, see Meacham and Weisberg (2011).

tional choice. It is then proved that, if the formal conditions identified really are requirements on rational choice, rational permission is coextensive with the maximization of some quantity. Representation theorems inevitably lead to rational monism. The whole point of proving a representation theorem is to arrive at a *representing* quantity: that is, a quantity the maximization of which is coextensive with rational permission relative to *every* decision problem. And all of the familiar representation theorems lead to some form of independent monism. The formal conditions identified always entail Alpha.[35]

The importance of the limitative result above thus becomes apparent. A proof that Alpha is false is, *inter alia*, a proof that none of the familiar representation theorems succeed.

The problem of consequentialist credentials poses a challenge to dependent monism because, as the complexity of the quantity that is alleged to be the universal rational-maker increases, so too does the difficulty of exhibiting its consequentialist credentials. It is one thing to try to explain why U—i.e., expected value—should be the universal rational-maker. It is another thing entirely to try to explain why, say, J—i.e., the quotient of the arctangent of conditional expected value and π plus a ratifiability score—should be the universal rational-maker.[36] It is hard to imagine a representation theorem that purports to prove that J is the representing quantity. Indeed, it is hard to imagine any satisfying explanation for why the maximization of J, specifically, should be so normatively important. And I think the same goes for other dependent quantities, too. I cannot *prove* that dependent monists will be unable to provide a satisfactory solution to the problem of consequentialist credentials, but I regard their prospects as very dim indeed.

One might have thought that the prospects for rational pluralism are even dimmer still, since, after all, the usual way of trying to answer the problem of consequentialist credentials—proving a representation theorem—

[35]The familiar representation theorems include: Bolker (1967), Buchak (2013), Joyce (1999), von Neumann and Morgenstern (1944), and Savage (1954).

[36]What I say here about J is meant to apply to any mathematical quantity with the same maximizational structure as J.

inevitably leads to rational monism. But there is an alternative and, I think, superior way to try to answer the problem of consequentialist credentials that does not inevitably lead to rational monism.

6 Constrained Optimization

I think consequentialists should answer the problem of consequentialist credentials in the same way that they answer every problem: namely, by optimizing.

The picture I have in mind goes roughly as follows. Each quantity is to be assigned a score, which measures the degree to which its maximization conduces to the realization of value. The rational-making quantity is then the quantity that scores highest, subject to a guidance constraint.

As a bit of terminology, if an agent of type $\langle C, u\rangle$ faces a decision of type $\langle A, K\rangle$, then we'll say that the agent is *involved* in $d = \langle C, u, A, K\rangle$. And if an agent involved in d is capable of being guided by some quantity Q, then we'll say that Q is *d-guiding*. Rational permissions are, by their very nature, guiding, so the rule for reducing rational permission maps every decision problem d to some d-guiding quantity. But, subject to this guidance constraint, we optimize, since the realization of value is all that fundamentally matters. Hence,[37]

> **Rational Optimization**: The rule for reducing rational permission maps each decision problem d to the highest-scoring d-guiding quantity.

[37]This picture has an obvious affinity to rule consequentialism, where quantities are swapped in for rules. In epistemology, Schoenfield (2015) has argued for picture not too unlike this one, on which epistemic plans are scored, and rationality is then a matter of following the best plan that can guide an agent. Within the theory of rational choice, the idea that we should be scoring quantities (or programs) and optimizing subject to some constraint has been a mainstay of work in bounded rationality, especially on the computer science sides of things; see *e.g.* Halpern *et al.* (2014), Icard (2018), and Russell and Subramanian (1995).

Rational Optimization is my proposed solution to the problem of consequentialist credentials. If the rule for reducing rational permission maps d to Q, it does so *because* Q is the highest-scoring d-guiding quantity: that is, the quantity the maximization of which best conduces to the realization of value, among the quantities that can guide an agent involved in d. Objective permission is a matter of unconstrained optimization: the rule for reducing objective permission maps every decision problem d to the best quantity, namely, actual value. Rational permission is a matter of constrained optimization: the rule for reducing rational permission maps every decision problem d to the best d-guiding quantity.

If we accept Rational Optimization, then two matters become pressing. We want to know how to score quantities, and we want to know what it is for a quantity to be d-guiding. My goal in the remainder of this section is to make some progress on these two matters. I will offer a partial account of how to score quantities and a full account of what it is for a quantity to be d-guiding. As we will see, by combining the two, we can shed light on the puzzling examples from above.

6.1 Scoring

As I envisage it, the score of a quantity should be determined by two factors. The first factor is the various d-scores of the quantity, where, for some decision problem d, the *d-score* of Q, $S(Q, d)$, is a measure of the degree to which the maximization of Q conduces to the realization of value relative to d, specifically. The second factor is some measure, $M(d)$, assigned to each $d \in D$. The score of a quantity is then some average of its d-scores, weighted by the $M(d)$'s.

My account of how to score quantities is partial because I do not know what the $M(d)$'s should be. If we put enough constraints on the space of decision problems, then certain measures, like an indifference measure, are tempting and plausible. But without imposing constraints on the space of decision problems, it is hard to know what the $M(d)$'s should be. So I will leave that matter undecided.

I do, however, have a proposal for how to d-score quantities. To a first approximation, I think that the d-score of Q should be the actual value that an agent involved in d expects to realize by choosing a Q-maximizing option.

More formally, let $Max(Q, w, d)$ be the set of options that maximize Q at $\langle w, d\rangle$, and let $\#Max(Q, w, d)$ be the number of options contained in $Max(Q, w, d)$.

Let $@(a, w, d)$ be the actual value of option a at $\langle w, d\rangle$. For example, in *Boxes like Miners*, if a is the option of choosing the right box, and w_1 and w_2 are worlds at which the right box contains \$10 and \$0, respectively, then, equating dollars and units of value, $@(a, w_1, d) = 10$ and $@(a, w_2, d) = 0$.

Let $@(Q, w, d)$ be the average of the actual values of the Q-maximizing options at $\langle w, d\rangle$—that is, $\sum_{Max(Q,w,d)} \frac{@(a,w,d)}{\#Max(Q,w,d)}$.

