

HEURISTICS AS A NORMATIVE DECISION THEORY

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Aaron Bramson

Abstract: In order to better understand whether heuristics can comprise a normative decision theory I first explore some common support for heuristics and comment against their importance for the normative questions. Then I examine the role that any normative theory must fill and how we can evaluate and compare them. I conclude (tentatively) that normativity rests on the actions rather than the technique and hence we need some higher-level theory to tell us which sets of actions have greater normative force. Nevertheless there are some identifiable benefits of a heuristic normative theory that lend strong credibility to its superiority as a general decision mechanism and more usefully employed for normative tasks. I finish up by addressing points that are off the main normativity questions but nonetheless often addressed in relation to this topic. Though this paper falls far short of establishing the superiority (or inferiority) of heuristics as a normative decision theory, it does touch upon those factors that must be included in an analysis sufficient to demonstrate superiority (or inferiority) and could serve as a springboard for that later analysis.

INTRODUCTION

Recent activity in psychology, economics, and their various points of intersection has demonstrated myriad failures of rational choice theory as an accurate descriptive theory for human decision making in general contexts. Attempts to mend the problems by, for example,

including visceral factors as elements in agents' utility functions (Loewenstein 1996, 2000) or alter utilities according to empirically revealed biases (e.g. Kahneman and Tversky's *Prospect Theory* (Kahneman 1979)) seem clumsy, add hoc, hard to justify, and generally unsatisfying. Those approaches no doubt have benefits in specific contexts, but they fail to provide an intuitively (or even convincingly realistic) human-like decision mechanism. The heuristic approach to human (and animal) psychology seems to be a more promising avenue of inquiry for describing and predicting behavior, and research in this area has been growing rapidly over the past decade. But success as a description of the mechanism of decisions does not ensure or even lend (much) support for a heuristic formulation of determining what decisions we ought to make generally and/or in specific contexts. Here I will explore several aspects of the proposal that heuristics may comprise useful and insightful normative decision models.

RELEVANCE OF EMPIRICAL EVIDENCE

One strategy for defending heuristics' use as a normative decision theory is to identify several simple and useful predictive tools and then demonstrate, through empirical testing, that they are in fact at least as accurate as alternative (statistical and rational choice) techniques. The decision rule research of Gerd Gigerenzer, Peter Todd, and the ABC Research Group (Gigerenzer 1999) could partly fill this role. The work of Tversky and Kahneman (Tversky 1974) and of Herbert Simon (Simon 1955) is also relevant to this project, but this is not the project being attempted here. Nevertheless some time will be spent here to briefly explain what support this evidence could provide for a philosophical defense of a heuristic decision theory.

IS THE COMPUTATIONAL BENEFIT REAL?

“It is likely that there is more skewness than equality in the world, so that betting on skewness may turn out to be a better strategy (Gigerenzer 1999, p. 124).” This is a succinct expression of one sort of consideration that differentiates ecological rationality from parameter fitting models (such as regressive techniques). It essentially exploits common regularities in data sets to save computational effort in specific analyses. One can see how using simple rules to classify environments by their type, and then using a simple heuristic for prediction within each type, could produce extremely accurate expectations over a wide range of environments.

The “fast and frugal heuristics” that Gigerenzer et al focus on in *Simple Heuristics that Make Us Smarter* are for predictive inference; they are replacements for such unboundedly rational techniques as multiple linear regression, Bayesian reasoning, etc. They provide several example problem environments and compare, in ghastly detail, the quality of results of several methods. Their champion rule is *take the best*¹ because it uses the least information and performs well across many tests (in appropriately noncompensatory environments), but as the problems become more complicated and less keyed to specific environments the benefits in computation become questionable. For simple one-dimensional problem spaces, binary cues, and small data sets it is not hard to believe that some technique could outperform linear regression; we don't need to employ heuristics to beat linear regression in these scenarios. Once we leave these comfortable restrictions, however, the computation needed to figure out whether, when and how to apply a heuristic may dominate the savings of the heuristic itself.

