Simplicity in Institutional Design

Nathan Berg

Max Planck Institute for Human Development-Berlin

and

University of Texas-Dallas

prof.berg@gmail.com

Berg Bio

Nathan Berg is Associate Professor of economics in the School of Economic, Political, and Policy Sciences (EPPS) at University of Texas-Dallas. He has published more than 25 articles and chapters in behavioral economics since 2001 in journals such as *Journal of Economic Behavior and Organization*, *Social Choice and Welfare* and *Contemporary Economic Policy*. Berg was a Fulbright Scholar in 2003 and his research has been cited in *Business Week*, Canada's *National Post*, *The Village Voice*, *The Advocate* and *Atlantic Monthly.* Berg spent 2005 at the Max Planck Institute-Berlin, Center for Adaptive Behavior and Cognition. In 2006, Berg was appointed to the editorial board of *Journal of Socio-Economics* and elected to the Board of the Society for the Advancement of Behavioral Economics. He sings and writes for the acoustic rock band, Halliburton(s), www.halliburtons.com.

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Introduction

Economists often cite simplicity as a leading criterion for evaluating economic models. Friedman (1953:14), for example, praises models that "`explain' much by little" in the way of context-specific detail or adjustable parameters, an idea canonized in economic methodology by frequent discussion of economic models' so-called parsimony.[1] Strangely, though, few economic models include simplicity among the inputs in any agent's objective function, or provide clear motivation for simplicity as a normative criterion in evaluating the effect of policies on individual and aggregate behavior.

Attempts to motivate simple behavior within the standard constrained optimization framework--by adding costs of complexity, energy expenditures for cognition, or time budgets to the constraint set--lead to an apparent paradox. The resulting optimization problems are even more complex than the benchmark models they were meant to improve upon in terms of realistically describing behavior. For example, Sargent's (1993) models of bounded rationality in which agents optimize subject to cognitive constraints, or the deliberation cost literature reviewed in Conlisk (1996), and even Khaneman and Tversky's prospect theory (1982), draw motivation from the observation that the standard model of unboundedly rational optimization is unrealistically demanding in terms of cognitive complexity. Paradoxically, however, the resulting attempts to construct models based on more realistic assumptions are significantly more complex and consequently less believable as descriptions of the actual decision processes underlying economic decision making. Although improved empirical realism is the primary aim of such attempts, the resulting action rules are, in essence, solutions to even more elaborate constrained optimization problems, with correspondingly implausible levels of complexity for achieving psychological realism. Such models contain additional parameters, which allow for improved fit in particular samples (essentially raising R^2 by adding more parameters), but without improving out-of-sample prediction (Brandstaetter, Gigerenzer and Hertwig, 2006) as is needed in applied work on institutional design.

The inclusion of simplicity among economic modelers' most widely held professional objectives, and simultaneous exclusion of simplicity from modelers' assumptions about the concerns of consumers, firms and policy makers, is puzzling. Why is simplicity important for deciding whether an economic model is interesting, but not for deciding what to buy, whom to hire, or how laws should be written?

Two modeling strategies

This chapter argues that simplicity deserves explicit inclusion in descriptive and normative accounts of the interaction between individual agents and institutions. Consideration of simplicity adds significant power to explanations of how institutions evolve, which rules and norms become durable through time, and why institutional changes have the effects that they do.[2] This chapter advances the view that empirically valid descriptive models of behavior are to be favored over those defended on the basis of as-if prediction—not only because they provide more realistic descriptions of economics phenomena, but because they make distinct predictions about how to design successful institutions. This chapter also discusses evidence in support of a constructive alternative that attempts to go beyond mere critique of the standard economic model's unrealistic assumptions. The constructive alternative relies on simple heuristics (Gigerenzer, Todd and the ABC Research Group, 1999) rather than the standard economic model, characterized by exhaustive search over large choice sets, systematic scoring of costs and benefits, and action based on selection of the most preferred feasible alternative. Gigerenzer et al. provide joint theoretical and empirical arguments showing that a wide variety of behavior can be modeled successfully, in terms of intuitive plausibility and predictive power, as having arisen from simple recipes for action that do not require exhaustive search, do not make trade-offs over multitudes of factors, and instead base action on lexicographic trees that, at each stage, trigger action based on one reason alone. The heuristic approach enjoys the advantage of an empirically grounded universe of possible behaviors modest in size, and induced from direct observation rather than derived axiomatically as solutions to constrained optimization.

Given its different starting point for generating hypotheses about decision-making procedures, the heuristic approach to the analysis of institutions can, at times, be both more inclusive and more exclusive--more inclusive in accommodating explanations ruled out by the economic model's assumptions, and more exclusive in ruling out standard explanations based on implausible models of psychological process. This chapter focuses on three cases in which the assumptions of the standard economic model *a priori* rule out institutional effects that can be predicted once heuristics are considered. The corollary claim is: heuristics that describe decision processes, and not merely decision outcomes, provide improved predictions, and an improved basis for institutional design in which the virtues of simplicity are clear.

The examples that follow are intended to persuade the reader that heuristic models of individual decision making provide a wholly distinct flavor of institutional analysis and new insights for assisting with their explication, management and design. One particular insight is the straightforward intuition heuristics provide in favor of transparency as a coordination-improving attribute characterizing a number of successful real-world institutions. In contrast, transparency is relatively difficult to motivate using the standard economic assumptions of perfect information, common priors, and game trees with universally observable nodes, information sets and payoffs.

Although the intent of this chapter is to provide constructive alternatives rather than dwell on critique already in broad circulation, it may be useful to restate one of Simon's critiques of economics' optimization paradigm as it relates to institutional design. Rather than a Panglossian stance toward simplicity that treats it as universally positive, Simon (1982) describes a more nuanced attitude regarding simplifications at different stages of the modeling enterprise. Simon criticizes the economic model for imposing a distorted sequence of simplifying assumptions by which the modeler radically simplifies the environment so that it can be represented as a scalar-valued objective function, and then assumes that consumers and firms' behavior is well described by a process of optimizing these simplified objective functions. Instead of simplifying the external world and assuming omniscient agents seeking to optimize well-defined functions over known action spaces, Simon advocates that modelers retain more real-world complexity about the external environment, and more realistic strategies of simplification on the part of consumers and firms who fruitfully employ simple decision procedures that effectively cope with complexity and fundamental uncertainty of the Knightian type.