I propose, then, that the d-score of Q should be the credence-weighted average of the $@(Q, w, d)$'s, as determined by the credence function in d. In other words, I propose that:

$$S(Q, d) = \sum_W C(w)@(Q, w, d).$$

One can, of course, conceive of many alternative ways to d-score quantities, and, in a fuller discussion, it would be instructive to compare this proposal to its rivals. But this proposal is natural and plausible. It's mathematically simple. It's metaethically simple. And, unlike many of its rivals,[38] it rightly ensures that the d-score of actual value is never exceeded.[39] It

[38]For example, I have not yet been able to find any (remotely plausible) way of d-scoring quantities that (a) entails that V weakly D-dominates U and (b) does not entail that the D-score of V sometimes exceeds the d-score of actual value. A method of d-scoring quantities cannot be adequate unless in ensures that the d-score of actual value is never exceeded, so this amounts to an outstanding challenge to V-enthusiasts.

[39]*Proof:* Let α be the quantity maximized by exactly the actual value maximizing options at every $\langle w, d\rangle$. For any quantity Q and for any $\langle w, d\rangle$, $@(\alpha, w, d) \geq (Q, w, d)$, since the average actual value of the options that maximize actual value at $\langle w, d\rangle$ cannot be less than the average actual value of the options that maximize Q relative to $\langle w, d\rangle$. Hence, for any d, $S(\alpha, d) \geq S(Q, d)$. Hence, $S(\alpha) \geq S(Q)$.

therefore seems reasonable to me to adopt this proposal, provisionally, and see what work it can do for us. (If the proposal does quite a lot of interesting work, then, at some later point, we can circle back and see whether we can provide a full and proper justification for it.)

Having (provisionally) adopted this way of d-scoring quantities, we still cannot determine the score of any quantity, since I have not offered any proposal about what the $M(d)$'s are. But I am going to assume that we can determine some facts about how the scores of quantities relate, nevertheless, by appealing to relations of weak domination. If, for some d, $S(Q_1, d) > S(Q_2, d)$, and if, for every d, $S(Q_1, d) \geq S(Q_2, d)$, then Q_1 *weakly D-dominates* Q_2. In what follows, I assume that a quantity always scores higher than does any quantity it weakly D-dominates.

6.2 Invariant and Supervenient Quantities

I now want to turn to guidance, building up to my preferred conception in stages.

One necessary condition for guidance is invariance. A quantity is *d-invariant* just if, for any worlds, w_1 and w_2, $Max(Q, w_1, d) = Max(Q, w_2, d)$. We can think of it this way: a quantity is d-invariant if the options that maximize it relative to d depend only on the credences and utilities of an agent involved in d.

If quantity Q is d-invariant, let $Max(Q, d)$ be the options that maximize Q relative to d: that is, the options that maximize Q at each $\langle w, d\rangle$. My proposed way to d-score quantities entails:

> If Q is a d-invariant quantity, then the d-score of Q is the average of the U-values of the options that maximize Q relative to d.

To see this, suppose that Q is d-invariant. If k is the dependency hypothesis that holds at world w, then the actual value of option a at world w equals $u(ak)$. Hence,

$$S(Q, d) = \sum_W C(w)@(Q, w, d) = \sum_K C(k)\frac{\sum_{Max(Q,d)} u(ak)}{\#Max(Q,d)} = \frac{\sum_{Max(Q,d)} U(a)}{\#Max(Q,d)}.$$

The fact that the d-score of a d-invariant quantity is the average of the U-values of the options that maximize it is important because it entails that the d-score of a d-invariant quantity never exceeds the d-score of U.

Let's say that a quantity is *supervenient* if, for every d, it is d-invariant. It is often taken for granted that options can be made rationally permissible only by supervenient quantities. All of the quantities above—U, V, J, B, and G—are supervenient. It is therefore remarkable that we can prove that U is the highest-scoring supervenient quantity. Just by appealing to relations of weak D-domination, we can prove that the highest-scoring supervenient quantities are only ever maximized by U-maximizing options. And, by imposing a very plausible continuity constraint on the space of quantities, we can prove:

> **Supervenient Optimality**: U is the highest-scoring (continuous) supervenient quantity.

Both the formulation of the continuity constraint and the proof of Supervenient Optimality are in the appendix.

To appreciate the metaethical import of Supervenient Optimality, suppose, just for a moment, that being supervenient is both necessary and sufficient for being d-guiding. Then, by combining Rational Optimization and Supervenient Optimality, we can give a metaethical proof of U-monism. Three metaethical claims—Rational Optimization, my proposed way to d-score quantities, and the claim that being supervenient is both necessary and sufficient for being d-guiding—jointly entail that the rule for reducing rational permission maps every decision problem to U.

6.3 Guidance and Stable Maximization

Now, as I said, I do not, myself, accept U-monism. I think that some unstable decision problems are counterexamples. But the attempted metaethical proof above is helpful because it allows me to say exactly where I think U-monism goes wrong.

In my view, being supervenient is necessary, but not sufficient, for being d-guiding.[40] The attempted proof above establishes this much—that the rule for reducing rational permission maps d to U, whenever U is d-guiding. But it fails to establish U-monism because U is not *always* d-guiding.

According to the conception of guidance I favor:[41]

> An agent facing a decision is capable of being guided by some supervenient quantity Q just if, for some option a, the fact that a maximizes Q can be the agent's reason for choosing a.

And according to the conception of reasons for actions I favor:

> The fact that a maximizes Q can be an agent's reason for choosing a just if (1) the agent is in a position to know that a maximizes Q and (2) conditional on a, the agent (still) is in a position to know that a maximizes Q.[42]

Condition (1) is an epistemic constraint that ensures that reasons are within the agent's ken. If we make things simple and take knowledge to be truth plus certainty, then it says that p can be an agent's reason for choosing a only if, relative to the agent's credence function, p is true and certain. Condition (2) is a non-self-undermining constraint that ensures that agents can choose on the basis of their reasons. If we again take knowledge to be truth plus certainty, it says that p can be an agent's reason for choosing a only if, relative to the agent's credence function conditional on a, p is true and certain.[43]

[40] It's worth noting that many of the claims I want to make do not require the claim that only supervenient quantities can be d-guiding. For example, if we assume that a quantity is d-guiding just if d-invariant, then we can show that, for any d, the options that maximize the highest-scoring d-invariant quantity also maximize U, even if we allow that a quantity can be d-guiding without being supervenient.

[41] A similar conception of guidance is defended in [redacted].

[42] Condition (2) is akin to, but not quite equivalent to, a principle that Hare (2011: 196) calls "Reasons are not Self-Undermining."

[43] Note an important distinction here. What condition (2) requires is that it be true

When we restrict attention to ideal agents, condition (1) is trivial. If Q is a supervenient quantity, then an ideal agent knows for certain exactly which options maximizes Q.