SOME BAD ARGUMENTS

Below are two arguments that sound plausible as springboards towards a heuristic-based normative decision theory, but are actually false starts. Both of them come up, or are likely to come up, when one focuses too much on the (strong) empirical evidence for heuristics. I have included them in order to cut off these avenues of inquiry and to support my claim that an in-depth review and analysis of the empirical material is irrelevant to the normative question.

‘DO’ IMPLIES ‘OUGHT’

In moral philosophy the maxim of ‘*ought*’ implies ‘*can*’ carries strong intuitive support. Though not without its detractors², the idea that one cannot be morally obligated to do something that is

¹ The heuristic they call *take the best* uses ranked cues over data to make predictions on a lexicographic basis from cue quality. For example, if we are making predictions about the population sizes of German cities then relevant cues might be whether we've heard of it, whether it has a soccer team, whether it has a subway/light rail systems, etc. One uses a learning subset of the cities to learn which cues track the actual sizes best, second best, etc. Then the best cue is used to predict the larger city in pairwise competitions; if the first fails to distinguish the two cities then the second cue is used and so forth through the cues. Ties for all cues are broken randomly.

² I recently met a legal theorist and professor of law who denies the ‘*ought*’ implies ‘*can*’ idea. After a long discussion I came to the conclusion that the difference was actually merely semantic; we didn't disagree about

not physically possible enjoys wide support. Let's assume that it turns out that human decision makers really do use heuristics (possibly even neurally hardwired ones) to process input into behavior. That is, let us assume that some kind of heuristic descriptive decision theory is correct. Then, the only actions that we **can** do are the ones for which we have rules to produce. So if any normative decision theory recommends an action given a certain decision problem then that action must also be an output for a cognitive rule given that same decision problem. If the normative output does not match the appropriate cognitive rule output then we could not do what the normative rule recommends. Thus by *modus tollens* it can't be the case that we ought to do what the normative theory recommends. This contradicts the normative theory's claims of normativity and so we discard the theory. Only a normative theory that recommends exactly what one could/would actually do may be valid.

It turns out that this argument will not support using heuristics for a normative theory -- any theory that can match the outputs of actual behavior could work. We could have a rational choice formalization with enough epicycles in it to produce only behavior that is psychologically plausible for humans. Some people already do that kind of work. Using heuristics to model heuristics is only especially appropriate if we think we could get a perfect match, otherwise a case would have to be made that such a normative project should use a heuristic approach. Regardless of that question, though, we can object to this line of thinking for separate and stronger reasons.

As will be discussed in more detail later (see "Role of Normative Decision Theories" below), this line of reasoning confuses two ideas regarding the scope of the normativity in a normative decision theory. The '*do*' implies '*ought*' thinking above looks to select the action we ought to do from the ones we actually can do. For any given problem our heuristic cognitive structure might produce one or multiple actions: if one is selected then that is the one we ought to do, and if multiple actions are selected then we ought to do all of them. If we cannot do all of them then it seems that the normative theory can at most work as the heuristic version of a tie-breaker. But this misses the larger point of a normative theory. People are often bad decision makers. We have evidence (in the form of negative feedback from our actions) that the cognitive machinery we have (whether heuristic or not) produces actions that we wish it didn't.

what was appropriate to do, feel, or think in any scenario, we only disagreed about the scope of 'ought'. But he casually cited others who hold an even more radical position.

So in the larger, more useful, sense of ‘normative’ we expect our normative models to recommend actions that we don’t already have cognitive mechanisms to produce.

NORMATIVE BECAUSE BETTER

A surface level description of a normative decision theory’s output is “what we (prudentially) ought to do”. If we are evaluating and comparing normative theories, what criterion can we use? In comparing the descriptive decision theories we can avail ourselves of many of the standard empirical theory desiderata: accuracy, simplicity, robustness, etc. Naturally the proponents of heuristic decision theory claim these properties for their technique, and under numerous conditions a heuristic theory’s output is expected to more closely match actual behavior with a smaller mechanism than rational choice theory. Clearly in such environments we ought to use a heuristic decision theory to predict behavior, but that doesn’t imply that we ought to use a heuristic theory to generate behavior.