These two modeling strategies are distinct in that they simplify at different stages of model building, which Simon illustrates with the problem of designing computer algorithms to play the game of chess. If chess strategies are defined as sequences of moves, each contingent on the action of the opponent, there are too many paths of play for even the fastest computer to consider. In designing an algorithm to effectively play against expert chess players, Simon illustrates the limitations of the economic model as follows. Analogous to the deductive approach of optimizing within a pre-simplified world as in neoclassical economics, one may restrict the list of the opponent's moves and the length of a strategy sequence, and then pick the optimal strategy from within this deductively simplified world. In contrast, the design of chess algorithms based on the heuristic methodology would program a short list of specific chess strategies and search procedures based on observed play of experts. Simon argues that, although the initial strategy space in the heuristic approach is smaller, it outperforms the deductive approach in many environments, implying a seeming paradox: performing better than optimization. There is no paradox, however, insofar as optimization is inherently limited, by taking place within an *a priori* restricted action space, and heuristic search has the possibility of generating strategies not contained within the pre-simplified world made safe for optimization. Thus, following Simon, the attitude toward simplicity put forward here is contingent rather than unconditional praise for simplicity. There are many ways to be simply bad.

Regarding *a priori* limitations necessary to operationalize optimization, many methodological commentators have expressed the view that mathematical formalization frequently requires simplifications, or restrictions within problem space, that introduce systematic distortions into economic science (e.g., Boettke, 1996; Etzioni, 1988). Coase (1988: 185) wrote: “In my youth it was said that what was too silly to be said may be sung. In modern economics it may be put into mathematics.”

The value of simplicity is often to be found in the face of complexity and uncertainty. In this regard, constructing models based on optimization in pre-simplified worlds reflects a research agenda prone to commit what has been described as a Type-III error: the right answer to the wrong problem (Kimball, 1957; Tukey, 1969; Mitroff and Featheringham, 1974).

The examples in this chapter seek to illustrate that simple behavior, when matched appropriately to institutions designed to exploit it, may either lead to aggregate gains (Berg and Gigerenzer, 2007) or to exploitation by those who construct environments, such as marketing campaigns based on recognition, or ploys of casinos that distort perceived probabilities of winning. To determine whether non-optimizing behavior is efficiency-improving or compromising, what is required are empirically derived models of human behavior for institutional analysis and design (Schmid, 2004).

These normative questions challenge us to re-evaluate how we, as scientists, decide whether a decision procedure is rational or otherwise. Complementing the heuristic approach put forward here is the related normative criterion referred to as *ecological rationality* (Gigerenzer, Todd and the ABC Research Group, 1999; Smith, 2003). According to ecological rationality, it is the match between environment and decision procedure that properly measures how well those procedures perform. The matching concept of ecological rationality requires simultaneous consideration of decision procedure and decision environment, in contrast to standard axiomatic definitions of rationality that impose restrictions on individual preference orderings in isolation from any environment in particular.

I argue that simplicity belongs inside the objective function of normative economic theory, as a performance-promoting instrument that should be considered explicitly in the development of new institutions, in describing why existing institutions succeed, and in diagnosing when institutions harm human performance by exploiting systematic weaknesses. Insofar as individuals use simple rules to guide choice and action, institutions designed under the assumption that individuals optimize well-defined objective functions tend to be mis-calibrated to actual behavior. Models that nowhere refer to a correct decision procedure cannot serve as reliable tools for the inherently out-of-sample task of designing new institutions, no matter how well the parameters can be adjusted to fit within-sample.

The chapter proceeds as follows. I first take up the example of default rules, comparing different countries' rates of consent for donating bodily organs upon death. I then discuss the general framework of heuristics, which focuses directly on decision processes rather than deriving behavioral rules as solutions to constrained optimization problems. Next, I return to several more examples illustrating institutions designed to facilitate the use of simple heuristics or, in the case of Las Vegas casinos, exploit the use of simple heuristics for the designer's gain. Taken together, these examples demonstrate the normative methodology of ecological rationality, whose key criterion is the match between the decision-making process and the environment in which it is used, rather than adherence to domain-general norms of self-consistency, such as transitivity, the Kolmogorov axioms, or the Savage axioms of expected utility theory. The concluding section considers prospects for future research on heuristics and institutional design.

Defaults in organ donation[3]

Ninety-nine percent of Austrians have given legal consent to donate body organs upon death, whereas only 12 percent in Germany have done so. To explain this large difference in consent rates for organ donation, social scientists using the standard decision-making model in economics have looked to differences in expected benefits and costs while controlling for income, education and religion (Gimbel et al., 2003). Regression models show little evidence, however, that large differences in actual organ-donor consent rates are statistically or causally linked to benefits and costs. Critics of the economic model have tried to explain cross-country differences in organ-donor consent rates in terms of culture, social norms and history. Differences between Austria and Germany's cultures, social norms and national histories, however—while undoubtedly important for some research agendas—seem unlikely candidates for explaining the large gap between those nations' consent rates.

Johnson and Goldstein (2003) identified one important institutional difference between Austria and Germany that does seem to explain differential consent rates, much better than economic, sociological and historical differences do: the default consent rules written into each country's respective law. In *donor-default* countries such as Austria, individuals are, from birth, considered to be potential organ donors, which means there is effective legal consent for their organs to be harvested upon death for transplants to the living. *Non-donor-default* countries on the other hand, such as Germany, use the opposite default: individuals are assumed to have not given consent without explicit indications to the contrary and, therefore, no organs can be legally harvested from the dead unless individuals opt in by giving explicit consent.

In non-donor-default countries such as Germany, opting in by switching away from the non-donor default is not especially costly in terms of time and hassle. According to German law (Gesetz über die Spende, Entnahme und Übertragung von Organen, BGBI 1997, Article 2631), one may switch into donor status by stating this wish in writing on virtually any sheet of paper.[4] As a current resident of Germany, I followed this procedure in less than a minute, writing a single sentence on a notepad and placing it in my wallet. Opting out of consent status in Austria requires a bit more effort and physical resources, but not much. Residents of Austria wishing to opt out of organ-donor status must express their objections in writing on an official form and submit it to the Austrian Federal Health Institute via post or fax, requiring approximately five minutes and a postage stamp or fax machine.

The main implication of these small costs of switching away from defaults is that, according to the stable preference assumption of standard economic theory, the defaults do not substantively affect the individual's choice set and, therefore, should not influence behavior. Someone with stable preferences who ranks donor over non-donor status, for example, and whose difference in payoffs across these two states more than offsets the cost of switching away from the default, should choose organ donor status, regardless of how defaults are set. Yet contrary to economic theory, defaults are strongly correlated with actual consent rates. Figure 1 shows consent rates for a cross section of countries, with hatched bars indicating non-donor-default countries and shaded bars indicating those with the donor defaults.