Of course, condition (1) is not trivial for nonideal agents. Take, for example, *The Fire*, replacing X with U. Even though U is supervenient, the firefighter is not in a position to know that entering via the right door (uniquely) maximizes U. With enough time to recalculate, the firefighter could again come to know as much. But she cannot do so given the time constraints she faces. In fact, the failure of condition (1) is what explains why the firefighter cannot be guided by U.

But, when it comes to ideal agents, condition (1) always holds. The action thus lies with condition (2), which is all about stability.

Say that option a *stably* maximizes Q relative to $d = \langle C, u, A, K \rangle$ just if a maximizes Q both relative to d and relative to $d^a = \langle C^a, u, A, K \rangle$. If my conception of guidance is correct, then guidance requires *stable* maximization. An ideal agent involved in d can be guided by a supervenient quantity Q just if some option stably maximizes Q relative to d. And, since the fact that an option maximizes a quantity can be the agent's reason for choosing the option only if the option stably maximizes the quantity, it is the *stable* maximization, as opposed to the *mere* maximization, of the rational-making quantity that makes options rationally permissible.

Putting Rational Optimization together with my preferred account of d-guidance, we get:

> **Expanded Rational Optimization**: What makes options rationally permissible relative to decision problem d is the stable maximization of the highest-scoring supervenient quantity that is stably maximized relative to d.

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and certain relative to C^a that a maximizes the quantity relative to C^a, not that it be true and certain relative to C^a that a maximizes the quantity relative to C. Thanks to [redacted] for discussion here.

And, with Expanded Rational Optimization in hand, we can shed some light on the puzzling examples from above.

6.4 Why U-monism Is Nearly True

Expanded Rational Optimization entails that an agent involved in decision problem d is capable of being guided by U just if some option stably maximizes U relative to d. This idea should sound familiar. Recall the distinction between stable and unstable decision problems. A decision problem is stable just if, relative to it, some option stably maximizes U. Thus, according to Expanded Rational Optimization, an agent is capable of being guided by U just if the agent is involved in some stable decision problem.

At an intuitive level, this prediction about guidance seems exactly right to me. An ideal agent facing a stable decision problem—*Newcomb*, say—*can* be guided by U. The fact that taking both boxes (uniquely) maximizes U can be the agent's reason for taking both boxes; U-maximization is stable enough to be the agent's guide. But an ideal agent facing an unstable decision problem—*The Frustrater*, say—*cannot* be guided by U. In an unstable decision problem, U-maximization is too elusive to be a guide. The agent cannot both know which option she will choose and that she will choose a U-maximizing option, so the fact that an option maximizes U cannot be the agent's reason for choosing it.

By putting Expanded Rational Optimization and Supervenient Optimality together, we can explain why the division between stable and unstable decision problems seems so important. For any decision problem d, it is the stable maximization of the highest-scoring d-guiding quantity that makes options rationally permissible. If d is a stable decision problem, then U is the highest-scoring d-guiding quantity. Hence, U is the rational-maker relative to every stable decision problem. But, if d is an unstable decision problem, then U is not d-guiding, so the rational-maker will be some quantity other than U. Thus, U is the rational-maker relative to d if and only if d is a stable decision problem.

So let's turn to the next obvious question: which quantity or quantities are the rational-makers relative to unstable decision problems?

7 U-Pluralism

If we had a full and correct account of how to score quantities, then we could combine it with Expanded Rational Optimization and *derive* the rule for reducing rational permission. No speculation would be needed. But, as I said above, I do not a full account of how to score quantities to offer. The form of rational pluralism that I develop in this section will therefore be speculative. But it is, in my opinion, also interesting and attractive. I think it compares favorably, in terms of theoretical simplicity, to the dependent monisms considered in §5. And, so far as I know, it is the only theory of rational choice on offer that can handle both Newcomb problems and the suite of unstable problems considered herein, a suite that includes Bostrom's *Meta-Newcomb*, Egan's *Psychopath Button*, and Ahmed's *Dicing with Death*. So, even if the theory ultimately proves mistaken, it still might help point us in the right direction.

7.1 UV-ism

As a warmup, consider a very simple form of rational pluralism. According to *UV-ism*, as I will call it, the stable maximization of U makes options rationally permissible relative to stable decision problems, and the stable maximization of V makes options rationally permissible relative to unstable decision problems.

The success of UV-ism is strange, but striking. It verifies both K-Selection and K-Permission. It recommends two-boxing in *Newcomb*, the right-handed option in *The Demi-Semi-Frustrater*, the envelope in *The Frustrater*, and the left-handed options in *The Semi-Frustrater*. (It correctly recommends: one-boxing in Bostrom's *Meta-Newcomb*, not pressing in Egan's *Psychopath Button*, and paying to flip in Ahmed's *Dicing with Death*.) And it correctly handles *Three Shells*, recommending shell A if the agent is highly confident that she will choose shell A, and recommending shells B and C if the agent is not highly confident that she will choose shell A.

Nevertheless, I think that we should reject UV-ism, for two reasons.

The first is metaethical. Given the truth of Expanded Rational Optimization, UV-ism is tantamount to a bold metaethical prediction: that V is the highest-scoring quantity that can guide an agent whenever U fails to be. The presupposition of this metethical prediction is correct. Whenever an option maximizes V, it also stably maximizes V. Therefore, for any decision problem d, V is d-guiding. But the substantive claim is dubious. In fact, I think it's false. I think that there are cases in which the highest-scoring quantity that can guide an ideal agent is neither U, nor V.

The second reason is extensional. There are cases—admittedly, rather complicated cases—that UV-ism seems to mishandle. The cases I have in mind are unstable and, at the same time, Newcomb-like. Here's an example:

> *The Meta-Frustrater.* There are two opaque boxes, one white and one black. The agent, who cares only about money, has four options. She can point to either box with either hand (a_{RW}, a_{LW}, a_{RB}, or a_{LB}). One of the boxes contains \$0 and the other contains \$100. The agent receives the contents of whichever box she points to. Which box contains which sum depends on a prediction made yesterday by a minion who seeks to frustrate. If the minion predicted that the agent would point to the white box, the black box contains \$100. If the minion predicted that the agent would point to the black box, the white box contains \$100. There are two left-right asymmetries. The first is straightforward. The agent receives an extra \$5 if she points to a box with her right hand. The second is more complicated. There are two minions: one is a 90%-reliable predictor of both left-handed and right-handed box-pointings, and the other is a 50%-reliable predictor of both left-handed and right-handed box-pointings. Which min-

> ion is up against the agent depends on a prediction made two days ago by the Meta-Frustrater, who is a *very* reliable predictor. If the Meta-Frustrater predicted that the agent would point with her right hand, then the Meta-Frustrater put the agent up against the minion who is 90% reliable. If the Meta-Frustrater predicted that the agent would point with her left hand, then the Meta-Frustrater put the agent up against the minion who is 50% reliable. The agent knows all of this.