There are two different contexts in which we may find ourselves comparing normative theories: when two different theories prescribe the same action for a problem and when they prescribe different actions. The two contexts require different criteria. Is an economy of formulism a reason in favor of one normative theory over another? How about the hypothesized parallel with actual human behavior generation? Perhaps it is our long-term satisfaction with actions generated via different normative theories, or simulated results, or intuitive reflection, or ... The next section addresses these questions indirectly by exploring what it is that we build normative theories to do and hence what may count as doing that better.

ROLE OF NORMATIVE DECISION THEORIES

Normative decision theory, as the name entails, concerns some degree of ‘ought’ with respect to one’s decisions, but it is usually ignored whether the ought applies to the path or to the end. We need to separate 1) a theory that outputs what one ought to **do** in a problem given one’s goals and the epistemic environment and 2) a theory that outputs what **decision mechanism** you ought to have in order to consistently make the best decisions. I take it that the second is the

job of a normative decision theory and the first is what we may call meta-decision theory.³ This meta-decision theory could be just the thing we need to provide criteria for comparing normative theories. But before going into any detail about what a meta-theory might look like we need to be clear about what role a normative theory fulfills.

NORMATIVE THEORIES PRESCRIBE ACTIONS

It is naive to put forward strong claims in these uncharted waters, but for the sake of progress I'll wager on the thought that the role of normative decision theories is just to prescribe actions. Such a role has two immediate corollaries of note: a) normative theories must be evaluated by their output – the actions they recommend – rather than their mechanism, and b) we need to have a separate theory available to determine what concept possesses decision value and a method to determine which decision has the most. The claim (a) means that the output of normative theories is expected to approach, as best as possible, the actions identified by the meta-theory and the better normative theory is the one that most consistently (across broad classes of problems) recommends actions agreeing with the meta theory.⁴ I have few ideas about what could fill the role of (b): intuition seems to be the going option, though our intuition regarding the quality of decisions, even after substantial time and reflection, are known to be poor, biased, inconsistent, and faulty in other ways. But something similar can be said for moral meta-theory and the lack of fully agreed-upon measures of moral value has not posed a barrier to the discussion and proliferation of normative moral theories.

³ Note that this nomenclature forms an analogue with ethical theory. The decision theories that recommend actions in particular problem constructions are parallel to applied ethics and clearly applied ethics is normative in the same way that decision support results are. Normative ethics deals with (among other things) comparing different mechanisms for determining what we are morally obligated, permitted, and disallowed to do in general. This is parallel to evaluating the systemic effects of different updating techniques, discounting methods, utility calculations, preference structures, etc.; and it is the level where we would compare the difference in recommendations between heuristic and calculation-based methods. Meta-ethics is the study of what 'good', 'ought', and related terms actually mean, what carries the moral value, delineates the domain of morality, and provides a basis upon which to compare and determine which does the best job of identifying moral acts. Meta and normative ethical theories can differ in character with, for example, a utilitarian theory defining the good and a virtue theory recommended for achieving it. This is parallel to the idea that rational choice theory might stand as a decision ideal with heuristics being actually better at making good choices in realistic environments (see *Notion that Rational Choice is an Unmet Ideal* below).

⁴ For each meta-theory we can expect different normative theories to perform differently and hence there is a great deal of feedback between the correctness of the meta-theory and the appropriateness of the normative theory. For decision theory we currently have zero formal meta-theories (and intuition is our only, yet unreliable, guide); I will anyway consistently refer to some hypothetical set of meta-theoretically correct outcomes.

Here's one version of normative theory-building and refinement. Given some set of problems and their meta-theoretically determined best outcomes the normative decision theorist's job is to apply the construction technique to the problems implied by the theory being used and derive the normative theory's recommended actions. To (intra-theoretically) compare two techniques one need only consider the two sets of recommended actions to the meta-theoretically determined best ones. The closer one wins. This comparison operation assumes that the distance in outcomes is an unambiguously measurable quantity, which is a bad (in fact, stupid) assumption. Anyway, through several iterations of alteration and performance comparison we would expect to eventually arrive at the best normative theory. Things are never this easy.