Figure 1: Proportions who are donors in non-donor-default and donor-default countries

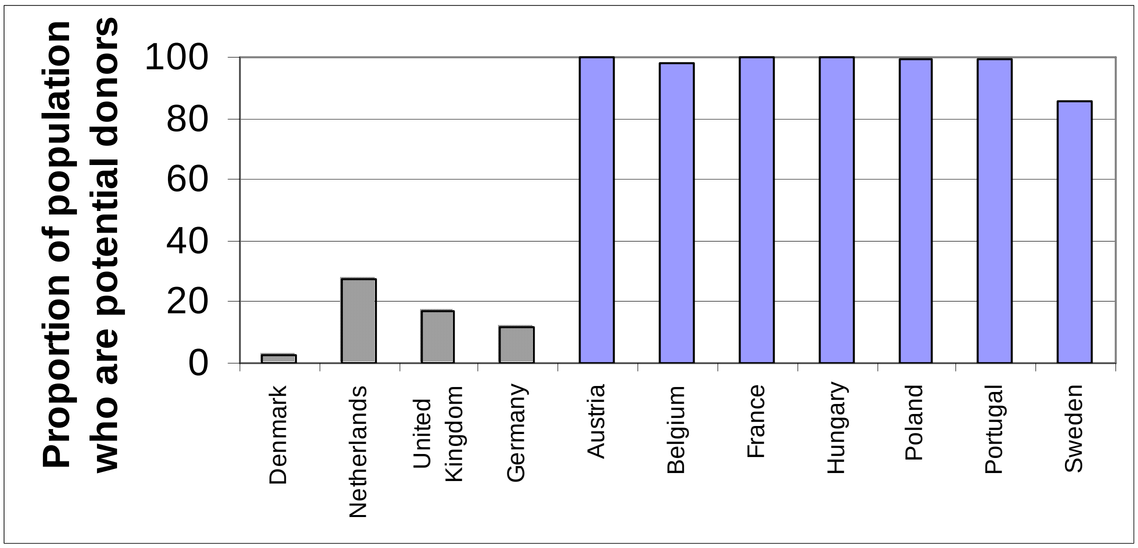


Figure 1: Consent rates for organ donation by country. Hatched bars indicate *non-donor-default* countries, where individuals are assumed *not* to be organ donors but can take action to opt into organ donor status. Shaded bars indicate *donor-default* countries, where the default presumes that individuals are organ donors but allows them to opt out if they choose.

Johnson and Goldstein suggested a simple heuristic model of individual behavior that fits the data in Figure 1 much better than rival explanations investigated elsewhere in the literature. The *default heuristic* consists of the following procedure: *when faced with a choice between options where one is a default, follow the default.*[5] In addition to fitting the cross section of consent-rate data in Figure 1, another advantage of the default heuristic over rival explanations is that it does not rely on inherent differences inside the minds of decision makers in different countries. The *default heuristic* is a single decision process that predicts distinct behavior from Austrians and Germans because it depends on an institutional default set differently in those countries, and not because of inherent personality differences, cultural differences, historical differences, etc. The heuristic model does not rely on a theory of inherent preferences or attribute observed differences in behavior to essentialistic concepts residing solely within (or exclusively outside, e.g., culture or history) individuals.

To further investigate the role of defaults in organ donation decisions, Johnson and Goldstein ran the following experiment. Subjects were randomly assigned to two groups. One group saw the following *non-donor-default* cover story:

> *Imagine that you just moved to a new state and must get a new driver's license. As you complete the application, you come across the following scenario. Please read and respond as you would if you were actually presented this choice today. We are interested in your honest response*: In this state every person is considered not to be an organ donor unless they choose to be. You are therefore currently not a potential donor. If this is acceptable, click here. If you wish to change your status, click here.

The second group of subjects saw the same message changed to a *donor-default* scenario with the script modified to read: "In this state every person is considered to be an organ donor unless they choose not to be. You are therefore currently a potential donor. . . ."

In this environment constructed in the laboratory, 82 percent of participants in the donor-default scenario preferred to be potential donors, while only 42 percent in the non-donor-default scenario did. This large gap between experimental consent rates mirrors actual differences between European countries in Figure 1. Furthermore, the experimental magnitude of 42 percent is near the consent rate of U.S. states with the highest consent rates using the prevailing non-donor-default institutional framework (Department of Health and Human Services, 2002: 9).

The experiment shows that changing institutions by adding or removing the word “not” on the organ-donation form, thereby changing the default, has a large impact on the aggregate consent rates. The plausibility of the heuristic explanation for the data in Figure 1 is further supported by extensive evidence from unsuccessful campaigns designed to increase donation rates by providing information about costs and benefits, which does not seem to work. Attempts to influence the public’s behavior by providing information about costs and benefits implicitly draw on the standard economic model of individual decision making, which assumes that individual decisions result from systematic weighing of costs and benefits. The economic model posits that the best way to influence behavior is to change benefit and cost parameters. Using the economic model, the Netherlands, for example, undertook a mass mailing campaign of 12 million information-disseminating letters, which ultimately failed to move consent rates even a single percentage point above the pre-campaign level of 28 percent (Oz et al., 2003).

Application of the heuristic model to the design of institutions would appear to have significant effects on consent rates for organ donation. Moreover, changes in consent rates seem to significantly change the numbers of organs actually donated, with regression models estimating that a switch from informed to presumed consent would lead to 16 to 57 percent more organs donated (Johnson and Goldstein, 2003; Gimbel et al., 2003). Drawing on heuristic models of behavior, researchers have also achieved large changes in aggregate savings behavior by modifying default settings of employers' retirement plans (Thaler and Benartzi, 2004).

General framework

In evolutionary game theory, strategies or behavior rules that yield submaximal payoffs are usually assumed to die out under competitive pressure from agents using strategies with higher average payoffs. Thus, decision processes such as the default heuristic, which are not derived as solutions to optimization problems, are often considered un-interesting, or simply non-problems. This dismissive attitude is based on the assumption that non-optimizing behavior could not become a regularity because it would be supplanted by superior decision strategies, and therefore need not be studied since one never expects to observe it. Of course, this exclusive focus on stable outcomes within standard economic theory has attracted its share of critics (e.g., Hayek, 1945; Schumpeter, 1942). Nevertheless, it remains a core tenet of economics as taught and practiced throughout most of the world.