The similarities between *The Semi-Frustrater* and *The Meta-Frustrater* are obvious. If the Meta-Frustrater is (nearly) a perfectly reliable predictor, then, in the two examples, the four options have (nearly) the same V-values and U-values.[44] According to UV-ism, the examples are also normatively alike. In both examples, UV-ism recommends the left-handed options.

Now, intuitions about examples this complicated are not always clear. But it seems to me, and it has seemed to many who I have informally surveyed about the matter, that UV-ism mishandles *The Meta-Frustrater*—that, on account of something Newcomb-like, the rationally permissible options in *The Meta-Frustrater* are the right-handed options. In *The Semi-Frustrater*, the predictor who seeks to frustrate the agent has a predictive weakness, which the agent can exploit by pressing left-handedly. But, in *The Meta-Frustrater*, the predictor who seeks to frustrate the agent—whichever minion it happens to be—has no predictive weakness to exploit. An agent who points left-handedly in *The Meta-Frustrater* thus seems to be merely managing the

[44]If the Meta-Frustrater is perfect, then in both examples:

$V(a_{RW}) = V(a_{RB}) = (105)(0.1) + (5)(0.9) = 15$; and

$V(a_{LW}) = V(a_{LB}) = (100)(0.5) + (0)(0.5) = 50$.

The U-values are sensitive to the agent's credences over A. If, for example, $C(a_{RW}) = C(a_{RB}) = C(a_{LW}) = C(a_{RW}) = 0.25$, then:

$U(a_{RW}) = U(a_{RB}) = (105)(0.5) + (5)(0.5) = 55$; and

$U(a_{LW}) = U(a_{LB}) = (100)(0.5) + (0)(0.5) = 50$.

news:[45] forgoing a certain benefit in order to produce evidence that she is up against the predictively weaker minion.[46]

7.2 U-pluralism

The form of rational pluralism that I favor explains why UV-ism has the success it does, better coheres with Expanded Rational Optimization, and correctly handles *The Meta-Frustrater*. I call it, *U-pluralism.*

Recall that U is defined in terms of K, the set of dependency hypotheses. To formulate U-pluralism, I am going to assume that there is some privileged way to gradually coarsen K. The set of these coarsenings, $\boldsymbol{K}$, is linearly ordered by granularity. The least member of $\boldsymbol{K}$ is the set of dependency hypotheses, to which I will append superscripted zeroes, $K^0 =$

[45] *Cf.* Lewis (1981).

[46] Like UV-ism, B-monism wrongly recommends the left-handed options in *The Meta-Frustrater*. No matter what the agent's credences are:

$B(a_{RW}) = \sum_K (C(k|a_{RW})(u(ak) - \frac{\sum_A u(ak)}{\#A})) = (0.1)(105 - \frac{210}{4}) + (0.9)(5 - \frac{210}{4}) = -37.5$;

$B(a_{LW}) = \sum_K (C(k|a_{LW})(u(ak) - \frac{\sum_A u(ak)}{\#A})) = (0.5)(100 - \frac{210}{4}) + (0.5)(0 - \frac{210}{4}) = -2.5$;

$B(a_{RB}) = \sum_K (C(k|a_{RB})(u(ak) - \frac{\sum_A u(ak)}{\#A})) = (0.9)(5 - \frac{210}{4}) + (0.1)(1055 - \frac{210}{4}) = -37.5$; and

$B(a_{LB}) = \sum_K (C(k|a_{LB})(u(ak) - \frac{\sum_A u(ak)}{\#A})) = (0.5)(0 - \frac{210}{4}) + (0.5)(100 - \frac{210}{4}) = -2.5$.

G-monism also wrongly recommends the left-handed options. No matter what the agent's credences are: $E(a_{RW}|a_{RW}) = 15$; $E(a_{LW}|a_{RW}) = 10$; $E(a_{RB}|a_{RW}) = 95$; $E(a_{LB}|a_{RW}) = 10$; $E(a_{RW}|a_{LW}) = 55$; $E(a_{LW}|a_{LW}) = 50$; $E(a_{RB}|a_{LW}) = 55$; $E(a_{LB}|a_{LW}) = 50$; $E(a_{RW}|a_{RB}) = 10$; $E(a_{LW}|a_{RB}) = 90$; $E(a_{RB}|a_{RB}) = 15$; $E(a_{LB}|a_{RB}) = 10; E(a_{RW}|a_{LB}) = 55$; $E(a_{LW}|a_{LB}) = 50$; $E(a_{RB}|a_{LB}) = 55$; and $E(a_{LB}|a_{LB}) = 50$. Hence,

$G(a_{RW}) = -1 \times (95 - 15) = -80$; $G(a_{LW}) = -1 \times (55 - 50) = -5$;

$G(a_{RB}) = -1 \times (95 - 15) = -80$; and $G(a_{LB}) = -1 \times (55 - 50) = -5$.

$\{k^0_1, k^0_2, ..., k^0_n\}$. As we gradually coarsen, we might arrive at some intermediate partition, $K^j = \{k^j_1, k^j_2, ..., k^j_m\}$, and then some coarser intermediate partition, $K^l = \{k^l_1, k^l_2, ..., k^l_k\}$. The coarsest and greatest member of $\boldsymbol{K}$ is the trivial partition, $K^\top = \{k^\top\}$, which has $k^\top = \top$ as its only member.

Just as there can be disagreement among U-monists about how best to conceptualize K,[47] there can be disagreement among U-pluralists about how best to conceptualize $\boldsymbol{K}$. In the interest of efficiency, I will help myself to one plausible conception.

Let $\{lh_1, lh_2, ..., lh_n\}$ be the set of propositions that specify the laws of nature and the history of the world up to the time of decision, insofar as those matters are beyond the agent's control.[48] If we take $\{lh_1, lh_2, ..., lh_n\}$ to be the set of dependency hypotheses, then the natural way to gradually coarsen is by removing successive slices of history, producing ever shorter initial segments, and then finally removing the laws, themselves. (I stress that this is not the only possible conception of $\boldsymbol{K}$.[49] But it's one possible conception, and it has the virtue of being easy to work with.)