We already know that the nature of the problem greatly affects what normative theory will "get it right". For FCC bandwidth auctions we are best-suited using rational choice and for naming our children we are better-off with heuristics. We are not actually interested in which decision theory is the best single way to make decisions. We are perfectly happy to mix and match where appropriate. How do we bin the domains to best modularize our decision apparatus? That is outside the scope of this paper. Once our decision theory is properly modularized so that for any given problem domain we know which decision technique will best perform in getting people to do the right thing, we might go another step. To unify the possibly hodgepodge collection of domain-specific decision mechanisms into a general purpose decision technique we would need a decision mechanism for making decisions about domain-specific techniques. This is required for any inter-domain decision problem, not just for whole-universe decision theory creation, but it also seems ripe for the insertion of ever-more-complicated epicycles of decision apparatus to fine tune our normative theories. Smoothing this out and providing theory-creation guidance is the role of various extra-theoretic guidelines and concerns. All this is revisited when I describe the benefits of heuristics as a normative decision theory below.

MORE THOUGHTS ON META-DECISION THEORY

The links between (1) and (2) above are tenuous, at best. The idea that there is a difference between a theory that reports the right output and a theory about how to get that right output has some immediate problematic issues. What I call the meta-theory has a strange non-

consequentialist ring to it; as if it matters not just what the outcome (the decision) is but what process got one there. But this is not the intended content. I am inclined to assert that if two normative theories always generated identical prescribed actions in identical scenarios then there are no intra-theoretic reasons for preferring one over another.⁵ But realizing that different normative theories will produce different recommendations in some (perhaps most) problems we need more than just a set of collections of <problem → recommendation> maps; we need a way to determine which collection of <problem → recommendation> maps is the best for the current environment.

One meta-theoretic decision consideration could be “if the decision environment has perfect information and the decision is non-moral and doesn’t rightly involve emotional factors then use rational choice theory to determine what one ought to do.” Another might be “if you have to make a quick action based on limited information, then use a fast and frugal heuristics approach.” Certainly this requires another level of decision theory (hence my decision to call it ‘meta-decision theory’). One would have to know which normative decision theory is most appropriate for which types of problems and/or have a calculus that can determine this from problem features. If you didn’t know certain things about the problem space then you’d have to have a way to deal with risk and uncertainty about the problem itself (in contrast to risk and uncertainty within the problem’s specification). I don’t plan to develop a meta-theory here, but in the next section I will outline some reasons and problem areas that favor a heuristic decision-theoretic approach.

BENEFITS OF HEURISTIC DECISION THEORY

In light of the above claim that the normative theories must be evaluated by their recommended actions rather than their mechanisms *and* the known result that any action is compatible with a Bayesian approach with some set of priors and some utility function it might seem impossible to delineate benefits of a normative heuristic system. Not so. There are many facets on which to compare different normative approaches, though many of these are outside of decision theory

⁵ There may very well be extra-theoretic reasons for preferring one over another; e.g. pragmatic reasons, computational reasons, information theoretic reasons, etc. Some of this is addressed in the section below about benefits of the heuristic approach.

per se. Additionally, we may gain some useful insight by realizing that there is currently only one class of alternative models, the rational choice ones, and they fail or reek with implausibility in many situations.⁶

STANDARD DECISION THEORY IS ALREADY HEURISTIC-LADEN

Rational choice theory is purported to be contradistinguished from heuristics. Yet modeling a decision problem via that methodology requires utilizing rules of thumb in setting up the preference relations, the degrees of belief, the update rules, etc. Using heuristics to set up a problem is not the same as using them to solve a problem. At a high level of abstraction mathematical axioms, rules of arithmetic, and accepted theorems (such as Bayes rule) are forms of heuristics. Resting on *that sort of rule*, however, would not make standard decision theory heuristic-laden in any way than lends support for a more general use of heuristics; decision heuristics are supposed to be of a very different flavor.