Those of us who study heuristics as an alternative to the economic model must acknowledge that the standard viewpoint of economic theory poses a fair challenge to its critics, in asking why agents would ever use decision processes that are not optimizing in some sense. Why, after all, would someone, rely on heuristics? In the case of the default heuristic, it is easy to see that it would be well adapted to environments where institutional designers (i.e., those in charge of choosing defaults) have the interests of default-heuristic users at heart, and communicate recommendations through their choices of defaults. Alignment of incentives between institutional users and designers will not always prevail, however, as in countries such as Germany and the U.S., where large majorities of those surveyed say they prefer to be a donor, and yet consent defaults are set against their preference.[6] Social preferences may also play a role in explaining why people follow defaults, for example, if people perceive social value in matching the action taken by the majority, or perhaps fear negative social consequences from behaving out of line with the majority. Defaults may codify social norms or provide a coordination mechanism by which users of the default heuristic succeed in acting with the majority.

Another possible explanation in favor of the default heuristic concerns decision costs. Beyond time and energy expenditures allocated to deliberation, consideration of some decisions is inherently distasteful, forcing individuals to consider unpleasant contingencies such as one's own death, which can be reduced or avoided by ignoring the full choice set regarding organ donation and accepting defaults instead.

Heuristics are models of individual behavior based on direct empirical observation rather than axioms of logical consistency. As the following examples show, heuristic theory allows one to analyze institutions that economic theory would never predict, and provides new explanations for the functioning of existing institutions according to institutional objectives such as simplicity and transparency, which are difficult to motivate using standard informational assumptions of economic theory.

As many critics have pointed out, neoclassical economics and game theory typically rely on a single, optimization-based model of human behavior rather than analyzing a larger set of hypotheses about the decision processes that generate observed behavior as the object of scientific investigation. The benefit-cost model of behavior (sometimes referred to simply as the economic model) assumes that agents conduct exhaustive search over the relevant choice sets, score all feasible choices in terms of benefits and costs, and finally decide on the action with the maximum score. Utility functions, for example, typically assign scalar scores to each multi-dimensional consumption possibility in a choice set of infinite cardinality, weighting various features of consumption bundles in a manner that implicitly integrates multiple, compensatory factors. One key implication of the economic model is that behavior, which is assumed to result from the process of optimization just described, should be directly conditioned on perceived benefits and costs. A second important implication is that institutional modifications that leave choice sets and their net benefits un-altered, as do default rules for consent in organ donation (apart from the costs of switching away from defaults), should have no effect on observed behavior. Similarly, logically equivalent representations of a given set of information should not, according to the economic model, influence behavior.

Given the abundant evidence against these predictions derived from the economic model, we turn to the heuristic approach and its rival predictions. Upon considering how to design institutions to fit human minds (i.e., the processes they actually follow) rather than fictitious agents behaving as if they are optimizing according to the economic model, new problems and new possibilities follow. Sometimes institutions that would not work in a world populated by economic agents work surprisingly well with real-world minds. For example, economists consider it something of a puzzle why voluntary compliance with income tax laws is as high as it is, and why littering in some very clean public parks is so well controlled, given that governments invest very little in enforcement. In other cases, institutions that depend on forward looking behavior, full information and costless information processing, encounter obvious problems based on limitations of information and human cognition.

The examples that follow illustrate a range of real-world institutions that one would never expect to see designed as they are if the hypotheses built into the economic model of man were valid. These examples provide the opportunity to take preliminary steps toward analyzing heuristics and institutions, and more ambitiously, a new arena of institutional design geared toward fitting minds as they are, based largely, although not always, on heuristics.

Rules without tradeoffs in traffic and soccer

When making a decision based on a list of factors, perhaps the most common recommendation in the decision sciences is to Weigh Multiple Factors. Weighing Multiple Factors requires one to make tradeoffs, which some (mistakenly) interpret as the essence of economics. The decision maker is supposed to apply weights to various factors, trading off one against another. Weighing Multiple Factors embodies the essence of often repeated adages about good decision making that insist on considering all the evidence, analyzing tradeoffs, not rushing to make snap decisions, etc.

In this section, two institutions are considered that help agents make transparent decisions without weighing multiple factors. Decision rules that require no tradeoffs are referred to as noncompensatory, because decision factors have a fixed ranking of importance, and factors that are less important cannot over-rule, or compensate for, higher ranking factors. The way we alphabetize words in the dictionary is a good example of noncompensatory decision rules, with the letters in each word representing the potential factors that contribute to the decision of which word is ordered first. In ordering the "words" *azzzzz* and *baaaaa*, for example, the first letter, or factor, by itself leads to an unequivocal decision: *azzzzz* comes before *baaaaa* because the first letter of *azzzzz* comes before the first letter of *baaaaa.* According to dictionary order (referred to also as lexicographic order), there is no possibility that, because the trailing *aaaaa* in the second word ranks far ahead of the trailing *zzzzz* in the first word, we should consider putting *baaaaa* ahead of *azzzzz.* Trailing letters cannot over-rule earlier letters. That is the defining characteristic that makes dictionary ordering noncompensatory, and is precisely what allows us to alphabetize words quickly without comparing all the letters.

When designing institutions in environments that require fast decisions which are also transparent--in the sense of minimizing disagreement among individuals' expectations about what is likely to happen, noncompensatory rules are a proven success. Speed and consistency are especially valuable when smooth temporal coordination between individual actors is required, as in the following analysis of traffic rules for determining right-of-way at an intersection.

Determining right-of-way

Ancient Rome was a city of millions but lacked traffic signs (let alone stoplights) to guide its many pedestrians, horse riders, and chariots. Right-of-way was determined by weighing multiple factors, such as wealth, political status, and reputation. In case of ambiguity about how to weigh the various cues against each other, right-of-way was frequently decided by how loud accompanying slaves could yell, or by physical force. This institution based on weighing multiple cues led to much confusion and conflict on the roads of Rome. Historian Michael Grant (2004) hypothesized that traffic chaos played a role in Nero's decision to burn the city in year 64, in hopes of building a more efficient road system.