However $\boldsymbol{K}$ is characterized, it gives rise to a spectrum of supervenient quantities, which range from U, at one extreme, to V, at the other:

$U^0(a) =_{def} \sum_{K^0} C(k^0)V(ak^0) = \sum_{K^0} C(k^0)u(ak^0) = U(a)$;

...

$U^j(a) =_{def} \sum_{K^j} C(k^j)V(ak^j)$;

...

[47] See *e.g.* Ahmed (2014a), Joyce (1999), and Lewis (1981).

[48] Each member of $\{lh_1, lh_2, ..., lh_n\}$ is compossible with each option. Moreover, since each lh_i specifies the laws and history only insofar as those matters are beyond the agent's control, this conception of dependence hypotheses is compatible with agents in deterministic worlds having multiple options.

[49] One alternative I find attractive is purely modal. Each fact is assigned some counterfactual fixity, *à la* Kment (2014), and we gradually coarsen by progressively removing the facts with the least counterfactual fixity. This purely modal characterization of $\boldsymbol{K}$ is harder to work with, but may prove superior.

$U^{\top}(a) =_{def} \sum_{K^{\top}} C(k^{\top})V(ak^{\top}) = V(a\top) = V(a).$

Let $\boldsymbol{U}$ be the set of these quantities, and let $\boldsymbol{U}$ inherit the order on $\boldsymbol{K}$: $U^i \prec U^j$ if and only if K^i is a refinement of K^j. Then the least member of $\boldsymbol{U}$ is the causally finest member, namely, U. The greatest member is the causally coarsest member, namely, V. And the intermediate members have intermediate degrees of causal granularity and are ordered accordingly.

With $\boldsymbol{U}$ characterized, we can state U-pluralism:

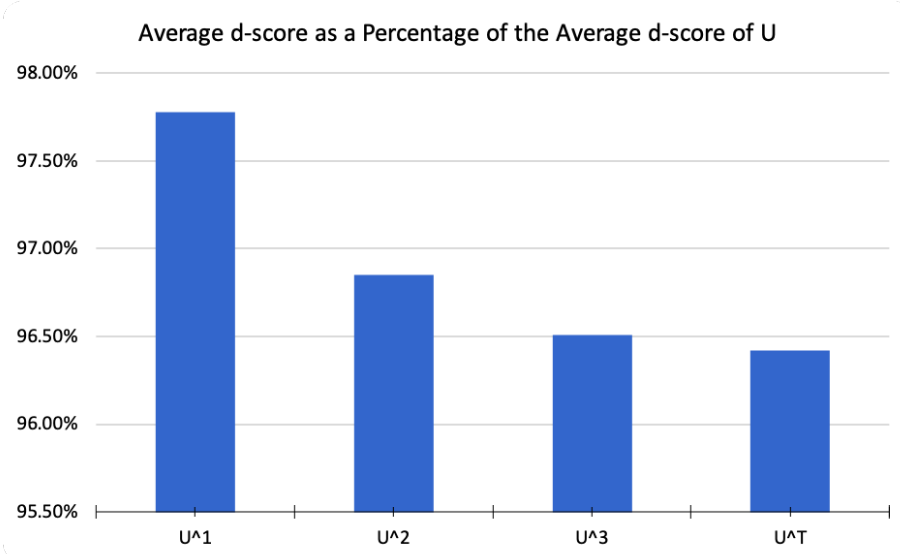
> **$\boldsymbol{U}$-pluralism**: What makes an option rationally permissible relative to decision problem d is the stable maximization of the least member of $\boldsymbol{U}$ that is stably maximized relative to d.

To *derive* U-pluralism from Expanded Rational Optimization, we would need two claims. First, we would need the claim that $\boldsymbol{U}$ is linearly ordered by score: that every member of $\boldsymbol{U}$ scores higher than does every greater member.[50] Second, we would need the claim that $\boldsymbol{U}$ is exhaustive: that the rule for reducing rational permission maps every decision problem to some member of $\boldsymbol{U}$.

I regard both claims as speculative but plausible. The first claim is supported by a computer simulation. As I said above, when enough constraints are placed on the space of decision problems, it can be plausible to use an indifference measure to average the d-scores of a quantity. In the simulation run, I did precisely that. The simulation involved 16 dependency hypotheses and four options. For each cycle, probabilities and utilities (between 0 and 100) were randomly distributed over the 64 atoms in $A \times K$. Since there are 16 dependency hypotheses, there are five members of $\boldsymbol{U}$: $U^0 = U$, U^1, U^2, U^3, and $U^{\top} = V$. Each quantity in $\boldsymbol{U}$ is supervenient, and the d-score of a supervenient quantity is the average U-value of the options that maximize the quantity relative to d, so, in each cycle of the simulation, for each $U^i \in$

[50]It is not true, however, that each member of $\boldsymbol{U}$ weakly D-dominates each greater member.

$\boldsymbol{U}$, I recorded the U-value of the U^i-maximizing option. After running the simulation 15,000 times, the following curve emerged:



Normalizing the average d-score of U to 1, the average d-scores of U^1, U^2, U^3, and $U^\top$ were, respectively, .9778, .9685, .9651, and .9642. Now, of course, this does not *prove* that each member of $\boldsymbol{U}$ is higher-scoring than every greater member, but it does lend considerable support to that claim.

The second claim is also plausible, especially in light of the first. We know that the rule for reducing rational permission maps every stable decision problem to U. And, since V is d-guiding for every decision problem d, we know that the rule for reducing rational permission never maps a decision problem to a quantity that scores lower than V. Therefore, if the first claim is true—if $\boldsymbol{U}$ is linearly ordered by score—then the second claim is plausible, although not by any means obvious or trivial.

Since I cannot derive U-pluralism, I regard it as a speculative hypothesis. But it is a speculative hypothesis that has much going for it. Not only does it cohere nicely with Expanded Rational Optimization; it delivers the recommendations we seek. It verifies both K-Selection and K-Permission. It recommends two-boxing in *Newcomb*, the right-handed option in *The Demi-Semi-Frustrater*, the envelope in *The Frustrater*, and the left-handed options in *The Semi-Frustrater*. (It correctly recommends: one-boxing in Bostrom's *Meta-Newcomb*, not pressing in Egan's *Psychopath Button*, and paying to flip in Ahmed's *Dicing with Death.*) It correctly handles *Three Shells*, recommending shell A if the agent is highly confident that she will choose shell A, and recommending shells B and C if the agent is not highly confident that she will choose shell A. And it also correctly handles *The Meta-Frustrater*, recommending the right-handed options.

I will not go through all of the relevant calculations, since that would be tedious. But let me go through two cases, *The Frustrater* and *The Meta-Frustrater*, to see the inner cogs of the theory at work.