One (I think) clear example of a decision heuristic being used in standard decision theory is the operation to maximize, satisfice, maximin, etc. the utility function once found. While each of these operations is mathematically defined and executed, the choice of which technique to use is heuristic. Perhaps that's a set up consideration. But if that is a setup consideration then my claim is trivially false because once all *these* sorts of things are done, which is the last thing in the process, the result is achieved (or unachievable). So what I really am claiming is that the operation from receiving a problem (e.g. the information sets (probabilities over states and player types) and agent preferences over outcomes) the decisions of what to do next are heuristic.

BETTER FOR DECISION ABOUT DECISIONS

Let's pause to appreciate some words of wisdom from the Maestro: "Savage (1954 p. 83) reminds us that in actuality we have but one decision to make: how we shall live our lives. In other words, we must choose a policy for drawing inferences and making decision. All other

⁶ This section provides arguments that a heuristic normative theory is better than a rational choice one. That is not the same thing as being a good normative decision theory, but since there are established metrics of normative quality this is the only analysis I could imagine performing. Along the way various desiderata are identified and it is demonstrated how well heuristics fulfill them (and how poorly rational choice theory does).

decisions follow from that (Gigerenzer 1999 p.186).⁷ That insight is altogether remarkable. For decision theory to be complete it cannot be a piecemeal combination of domain-specific criterion and techniques. Insofar as different techniques will be appropriate under different circumstances we will need a meta-decision theory of a different sort than I describe above; simply a decision apparatus for deciding what decision apparatus to use given information about the environment, players, etc.⁸

I've already hinted at my position regarding which sort of decision theory is most useful for domain-specific apparatus selection. I again quote researchers of Gigerenzer's ABC Research Group, "One could even argue for the application of the Bayesian ideal of rationality at the meta level, at the level of selecting policies for which approach to use on given classes of problems. Therefore, a decision-theoretic argument can be developed for the use of fast and frugal heuristics in place of the optimizing strategies in situations in which computation time and cost are important considerations (Gigerenzer 1999 p.187)." But what sorts of considerations separate domains appropriate for Bayesian analysis and domains appropriate for heuristics? They often take the form of the simple yes/no cues that heuristics specialize in (Complete information? Finite payoffs? Any Deep Uncertainty? Etc.). We can be assured that the Bayesian approach is the best approach in certain domains, but the domain of deciding which approach to use is not one of them, for if there is deep uncertainty regarding any feature of the problem space then we would be doomed before we even got started. As has already been stated in the previous section, the Bayesian approach already uses heuristics to establish its appropriateness before being used on a problem. Since the rational choice approach has the most restricted domain it makes sense to apply it only after all its needs are known to be satisfied.

AVOIDS DECISION PROBLEMS AND PARADOXES

Recalling that the role of normative decision theories is to produce prescribed actions we can see that a failure to produce an action is a devastating problem to any decision theory claiming

⁷ Note that this chapter of Gigerenzer's book was authored by two associates at the ABC Research Group: Laura Martignon and Kathryn Blackmond Laskey. There two are responsible for the quoted paraphrasing.

⁸ This sort of theory is *meta* in the sense that it's a decision about the decision process itself rather than a decision for an action in the decision problem. But it isn't *meta* in the sense of applied → normative → meta that is used elsewhere in the paper. This step is just the first step in a grand, all-encompassing general decision theory. That is to say, if each person has one sequence of rules, equations, or whatever that transforms perceptions from the environment into behavior then these decision-domain decisions are part of that theory rather than meta to it.

normative status. The many known (infamous) decision paradoxes (e.g. Death in Damascus, Newcomb's paradox, Mule between Identical Bales of Hay) reveal situations in which rational decision theory cannot prescribe a singular action. There is no way within the theory to reconcile these problems; proponents often agree that it is not the role of decision theory to do so. But while we may agree that rational choice theory ought not have any specific recommendation in those problem environments, decision theory should. That is to say, the theory with the role of informing people "how we shall live our lives (Savage 1954)" should tell us how to deal with these situations, even if rational choice theory doesn't. Taken together I conclude that rational choice theory *cannot* comprise the whole of our general decision theory.