In contrast to the compensatory institution of Nero's time, right-of-way institutions nowadays throughout most of the world are noncompensatory, leaving far less room for ambiguity and disagreement. Even though the details determining right-of-way are different, noncompensatory lexicographic structure is common to nearly all countries' right-of-way institutions. In Germany, for example, the rule is as follows. When the traffic light is red, one must stop. Even if there is a sign giving explicit right-of-way at an intersection and other drivers are coming only from the left, the red light cannot be over-ruled by the presence of two contradicting cues lower in the cue hierarchy. The stopping gesture of a police officer cannot be over-ruled by even three lesser-priority cues indicating right-of-way through an intersection (e.g., green light, right-of-way sign, one's position is to the right of others).[7]

If drivers had to apply weights to various factors or cues and compute weighted sums to decide whether to drive through an intersection, disastrous consequences would surely follow. Individual decision processes would slow down as more information would need to be looked up and processed. The possibility of overlooking information, computational errors, and individual variation in weights assigned to cues would make it almost impossible to anticipate how other drivers might act. In contrast, processing cues in a simple noncompensatory fashion, and relying on other drivers to do so, frees cognitive resources for other important driving tasks. Noncompensatory rules also help settle arguments quickly when accidents occur. The transparency benefits of noncompensatory regulation is not limited to traffic, as the next example shows concerning rules in soccer tournaments for deciding which team advances to the next round.

Making it to the next round

The International Federation of Football Associations (FIFA) is the governing body of a number of major tournaments in the soccer world. It manages the World Cup tournament, which attracts more television viewers around the world than the Super Bowl. Economists studying sports tournaments have focused on designs that maximize profits (Knowles, Sherony and Haupert, 1992), and whether tournament rules satisfy certain axioms (Rubinstein, 1980). The relevance of soccer tournaments to the present discussion is in analyzing how noncompensatory rules exploit transparency to minimize controversy.

World Cup tournaments involve distinct group and knock-out stages. In the later knock-out stage, losers are eliminated with a single loss. In the group stage, however, teams are arranged in groups usually consisting of four teams, where each team plays all others in the group, and a single loss is not necessarily fatal. To determine which team advances to the next stage, FIFA uses a point system. Winners of a match are awarded 3 points regardless of the final score, and the loser receives zero points. If a match’s final score is a tie, then each team gets one point. After all group-stage matches are played, teams are ranked according to points to determine who advances to the knock-out stage.

Because ties according to the point system occur in the group stage, it is interesting to examine how FIFA breaks ties (in terms of points) to achieve unambiguous group-stage rankings of teams. FIFA considers up to seven cues. One team advances over its competitor as soon as one of the following cues, in the following order, is decisive:

1. more points based on wins, ties and losses in all group stage matches
2. more points in matches against teams with the same number of total points
3. a larger goal differential in matches against teams with the same number of total points
4. more goals in matches against teams with the same point total
5. a larger goal differential in all matches
6. more goals in all matches
7. If two teams tie according to the first six criteria (i.e., none of the six cues discriminates), then ranking is made by coin toss.

To illustrate FIFA's noncompensatory group-stage ranking rule, consider the notorious example from the 1982 World Cup in Spain, known as the "Disgrace of Gijón," in which four teams—Algeria, Austria, Chile, and Germany—comprised a group that played six matches, with the following results:

1. Germany loses to Algeria 1:2
2. Chile loses to Austria 0:1

3. Germany defeats Chile 4:1

4. Algeria loses to Austria 0:2

5. Algeria defeats Chile 3:2

6. Germany defeats Austria 1:0

Only two teams could advance to the next stage. The first cue, total points (not goals), decided that Chile would not advance, leaving three teams tied with 6 points. To rank Germany, Algeria, and Austria, the second cue (points in games among the three teams with tied point totals) was computed. But because Algeria beat Germany, Germany beat Austria, and Austria beat Algeria, this cue did not discriminate, either. The third cue (goal differential in games among the three tied teams) did discriminate: Austria had a differential of +1, Germany had a differential of 0, and Algeria had a differential of –1. Thus, Austria and Germany advanced to the next round.

This result, however, led to widespread suspicion and criticism, because the game between Germany and Austria took place after the results of the first five group-stage matches were known. Germany and Austria knew before their match began that a 1:0 result in either team's favor would allow both teams to advance. Many suspected that the teams somehow colluded to ensure their joint success over Chile. After this incident, FIFA redesigned the timing of matches so that its ranking rule could not be manipulated. The last two group-stage games now take place simultaneously.

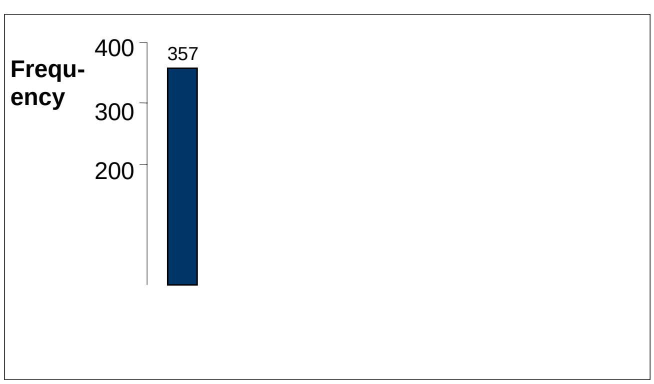
Why does FIFA use a lexicographic rule to produce group-stage rankings rather than weighting and adding all the cues as if computing a conditional expectation using a regression model? After all, there is plenty of time (unlike the right-of-way example) and abundant computing resources available to plug in the final group-stage results and quickly arrive at rankings using more complex, compensatory ranking schemes. One reason appears to be transparency. When stakeholders in any ranking scheme clearly understand the process by which results are obtained, they tend to accept those rankings more than they do when complex algorithms are employed. The idea is based on the theory that rankings, like tax schemes and constitutions in democracies (Berg, 2006), require a large degree of shared belief in their legitimacy in order to effectively coordinate action. The basic principles behind FIFA group-stage rankings are easy to understand: points are more important than goal differentials; goal differentials are more important than total number of goals scored; and all arguments about how much more important one factor is relative to another are moot, thanks to the fixed hierarchy of decision factors.

Other soccer organizations—like the European Union of Football Associations (UEFA)—also use lexicographic rules with similar cue orders to determine which teams advance in prestigious tournaments like the Champions League. Like FIFA, UEFA's ranking rule uses the principle that points are more important than goal differentials, and goal differentials are more important than total goals scored. But UEFA's rule relies on one cue that somewhat intransparently integrates lots of information, referred to as the UEFA coefficient, which is based on a team's previous record against other teams in the same country. However, this cue is last in the hierarchy of cues, in place of the random device FIFA uses (the coin toss).

One measure of simplicity for a ranking device is its informational requirements. A ranking device based on a regression model using the cues described above would rely on all available information to make any pair-wise ranking: plug in cue values for both teams, apply beta weights from the regression model, and rank the team with the higher score ahead of the other. In contrast, the noncompensatory ranking rule that FIFA uses operates much more frugally, in the sense that most pairs of teams can be ranked based on a single reason, without looking up each team's values for all cues.