To make things simple, suppose that the agent facing *The Frustrater* is certain that the Frustrater's prediction was made instantaneously j units prior to the time of decision. (This assumption is not necessary. It merely helps to vivify the metaethical structure.[51]) Let the k^j's be propositions that specify the laws of nature and the history of the world up to j units prior to the time of decision, and let U^j be defined in terms of K^j. As we work our way through the members of $\boldsymbol{U}$, from least to greatest, we encounter a metaethical shift.

If $U^i \prec U^j$—in other words, if K^i is any refinement of K^j—then, de-

[51]Assuming that the agent is certain that the prediction was made instantaneously j units prior to the time of decision makes the metaethical transition sudden. For every $U^i \prec U^j$, $U^i(a_A) + U^i(a_B) = 100$. And, for every $U^k \succeq U^j$, $U^k(a_A) + U^k(a_B) \approx 0$. If we drop the assumption that the agent is certain that the prediction was made j units prior to the time of decision, the metaethical transition might instead be gradual. If the decrease is gradual, then emphasizing *stable* maximization might be important. In a version of *The Frustrater* in which the agent is uncertain when the prediction was made, it may be the case that the least member of $\boldsymbol{U}$ that is stably maximized, say, U^j, is maximized both by, say, a_A and a_E. This sort of co-maximization would not make a_A rationally permissible, however, because a_A will not stably maximize U^j. In fact, neither a_A, nor a_B stably maximize any member of $\boldsymbol{U}$. If a_A maximizes some U^j, then $\sum C(k^j|a_A)u(a_A k^j) < \sum C(k^j|a_a)u(a_B k^j)$, since the agent then will regard a_A as evidence in favor of a_B-friendly k^js. But the co-maximization would make a_E rationally permissible, since a_E stably maximizes the least member of $\boldsymbol{U}$ that is stably maximized, whatever that proves to be.

pending on the agent's credences, a_A and/or a_B maximizes U^i, but no option stably maximizes U^i. Each k^i specifies how much money is in each box. As a result, for any k^i, $V(a_E k^i) = 40$ and $V(a_a k^i) + V(a_b k^i) = 100$. Hence, $U^i(a_E) = 40$ and $U^i(a_A) + U^i(a_B) = 100$. But no option stably maximizes U^i because the agent regards choosing a box as strong evidence that the box is empty:

$\sum_{K^i} C(k^i|a_A)V(a_A k^i) < \sum_{K^i} C(k^i|a_A)V(a_B k^i)$, and

$\sum_{K^i} C(k^i|a_B)V(a_B k^i) < \sum_{K^i} C(k^i|a_B)V(a_A k^i)$.

By contrast, if $U^j \preceq U^k$, then taking the envelope stably maximizes U^k. No k^k specifies how much money is in each box. As a result, $V(a_A k^k)$, $V(a_B k^k)$, and $V(a_E k^k)$ are determined by what k^k says about the Frustrater's reliability. If the agent is certain that the Frustrater is almost perfectly reliable, then, for any k^k, $V(a_E k^k) = 40$ and $V(a_A k^k) = V(a_B k^k) \approx 0$. Hence, $U^k(a_E k^k) = 40$ and $U^k(a_A k^k) = U^k(a_B k^k) \approx 0$. And choosing the envelope also *stably* maximizes U^k. Indeed, if the agent has no uncertainty about the Frustrater's predictive powers, then, for any k^k, $C(k^k|a_A) = C(k^k|a_B) = C(k^k|a_E)$. Thus, according to U-pluralism, an agent facing *The Frustrater* is rationally required to choose the envelope, and is so *because* choosing the envelope is the only option that stably maximizes the least member of $\boldsymbol{U}$ that is stably maximized, namely, U^j.

When we see how U-pluralism handles *The Frustrater*, we can understand why UV-ism has the success it does.

Think about stable decision problems. What makes options rationally permissible relative to a stable decision problem is the stable maximization of U. But in the simplest stable decision problems, V-maximization and U-maximization coincide. Thus, although V-monism is mistaken metaethically, it very often delivers the correct recommendations. The only stable decision problems in which V-monism gives the wrong recommendations are Newcomb problems.

A similar thing holds true of unstable decision problems. What makes options rationally permissible relative to an unstable decision problem is the stable maximization of the least member of $\boldsymbol{U}$ that is stably maximized. But in the simplest unstable decision problems, V-maximization coincides with the maximization of the least member of $\boldsymbol{U}$ that is stably maximized. Thus, although UV-ism is mistaken metaethically, it very often delivers the right recommendations. The only unstable decision problems in which UV-ism delivers the wrong recommendations are unstable Newcomb problems, like *The Meta-Frustrater*.

Let's now consider *The Meta-Frustrater*. To make things simple, suppose that the agent is certain that the Meta-Frustrater's prediction was made instantaneously l units of time prior to the decision, and that the agent is certain that the minion, whichever one the agent is up against, made their prediction instantaneously j units of time prior to the decision, $j < l$. (Again, these assumptions merely serve to vivify the metaethical structure.[52]) Let each k^l specify the laws and the history of the world up to l units prior to the decision; let each k^j specify the laws and history up to j units prior to the decision; and let U^l and U^j be defined in terms of K^l and K^j, respectively. As we work our way through the members of $\boldsymbol{U}$, from least to greatest, we encounter two metaethical shifts.

If $U^i \prec U^j$, then, depending on the agent's credences, a_{RW} and/or a_{LW} maximize U^i, but no option stably maximizes U^i. Each k^i specifies which box contains \$100. As a result, for any k^i:

$V(a_{RW}k^i) = 5 + V(a_{LW}k^i)$;

$V(a_{RB}k^i) = 5 + V(a_{LB}k^i)$; and

$V(a_{RW}k^i) + V(a_{RB}k^i) = 110$.

[52]There is one added complication. As [redacted] pointed out to me, according to U-pluralism as formulated, it is essential that the Meta-Frustrater makes his prediction before the minions do. If the minions make their prediction first, then the options that stably maximize the least member of $\boldsymbol{U}$ that is stably maximized will be the left-handed options. I am not sure whether this prediction is wrong. (Flipping the temporal order makes my intuitions less clear.) But, when I am inclined to think that flipping the temporal order makes no normative difference, I am inclined, not to abandon U-pluralism, but to adopt an alternative conception of $\boldsymbol{K}$. See *e.g.* note 49.