The above considerations were intra-theoretic reasons to prefer (or at least consider admissible) a heuristic-based approach to normative decision theory. We now look to some extra-theoretic reasons (e.g pragmatic reasons) for thinking rules constitute a more appropriate normative decision system.

MORE EASILY INCULCATABLE

If people do, in fact, use heuristics to generate behaviors then it may very well be the case that having our normative theory formulized as similarly structured heuristics has benefits for our ability to motivate people to act in accordance with them. The ability to produce simple, memorizable rules of thumb should aid the inculcation of normatively more valuable maxims of decision making. Rational choice theory can recommend an action, but does not include mechanisms to provide motivation for that action; moving from actual behavior to recommended behavior is left outside the theory. Applying some to-be-developed metatheory to different systems of heuristics across multiple environments could produce a decision support mechanism in which each step is readily understood and usable by ordinary humans. One extra-theoretic desiderata of a normative decision theory is that having it should result in people's making better decisions; a heuristic-based decision theory clearly has benefits on this account.

BECAUSE WE ACTUALLY CAN

As the environments in which we wish to provide decision guidance become fuller and more realistic, the computational power requirements to produce and churn through a rational choice

analysis becomes impossible to accommodate. The need to generalize and simplify quickly overwhelms the accuracy and usefulness of the rational choice technique. Techniques to losslessly compress aspects of the environment may facilitate analysis, but these compression techniques are outside the actual rational choice framework.⁹ Normative rules may be useful and necessary for some of the same reasons that human cognition seems to utilize fast and frugal heuristics: the domain of features *necessary to consider* in order to produce decisions appropriate for general purpose decision making is too vast **not** to use a heuristic approach.

There is another side of the “because we can” realization. Rational choice theory’s necessary components (utility theory, estimation theory, probability theory, etc.) are not already equipped with methods to seek new information, break ties, cope with uncertainty, and many other things that inevitably occur in ordinary problem solving and decision making. Thus, confronted with a decision problem, we are much more likely to come to some or other conclusion (rather than none all) using a non-rational approach such as a system of heuristics. And furthermore the heuristic approach is much more likely (although not necessarily) to involve perceptions, checks, manipulations, actions, and reactions that are actually available to human decision makers. So in a viable heuristic normative theory we are assured to find a decision recommendation and one for which the means to accomplish it are within our reach.

FINAL THOUGHTS AND CONCLUSIONS

The definitions used above eschew an attempt to delineate *rational behavior*. So it is compatible with what is presented here to let the rational choice theorists maintain their version of rationality and to also conclude that *one ought to be rational in only very limited domains*. In general, one’s decision apparatus ought to align with a highly robust system of behavior rules that have demonstrably optimal outcomes over an extremely wide application.

NOTION THAT RATIONAL CHOICE IS AN UNMET IDEAL

Many of the comments above focus on the use of normative guidance for general purpose decision making and implicate Bayesian/rational choice methodology for requiring more than is available. My claim is that the normativity lies with the actions, rather than the mechanism.

⁹ The information sets, player types are given in the problem formulation. These are required inputs for rational choice and so a substantial portion of the problem’s decisions have already been made before the Bayesian begins work on it.

Even when perfect information is available to a perfect agent, the computational burden of rational choice may not provide any benefit. “If cue weights are noncompensatory, then linearly combining cues [a rational choice approach] gives the same performance as processing cues in lexicographic fashion, one cue at a time (Gigerenzer 1999, p. 122).” And Gigerenzer’s group has many more examples of when heuristics do at least as well as any more-informed technique with less computational effort. To be sure, these are stylized environments as much as the rational choice theorists’ favorite examples of successes, but the point is that there are reasonable problem environments in which rational choice techniques fare worse than other techniques. Anybody familiar with Jorge Borges stories¹⁰ will immediately recognize that perfect knowledge and fully formed and informed preferences are not ideals for mortal men. It is not a case of compromise that we fail to be rational, it is a matter of being adapted to environments where rationality fails to achieve our goals and the dictates of normativity.