Figure 2 shows an empirical frequency distribution for the variable that counts how many cues are looked up in determining pair-wise rankings according to FIFA's noncompensatory ranking rule. At this writing, there have been 17 World Cups, which include 67 groups with exactly four teams, where each team played each other once. For groups of four that play other teams just once, there are six (in combinatorial terms, 4 choose 2) group-stage matches and, correspondingly, six pair-wise orderings, or rankings, of teams, providing a sample of 6 x 67 = 402 pair-wise rankings. For each of these 402 pair-wise rankings, a count variable was computed counting how many of the seven cues were looked up to determine the ranking. According to Figure 2, most of the time (357 out of 402, or 87 percent), the first cue (overall group-stage points) determined the pair-wise ranking. The second cue was decisive in 16 cases. The fifth cue determined rankings in 18 cases, and the sixth cue determined six cases. One ranking was decided by chance. The average number of cues looked up was 1.3, indicating a high degree of informational frugality, due in large part to the highly decisive, non-binary cue in the first position.

Figure 2: Frequency of the number of cues looked up in pair-wise rankings according to FIFA's group-stage ranking rule



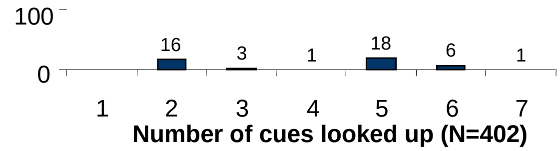


Figure 2. Empirical frequency distribution of a count variable measuring the number of cues looked up to determine pair-wise rankings in the group stage of World Cup tournaments 1930-2002.

In contrast to FIFA's noncompensatory institution, chief among whose virtues is transparency, organizations such as casinos are strategically designed for intransparency, to distort gamblers' perceptions about the chances of winning. Intransparency is investigated in terms of heuristics, with special attention to how casinos' strategies depend, once again, on behavioral assumptions that deviate markedly from the economic model.

Slot machines and gamblers' beliefs

In 2003, North American casinos took in an estimated $30 billion in revenue from slot machines alone, "more annually than McDonald's, Wendy's, Burger King and Starbucks combined" (Rivlin, 2004: 42). To earn profit, it is no secret that gambling institutions such as casinos, sports books, race tracks, and lotteries, are designed so that the average gambler loses money. Because gamblers can expect to lose money, the fact that so many people who are risk-averse in other decision domains choose to gamble presents a perplexing challenge to the economic model (Eadington, 1987; Wagenaar, 1988; Walker, 1992b).

Several theories have been put forward to rationalize gamblers' behavior according to the rational actor model, focused on non-monetary thrills as compensation for monetary losses. When gamblers choose to gamble, this reasoning goes, they willingly forgo a sum of money (the expected monetary loss from gambling) as the purchase price for a thrilling experience. Like individual consumer's surplus from the purchase of a cup of coffee—the difference between the consumer's subjective valuation of the coffee minus its purchase price—the theory of gambler-as-consumer understands gambling as a positive-net-surplus activity (Bennis, 2004; Smith and Preston, 1984; Wagenaar, Keren, and Pleit-Kuiper, 1984; Zola, 1963).

Although fun and thrill-seeking are undoubtedly part of what motivates gamblers, there is abundant evidence that gamblers gamble because they expect to win money. Casino gamblers systematically overestimate the chances of winning, overestimate the role of skill in games that are largely determined by chance, and endorse gambling strategies that have no effect, or detrimental effects, on winnings (Ladouceur, 1993; Wagenaar, 1988; Walker, 1992b). Thus, at least part of why people gamble is systematic failure to correctly estimate expected payoffs.

Theories of this failure to correctly compute expected payoffs fall into two broad categories. The first and by far most common approach identifies the source of the problem as originating inside gamblers' minds. According to such theories, gamblers possess inherently distorted understandings of small probabilities and sequences of random events, owing to pathological biases hard-wired into human perception and cognition (Gaboury and Ladouceur, 1988, 1989; Ladouceur and Dube, 1997; Ladouceur et al., 1995; Metzger, 1985; Steenbergh et al., 2002; Wagenaar, 1988; Walker, 1990, 1992a). The second category of explanation as to why some people gamble more than others focuses on factors in the external environment (Bennis, 2004; Dickerson, 1977;

Griffiths and Parke, 2003a). Rather than explaining gambling behavior as the result of inherent preferences or personality traits (e.g., a taste for gambling, a pathological tendency to distort perceived probabilities, or overconfidence), the second line of explanations is pursued by investigating interactions between heuristics and factors in the environment that make gambling more or less likely. Indeed, it is precisely these variables that designers of casinos and gambling machines seek to exploit. Recall that ecological rationality requires effective matching between decision process and environment in a way that benefits individuals using the decision process. Casinos, on the other hand, are environments specifically designed to mis-match commonly used decision heuristics, which may be adaptive in other settings, yet prone to systematic under-performance in environments designed to inflate expectations of winning. This is similar to recognition-based heuristics, which are adaptive in many non-strategic decision-making contexts, yet clearly vulnerable to manipulation by ad campaigns, for example, encouraging people to conflate recognition with value, quality, and other economic fundamentals (Goldstein and Gigerenzer, 2002).

The next section focuses on slot machine environments constructed by Las Vegas resort casinos that encourage mis-use of uninformative cues (Bennis, 2004). In the economic model, logically equivalent re-representations of information are irrelevant, because deductive logic is assumed to underlie behavior. For example, whether a probability is represented as “a 0.01 chance of winning,” “a 0.99 chance of loss,” or “1 in 100 are expected to win,” should have no impact on the gambling decision according to the economic model. Thus, the casino’s strategic representation of information becomes an interesting object of investigation only after enlarging the economic model to include alternative theories of behavior such as heuristics.

Representing the Experience of Winning

Major hotel-casino resorts in Las Vegas have one or more gambling floors where hundreds, sometimes thousands, of slot machines are arranged in aisles with lines of machines on both sides. Slot machines surround areas where groups of blackjack, roulette, craps, and other table games are played. In addition to providing traditional elements of slot machine play, contemporary slot machines generate an abundance of audio and visual cues that are hard to ignore.