This ensures that choosing a_{RW} and/or a_{RB} maximize U^i. But no option stably maximizes U^i because the agent regards pointing right-handedly to a box as strong evidence that the box is empty:

$$\textstyle\sum_{K^i} C(k^i|a_{RW})V(a_{RW}k^i) < \sum_{K^i} C(k^i|a_{RW})V(a_{RB}k^i), \text{ and}$$
$$\textstyle\sum_{K^i} C(k^i|a_{RB})V(a_{RB}k^i) < \sum_{K^i} C(k^i|a_{RB})V(a_{RW}k^i).$$

By contrast, if $U^j \preceq U^k$ and $U^k \prec U^l$, then the two right-handed options both stably maximize U^k. The k^k's do not specify which box contains \$100, but they do specify which minion the agent is up against. If k^k says that the agent is up against the 50% reliable minion, then:

$$V(a_{RW}k^k) = V(a_{RB}k^k) = (0.5)(105) + (0.5)(5) = 55, \text{ and}$$
$$V(a_{LW}k^k) = V(a_{LB}k^k) = (0.5)(100) + (0.5)(0) = 50.$$

If k^k says that the agent is up against the 90% reliable minion, then:

$$V(a_{RW}k^k) = V(a_{RB}k^k) = (0.1)(105) + (0.8)(5) = 15, \text{ and}$$
$$V(a_{LW}k^k) = V(a_{LB}k^k) = (0.1)(100) + (0.9)(0) = 10.$$

Hence, no matter how the agent distributes her credence over K^k, the two right-handed options maximize U^k.

The Newcomb-like phenomenon in *The Meta-Frustrater* is thus made apparent. In *Newcomb*, taking both boxes stably maximizes U, even though the agent regards taking both boxes as bad news, and this is because, no matter how the agent distributes her credence over K, taking both boxes maximizes U. In *The Meta-Frustrater*, for any U^k, $U^j \preceq U^k \prec U^l$, the two right-handed options stably maximize U^k, even though the agent regards the right-handed options as bad news, and this is because, no matter how the agent distributes her credence over K^k, the two right-handed options maximize U^k.

Now, if we *continue* working through the members of $\boldsymbol{U}$, from least to greatest, we will encounter another metaethical shift. If $U^l \prec U^m$, then the two left-handed options stably maximize U^m. This is because the k^m's specify neither which box contains \$100, nor which minion the agent is up against. Thus, as we know, the two left-handed options maximize V.

But the quantities stably maximized by the left-handed options are metaethically irrelevant. What makes options rationally permissible in *The Meta-Frustrater* is the stable maximization of U^j, the least member of $\boldsymbol{U}$ that is stably maximized. So the rationally permissible options are the right-handed options

Now, as I said, U-pluralism is a speculative hypothesis. It may prove false. But it has at least three things going for it. One: it coheres nicely with Expanded Rational Optimization. Two: it is, so far as I know, the only theory on offer that can handle both Newcomb problems and the full suite of unstable problems considered herein. And three: it is metaethically conservative. According to U-pluralism, expected value theory is nearly true! The stable maximization of U, i.e., expected value, is almost always what makes options rationally permissible. The other members of $\boldsymbol{U}$, and the additional complications that they bring in tow, are relevant only when we turn our attention to highly unusual cases.

8 Conclusion

An adequate consequentialist reduction of objective permission must involve both an identifying element and an explanatory element. For each decision problem d, we need to identify the quantity that is the objective-maker relative to d, and we need to explain why that quantity is the objective-maker relative to d. As it turns out, both elements are easy. Actual value is the universal objective-maker, and it is so because it is the best quantity to maximize.

An adequate consequentialist reduction of rational permission likewise must involve both an identifying element and an explanatory element. For each decision problem d, we need to identify the quantity that is the rational-maker relative to d, and we need to explain why that quantity is the rational-maker relative to d. But here, both elements are more difficult.

The identifying element is more difficult because there's not just one answer. Of course, many assume that there's just one answer. Many who work on rational choice are searching for the universal rational-maker: the quantity that stands to rational permission as actual value stands to objective permission. But, as I have argued, there is no such thing. Even if we restrict attention only to ideal agents, there is no universal rational-maker. Rational monism is false.

And that fact makes the explanatory element more difficult, too; for the usual ways of trying to explain why a quantity is a rational-maker presuppose and require that the quantity be a universal rational-maker. There is no received theory of occasional rational-making. There are received ways of trying to explain why a quantity is the universal rational-maker, but there are no received ways of trying to explain why a quantity is a rational-maker only relative to a particular decision problem.

The positive part of this essay began with me offering a theory of occasional rational-making. I suggested that what makes a quantity a rational-maker relative to decision problem d is being the best quantity to maximize, among the quantities that can guide an agent involved in d. Stated in this way, the proposal is skeletal. But I tried to put some meat on the bones by offering a partial account of how to score quantities and an account of what it is for a quantity to be d-guiding.

When the theory of occasional rational-making is fleshed out in the ways I prefer, it predicts that U is the rational-maker relative to all and only the stable decision problems. To my mind, this brings some needed clarity to the theory of rational choice for ideal agents; for it allows us to reconcile the pro-U intuitions in Newcomb problems with the anti-U intuitions in unstable problems.

But the real value of a theory of occasional rational-making lies, not in the theory of rational choice for ideal agents, but in the theory of rational choice for nonideal agents.

A monistic conception of rationality can lead one to think that ideal agents are the only agents that can be perfectly rational. For example, if you are convinced that perfect rationality requires that an agent always choose so as to maximize U, and you are convinced that it is psychologically impossible for humans to always choose so as to maximize U, then you will be convinced that perfect rationality is not humanly attainable.

But a theory of occasional rational-making leads naturally to rational pluralism, and a pluralistic conception of rationality suggests a very different picture, on which perfect rationality is always attainable. On a given occasion, a nonideal agent might be incapable of being guided by U, the best (continuous) supervenient quantity. In this way, the nonideal agent proves nonideal, for we may suppose that an ideal agent facing the same decision would be capable of being guided by U. The nonideal agent perhaps has some reason to regret being incapable of being guided by U, in the same way that all of us always have some reason to regret being incapable of being guided by actual value. Being capable of being guided by better quantities is an achievement. But the agent, no matter how nonideal, is capable of being guided by the best quantity that the agent is capable of being guided by. And, on the sort of pluralistic conception of rationality that I have been defending, that's all that perfect rationality requires. Perfect rationality is not a matter of maximizing some special quantity, the universal rational-maker. It's a matter of doing the best you can.