DECISIONS ARE IRRELEVANT ANYWAY

There is an increasingly strong body of evidence that the psychological process of making a decision is a post-hoc and causally irrelevant epiphenomenon. A vast majority of our behavior is generated by the lower brain, through the spinal cord and motor neurons, and regulated by hormones and stimulus/response reactions – completely isolated from the lofty functions of our prefrontal cortex. The brain’s operation is neither rule-based nor formulaic; these categories do not apply to electro-chemical and physical processes. For descriptive decision theory one might argue that processes verisimilitude is a benefit (I would). But for normative decision theory it is irrelevant. Remember, the normativity is in the actions, not the process, so even if decisions are irrelevant to action normative decision theory is still valuable in the sense that it tells us *what* to do, not how to figure out what to do. It *is* how to find out what to do, but its output is simply the recommended action.

How does the irrelevance of decisions for actions mesh with the proposed benefits of a heuristic normative theory? For example, why would rules be more effective guiders of action than equations if there is such a disconnect between conscious thought and action? I have no

¹⁰ I am thinking specifically of two stories, *Funes the Memorious* and *The Library of Babel*, although I suspect that there are several other relevant works by Borges and other authors (fiction and nonfiction) espousing the benefits of limited memory, uncertainty, incommensurability, and various other violations of rational choice environments.

idea. These are not philosophical questions and though I could spend time being an armchair neuro-psychologist I am not going to do so here. Some mending must be done to reconcile these disciplines' findings, but here I am not interested in making decisions admissible to neurology or making epiphenomenalism unproblematic for psychology. Empirical evidence exists for both that 1) people respond better to rules than to numbers and 2) behavior is generated in the lower brain; how they coexplain is a different paper.

EGRESS

This paper demonstrates several strong extra-theoretical reasons for the superiority of a heuristic normative decision theory. The intra-theoretical consideration that heuristics are likely to be the necessary mechanism for identifying problem domains and choosing the appropriate domain-specific decision technique indicates that heuristics are an essential part of decision making. I consider the parallels between moral theory and decision theory (especially the need for advancement in meta-decision theory) to be the most valuable insight gained from this exercise. Contemplating the wielder of decision-theoretic value might have deeper parallels to the ethical questions and thinking here may help inform both fields. The question of whether the action recommended by one approach to a problem or another ought to be performed is, unfortunately, further from being answered. Until we can fill in this meta-theory we may not have any principled reason to consider one set of outputs better than another; but as long as rational choice and heuristic approaches both produce intuitively plausible recommendations this paper identifies some good reasons to prefer heuristic-based decision theory.

BIBLIOGRAPHY

Gigerenzer, Gerd, Todd, P. M. & the ABC Research Group (1999). *Simple Heuristics That Make Us Smart*. New York: Oxford University Press.

Gigerenzer, Gerd (2000). *Adaptive thinking: Rationality in the real world*. New York: Oxford University Press.

Kahneman, Daniel, and Amos Tversky (1979) "Prospect Theory: An Analysis of Decision under Risk" *Econometrica*, XLVII, 1979, pp. 263-291.

Loewenstein, George (1996) "Out of Control: Visceral Influences on Behavior" *Organizational Behavior and Human Decision Processes* Volume 65, Issue 3, March 1996, pp. 272-292.

Loewenstein, George (2000) "Emotions in Economic Theory and Economic Behavior" *The American Economic Review*, Vol. 90, No. 2, Papers and Proceedings of the One Hundred Twelfth Annual Meeting of the American Economic Association, May 2000, pp. 426-432.

Savage, L.J. (1954) *The Foundations of Statistics*. New York: Dover.

Simon, Herbert A. (1955) "A Behavioral Model of Rational Choice" *The Quarterly Journal of Economics*, Vol. 69, No. 1, Feb. 1955, pp. 99-118.

Smith, Edward, Christopher Langston and Richard Nisbett (1992) "The Case for Rules in Reasoning" *Cognitive Science* 16, pp. 1-40.

Weirich, Paul, (1946) *Realistic decision theory :rules for nonideal agents in nonideal circumstances*. New York : Oxford University Press.