When players cash out winnings from slot machines, metal tokens drop several inches onto a metal tray, generating loud clanking sounds, which can be heard almost constantly, and from virtually every direction, in busy casinos. Audio equipment installed to amplify the clanking of coins makes winning a very public and familiar event to those who spend any time on the gambling floors. If slot players do not immediately collect their tokens, beeping sounds announce the win with gradually increasing volume, marking increases in credit on the machine with louder and louder audio effects. There is a subtle design feature here, in that the volume of the slot machine's audio effects tends to get louder at a faster rate than winnings actually increase, encouraging exaggerated perceptions of winnings among players who might rely on audio volume as a cue.

In addition to audio cues, most slot machines generate visual cues, separate from the game display that players use, which are visible to non-players at distances of a hundred feet or more. Notably, most slot machines in Las Vegas casinos are equipped with a spinning, red light, reminiscent of those atop police cars, which flash whenever a major jackpot hits, usually reserved for at least hundred-dollar or thousand-dollar jackpots, but sometimes less.

Larger jackpots need to be paid by hand. During the time it takes for slot machine attendants to walk to the winner and deliver the money, the winning machine's light flashes and its siren sounds, sometimes for more than half an hour. Slot machine players regularly complain about how slow slot machine attendants are to pay major jackpots. Whether this is intentional or not, the long waits serve to advertise large jackpots in a manner that makes their occurrence appear more frequent than is actually the case. On busy nights, many large jackpot winners can be observed, often several at the same time, thanks to payoff wait times that extend the opportunity for others to observe. Some casinos prominently display posters of past winners of major jackpots, photographed while being paid with over-sized publicity checks.

Winnings are emphasized and communicated through a wide variety of cues in the casino environment. But losses are hardly visible at all. This raises a question about gamblers' perceptions of win and loss probabilities. Where cues have been constructed to emphasize winnings and hide losses, do we expect individuals to see through the selectively represented cues and formulate hard-nosed expectations? Does one expect gamblers to reason that casinos must profit to stay in business, that gambling is a zero-sum game and, therefore, that losses must be expected? Or might gamblers expect to win because instances of winning are nearly always visible in the casino?

Heuristics that adaptively guide foraging behavior by transparently following the observed successes of others run into problems in the casino environment. To the extent that frequencies of success are processed unconsciously by observing other gamblers in the casino, the casino's non-representative construction of cues, which includes logically uninformative signals such as sirens and flashing lights, may significantly influence gambling behavior, to the detriment of most gamblers.

Representing How the Machines Work

Another aspect of how non-representative cues distort gamblers' perceptions of the constructed casino environment concerns the inner workings of slot machines. Until the 1960s, slot machines worked much as their exterior design suggests. A machine had three reels covered with symbols, each with around twenty possible stop positions where the reel might come to rest, each with an equal probability of occurring (Cardoza, 1998; Kiso, 2004; Nestor, 1999). Given this design, there would be 20^3 or 8,000 possible outcomes, and a jackpot requiring a unique combination of three symbols would occur with probability one in 8,000, or 0.000125. After several spins on an old machine with a view above and below the pay line, a savvy player could estimate the number of stops, and the number of each symbol on each reel, to determine the expected value of a particular machine.

On the surface, new slot machines look very much like older machines, although their internal mechanics are entirely different. New slot machines use digital random number generators rather than physically spinning reels to determine winners. Nevertheless, contemporary machines continue to display spinning reels, providing non-representative cues meant to distort the true payoff-generating process. If, for example, the largest jackpot requires three red sevens, it would be possible for the casino technicians to assign a one in one billion chance to this payoff, while the machine's display shows three reels with 20 stops each, falsely suggesting a one-in-8,000 chance of winning as would have been true on older machines. Casinos can use the digital technology to assign inflated frequencies to near misses that inspire hope. Strategically non-representative design is standard practice in the casino environment (Griffiths and Parke, 2003b; Turner and Horbay, 2004). Because institutional designers go to great lengths to represent information in ways that should not matter in the standard economic model (e.g., Bayesian updaters making inferences about winning probabilities should not be influenced by sirens, flashing lights, and uninformative spinning wheels), one may infer that gamblers use decision processes that are indeed sensitive to irrelevant cues and, thus, depart significantly from the economic model.

Conclusion

Unlike axiomatic definitions of rationality that the economic model draws upon, evaluating the rationality of heuristic decisions calls for new normative criteria focused on the match between decision process and environment rather than axioms of internal logical consistency. If rationality is ecological rather than axiomatic, then decision processes, whether based on heuristics, optimization, or something else altogether, should be evaluated contextually according to how well they match the environments in which they are used—not as universal restrictions on any sample of decision data. As it turns out, these distinct normative notions of rationality have important implications for the analysis of institutions.

According to the economic model, strategic interaction between institutional designers and non-optimizing heuristics users need not be analyzed. The universe of problems to which the economic model is applicable is therefore rather narrowly circumscribed because of stringent behavioral assumptions such as exhaustive search, weighing costs and benefits, and adherence to logical norms of probabilistic reasoning. Additionally, the informational assumptions built into most economic models, ranging from the common prior assumption to the very representation of games where players see the full range of feasible action profiles and their associated payoffs, further rules out consideration of institutions that may actually work well in environments populated by heuristics users.

The organ donor example shows how the standard economic model misses an important institutional determinant of real-world behavior—the setting of defaults that do not change feasible choice sets yet influence decision making nevertheless. The example of noncompensatory rules regulating traffic and professional soccer rankings highlights two critical objectives for institutional designers, namely, simplicity and transparency, which are difficult to motivate using the standard economic model, yet follow naturally within the heuristics framework. In economic models that assume each agent is optimizing an objective function with precisely specified symbolic representations, the modeler is paradoxically forced to employ rather more elaborate quantifications of model complexity in order to specify preferences that favor simplicity and transparency. In contrast, the heuristic framework provides strong intuitive motivations for informationally frugal decision processes, without trade-offs or quantifications of complexity (Gigerenzer and Selten, 2002), and explains the roles of simplicity and transparency in the success of real-world institutions.

The final example of casinos as environments designed to exploit vulnerable heuristics that can be successful elsewhere shows further overlaps and distinctions between the heuristics versus the economic models. Conflict of interest between institutional designers and agents who depend upon the institutions they design is common to both methodological approaches. However, the notion of ongoing systematic exploitation of gamblers by casinos is understood much more easily using the concept of mis-match between heuristic and decision-making environment than through tortured rationalizations of gambling as a positive-surplus-yielding activity owing to intrinsic, non-pecuniary gains despite monetary losses.