The ultimate hope would be a unified theory of rational choice that applies equally to all agents. Schematically, we have a rough sense of how it would go. Whereas it takes four parameters to represent an ideal agent facing a decision—C, u, A, and K—it takes many more parameters to represent an agent, of any level of idealization, facing a decision. Let's suppose that it takes n parameters. A *generalized decision problem* then will be an ordered n-tuple, $d^+ = \langle C, u, \ldots A, K, \ldots \rangle$.[53] A *generalized quantity* will be any function

[53] The assumption that this n-tuple has a credence function and a utility function can be relaxed.

that maps each $\langle w, d^+ \rangle$ to some subset of the options in d^+. We will need some way of scoring these generalized quantities, and a natural proposal is to take the score of a generalized quantity Q^+ to be some average of its d^+-scores, and take the d^+-score of Q^+ to be the actual value that an agent involved in d^+ expects to realize by choosing a Q^+-maximizing option.[54] We also will need some operationalized conception of d^+-guidance, which determines, for every generalized decision problem d^+, exactly which generalized quantities an agent involved in d^+ can be guided by. With all of this in place, the underlying metaethics kicks into gear. We optimize for score, subject to the guidance constraint. We take the *generalized rule for reducing rational permission* to map each d^+ to the highest-scoring d^+-guiding quantity, and we claim that what makes options rationally permissible relative to d^+ is the (stable) maximization of the highest-scoring d^+-guiding quantity.

Of course, at present, this sort of unified theory of rational choice is a pipe dream. Even the first step lies far beyond our ability. We have no idea how to represent a highly nonidealized agent facing a decision. But we can work toward this sort of unified theory bit by bit, progressively considering ever less idealized agents. In fact, much of the work on "bounded" rationality can be seen as carrying out the first steps of this project.[55] When the nonideal agents are sufficiently idealized and the sort of decisions they face are sufficiently circumscribed, the relevant constrained optimization problems are tractable. And there is reason to hope that the constrained optimization problems will continue to be tractable as we consider ever less idealized agents and ever less circumscribed decisions.

[54] Of course, we'll need to specify what the relevant notion of expectation is, since nonideal agents may not have the sorts of doxastic state needed to form expectations in the mathematical sense.

[55] For some relevant work on bounded rationality and decision-making, see *e.g.* Bossaerts and Murawski (2017), Gigerenzer (2008), Gigerenzer and Selten (2001), Griffiths *et al.* (2015), Griffiths and Tenenbaum (2006), Halpern *et al.* (2014), Icard (2018), Lorkowski and Kreinovich (2018), Paul and Quiggin (2018), Russell and Subramanian (1995), Simon (1956; 1957; 1983), Vul *et al.* (2014), and Weirich (1988; 2004).

Work on bounded rationality often proceeds on the assumption that rational monism holds true of ideal agents. Rational pluralism is thought to be true of bounded, nonideal agents, but it is typically assumed that some form of rational monism holds true of unbounded agents. But that assumption is mistaken. We should be thoroughgoing rational pluralists. We should think that what makes options rationally permissible is the (stable) maximization of the best quantity that can guide the given agent on the given occasion, and we should think that, even restricting attention to ideal agents, there is no such thing as the universal rational-maker.[56]

[56] Thanks to [redacted].

A Proof of Supervenient Optimality

The proof of **Supervenient Optimality** has two parts. First, we show that U weakly D-dominates any supervenient quantity that diverges from U. Then we show that any quantity that is distinct from U, but does not diverge from U, violates a plausible continuity constraint.

If $Max(Q, w, d) \not\subset Max(U, w, d)$ for any point $\langle w, d \rangle$, I will say that there is a *point of divergence* between Q and U. If Q is supervenient and there is a point of divergence between Q and U, then U weakly D-dominates Q. After all, suppose that $\langle w, d \rangle$ is a point of divergence between Q and U. Since Q and U are both supervenient, the d-score of Q is the average of the U-values of the options in $Max(Q, w, d)$, and the d-score of U is the average of the U-values of the options in $Max(U, w, d)$. Hence, since at least one member of $Max(Q, w, d)$ fails to maximize U relative to d, the average of the U-values of the options in $Max(Q, w, d)$ is strictly less than the average of the U-values of the options in $Max(U, w, d)$. Hence, $S(Q, d) < S(U, d)$. Moreover, if Q is supervenient, then, for any d, $S(Q, d) \leq S(U, d)$. So it follows that U weakly D-dominates Q. And given my assumption that the ordinal rankings of quantities respect relations of weak D-domination, it follows that U scores higher than does Q.

The supervenient quantities that are distinct from U, but score as highly as U, are *subset quantities*: quantities that are always maximized by U-maximizing options, but not always maximized by every U-maximizing option. (Think, for example, about the quantity that corresponds to being the leftmost U-maximizing option.) But subset quantities violate an intuitively plausible continuity constraint. If u is a utility function, and $u(w) = x$, then let $u^{w,\epsilon}$ and $u^{w,-\epsilon}$ be utility functions that are exactly like u, except that $u^{w,\epsilon}(w) = x + \epsilon$ and $u^{w,-\epsilon}(w) = x - \epsilon$. If $d = \langle C, u, A, K \rangle$, then let $d^{w,\epsilon} = \langle C, u^{w,\epsilon}, A, K \rangle$ and let $d^{w,-\epsilon} = \langle C, u^{w,-\epsilon}, A, K \rangle$. The relevant continuity constraint then can be stated as follows:

Utility Continuity. If $a \notin Max(Q, w, d)$, then, for any world

w_i there is some ϵ such that $a \notin Max(Q, w, d^{w_i, \epsilon})$ and $a \notin Max(Q, w, d^{w_i, -\epsilon})$.

In effect, Utility Continuity says that small changes to utilities assigned to any particular world should precipitate only small changes in the values that a quantity assigns to options.

To see that every subset quantity violates Utility Continuity, suppose that Q is a subset quantity, and suppose that a is among the options that maximize U at $\langle w, d\rangle$, but not among the options that maximize Q at $\langle w, d\rangle$. There will then be some a-world, w_i, to which the credence function in d assigns nonzero probability, which is such that, increasing its utility, while keeping the utility of every other world the same, increases the U-value of a, but does not increase the U-value of any other option in A. So, for any ϵ, a uniquely maximizes U at $\langle w, d^{w_i, \epsilon}\rangle$. Since Q is a subset quantity, a also uniquely maximizes Q at $\langle w, d^{w_i, \epsilon}\rangle$. But that shows that Q violates Utility Continuity.

Thus, Supervenient Optimality holds: U is the highest-scoring supervenient quantity that satisfies Utility Continuity.

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