In *Simple Rules for a Complex World*, Epstein (1995) argues similarly that, in the U.S., the law has become excessively complex and intransparent, resulting in an excessively litigious environment where complexity is exploited by lawyers. According to this view, complexity in the legal code makes legal outcomes more malleable to intervention by skilled legal craftsmanship and, thus, more volatile. Epstein advocates that we reduce complexity in the legal code to save on legal costs and, more importantly, to reduce uncertainty through greater transparency, thereby encouraging more productive forms of risk-taking.

Finally, it is worth emphasizing that environmental structure is not simply an independent variable on which decision processes and their performance depend. Environments themselves can be, and often are, actively structured, selected, and intentionally designed. An important ingredient in successfully analyzing institutional dynamics in which environments and behavior co-evolve is understanding the decision heuristics actually used by the population under consideration. Future study will hopefully illuminate these dynamics more fully. Some examples of how heuristics shape environments can be found in Todd and Heuvelink (2007) and Todd and Kirby (2001). The descriptive question of how well, or poorly, people make decisions in particular environments is also, fundamentally, a question about how well environments are tuned to particular decision tasks. From the standpoint of ecological rationality, the normative question is not simply whether our reasoning processes can be improved, but also how to design environments to better match the ingenious human hardware that comes for free.

One final issue on the table among contributors to this volume concerns whether fundamentally different approaches have their own value-added or if, instead, a larger integration or harmonization is warranted. The heuristic approach explicitly eschews the goal of a single list of axioms from which all behavioral models are derived. Attempts have been put forward to generalize the heuristic approach by classifying their subcomponents as various building blocks (Gigerenzer, Todd and the ABC Research Group, 1999). However, it would seem that empiricism is the unifying element in the heuristic approach: moving directly from observed behavior to symbolic representations of behavior without the intervening step of deriving behavior as the solution to a constrained optimization problem. Acknowledging that different problems benefit from different approaches does not doom the research project to hopeless relativism of ad-hocery. The concern is that with no superceding structure to “discipline” the modeling agenda, one may conveniently, and tautologically, elaborate theory after theory, one for each observed behavior. Despite this potential downside, proponents of heuristics have not fallen into the pitfall of empty re-labeling, and their models, findings from the field, and laboratory results, have been validated by outside researchers (Bröder and Eichler, 2006; Bröder, 2003).

The bottom line regarding simplicity is, as mentioned before, not a sweeping claim that less is always more. Perhaps counterintuitively, simplicity shines brightest as a strategy for dealing with complexity, limited information and profound uncertainty—where states of nature and probabilities are unknown. The methodological approach advocated here points to a tool-kit approach, in which the elements of the toolkit are simple heuristics with empirical grounding.

As this toolkit expands, is there a possibility that it becomes complex? Is there need to better understand meta-heuristics needed for choosing among the elements of the toolkit? Yes, on both counts. As to whether there is need for peacemaking and harmonization of disparate approaches (see Berg and Gigerenzer, 2006, for critical commentary on methodological peacemaking), the future will tell. There seems to be little evidence as yet that dissonance in the choir of theorists molding stories is causing frictions slowing theoretical progress.

One is reminded of the importance of conflict by Schmid (2004), which is fitting for this volume in honor of one of the profession's most accomplished articulators of why perceptions and relationships are indeed economic fundamentals (Schmid, 1967, 2000), and why conflict and distribution must be tackled head-on in undertaking normative institutional analysis (Schmid, 1987). Aside from a few studies of cognitive dissonance (e.g., Akerlof and Dickens, 1982), the economics literature contains few models to aid in understanding how competing and conflicting goals within the unit of the decision maker give rise to observable behavior. I offer the toolkit of heuristics as a modest step toward capturing the multiplicity of decision processes that define everyday economic behavior. Because heuristics used by single or multiple individuals may conflict with each other, future work will hopefully develop theory and empirics for understanding regularities of behavior triggered by commonly encountered conflicts. One would, of course, like to go further, taking active steps to assemble conflict-based processes into the decision-making model. Inclusion of both inter- and intra-personal conflict as explanatory variables in future economic models will provide welcome scientific progress, while paying tribute to Allan Schmid by extending his invaluable foundational analyses.

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End Notes

[1] Jansen and Ostrom (2006) evaluate a wide variety of contemporary techniques for data collection and modeling methodologies, providing a balanced assessment of trade-offs between the benefits of model complexity in data fitting against the costs of reduced out-of-sample validity resulting from over-fitting with highly parameterized statistical models.

[2] See Schmid (this volume) on definitions of institutions.

[3] This section draws heavily on Berg, Bennis, Katsikopolous, Goldstein and Dieckmann (forthcoming).

[4] A government website (www.organspende-kampagne.de/) provides an official form that residents of Germany may use for this purpose. The official form is not required, however, nor is any formal registration. In some cases where relatives have been clearly informed of the individual's wish to become an organ donor, verbal consent may substitute for written consent.

[5] Heuristics have been defined elsewhere as consisting of three components, which specify rules for search, stopping and deciding. The default heuristic fits this definition, although its search and stopping rules are not explicit in the statement above. The default heuristic searches through a list of alternatives in the order given, in this case, one of two vectors, either (non-donor, donor) or (donor, non-donor). Search stops once a default is discovered, which means that search sometimes starts and stops with only a single element of the choice set considered. Finally, the default is chosen. Subsequently, we discuss reasons why default heuristics are likely to be well-adapted or maladapted to particular decision-making environments as a function of whether incentives of agents and institutional designers are aligned or opposed.

[6] Around 80 percent of Americans (Gallup, 2003) and more than 70 percent of Germans (www.organspende-kampagne.de/) express a preference in favor of consenting to become organ donors.

[7] The "right on red" provision in some U.S. states does not imply that traffic rules are compensatory. According to the "right on red" rule, if one is turning right and the intersection is clear of other oncoming vehicles, then one may turn right on red after stopping first. This sounds as if "turning right" and "clear of other oncoming vehicles" jointly over-rule the red light. Through a suitable re-definition of the cues, however, the noncompensatory structure, and all its practical advantages, are retained. Consider the following cues arranged hierarchically from most to least important in a "right on red" state: Police officer directs one to stop; person or object (such as train or broken down car) is blocking the intersection; red light and I am not in the right lane; red light and I am in right lane, while there are oncoming vehicles; signs indicate that one must yield. When two drivers both see no police officer directing drivers to stop, the first cue does not discriminate (i.e., indicate which of the two should go first), and we proceed to the second cue. When two drivers both see nothing blocking the intersection, then the second cue does not discriminate, and we proceed to the third cue. As soon as a discriminating cue is identified, right-of-way is determined no matter how many contradicting factors appear lower in the hierarchy.