

**The Irrationality Illusion:
A New Paradigm for Economics and Behavioral Economics**

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Abstract

A new conceptual and formal framework for analyzing economic decisions, the homo communitatis paradigm, is introduced. The framework is in the form of 7 principles, which collectively articulate the entire range of factors that affect choice, including all aspects of individual behavior and of the social context – the communities – the actor is a member of. Traditional economic analysis is shown to be a special case of homo communitatis analysis in which key variables are omitted. Using the principles, we show that experimental results such as loss aversion, framing effects, mental accounting, and judgment biases are not irrational, and that the apparent irrationality is in every case an illusion arising from incomplete specification and control of independent variables elucidated in the principles. Several implications for future work are discussed, including high-fidelity models of socioeconomic systems, significantly more powerful and detailed economics simulations, and adoption of significantly different approach to design of economic experiments, one that takes into account all the variables involved in human choice.

It is almost an article of faith in economics and elsewhere that people are irrational. As the term is used in economics, it is both a matter of technical definition and an implicit norm: rationality is defined as acting so as to maximize (subjective) expected value, and the implicit assertion is that persons “should” act so as to maximize their self-interest over the time horizon they can encompass. Not doing so is defined as irrational.

The view that deviations from expected utility theory are anomalies demonstrating human irrationality (in the wider, not merely technical, sense) is both persistent and pernicious. When the theory of the day was that the planets travel in circular orbits, actual orbits were “anomalous,” accounted for by adding epicycles. The problem was not the planets; it was the paradigm. In economics, actual decisions are not anomalous; expected utility theory and homo economicus are inadequate.

The perniciousness of the claim is that it is taken to mean, both popularly and in economics, that an individual’s actions are at the whim of “hidden forces” outside their control (Ariely 2008). To the extent that a person accepts this description, they are accepting that their behaviors in matters that are important to them are whimsical, unconnected with their circumstances, and ineffective in achieving what they value. Clinical psychologists recognize such a claim as a degradation – an attempt to reduce the person’s place in their world from effective actor to deluded fool – and the acceptance of such a degradation as a pathological state. The purpose of this article is to show that the appearance of irrationality is an illusion, by presenting an entirely new approach to economics.

We might expect that a field characterizing itself as “behavioral economics” would offer a different paradigm than homo economicus, one whose central concept would be human behavior, with a focus on economic facts and quantities related to behavior. Such is not the case. Behavioral economics, as the field stands today, consists of standard neoclassical economics with several “psychological” factors grafted on to account for some, though by no means all, of the failures of the neoclassical model. The result is an ad-hoc collection of concepts and factors that are basically disconnected, standalone concepts. Each is a “kluge” – an engineering term for a certain kind of ad-hoc solution to a problem: one that works but is otherwise a poor fit with the structure it has been grafted onto. Because of this ad-hoc structure, or lack of it, it is difficult or impossible to identify and articulate relationships (causal or otherwise) between various phenomena, to identify which ones influence or account for others, or, perhaps most importantly, to identify and develop new extensions to the theory. For example, a variety of economic phenomena are known to be affected by several societal factors often grouped together as “social norms” (Ariely 2008), but behavioral economics includes no articulation of the connection between these factors and others such as framing, loss aversion, and deviations from Bayesian probability assessments ascribed to cognitive processes. We know, for example, that various political, psychological, and social factors lead to certain actors engaging in the behavior of suicide bombing, which cannot be justified by any form of the neoclassical model, but which also cannot be explained or predicted by any existing “behavioral” additions, unless the concept of subjective utility is arbitrarily

expanded to include identity and social group values – extensions that are perfect examples of kluges.

The core of current behavioral economics is Kahneman and Tversky's prospect theory. They state that in creating the theory they deliberately proceeded as conservatively as possible (Kahneman and Tversky 2000). They set out to make the “minimal set of modifications of expected utility theory” to account for deviations of experimental data from utility theory, accepting the basic framework of “rationality”, as defined by Von Neumann and Morgenstern. They did not, in other words, set out to create a new framework for economics, but rather to extend the existing one as necessary. Kahneman and Tversky created a combination of neoclassical economics and cognitive psychology, and their approach has remained the approach of all researchers in the field: when a new behavioral factor is recognized as needing inclusion, find a facet of neoclassical economics or cognitive psychology that can be manipulated to incorporate it, alter or add to it as necessary, and show that the alteration can account for the data of interest. Cognitive psychology is particularly easy to manipulate in this way, since its core concept is “mental processes” whose output can be altered by positing other “mental processes.” For example, every one of the heuristics and cognitive errors that form the core of the content of behavioral economics today are described as the result of a specific posited mental process or an error in a mental process.

Kahneman and Tversky accept the fundamental assumption of decision theory: that decision making under risk can be viewed as a choice between outcomes (Kahneman and Tversky, 1979). That assumption is universally accepted in economics, including behavioral economics, and has been so for centuries (Bernoulli, 1738/1954). Considerable analysis has been devoted to the issue of whether outcome should be defined in terms of total wealth, as Bernoulli did, or changes in wealth (Kahneman and Tversky, 1979), but analyses and theories, including utility theory and prospect theory, are theories of outcome evaluation.

We take a substantially different approach from that of Kahneman and Tversky, including rejecting the view that decision making is choice of outcome. Starting from first principles, we develop a new paradigm for economics, including behavioral economics: a systematic, precise, and comprehensive conceptual framework for the *entire* range of economic phenomena, both traditional and behavioral, not merely those that fit the neoclassical concepts of *homo economicus*, which we, along with others (Stiglitz 2010), consider to be a failed paradigm. Unlike previous work in the field, which attempted to retain the basics of the existing paradigm and add structures and “fixes” necessary to account for the empirical deviations from the theory, the formulation presented here addresses the entire range of human action, as it relates to economic phenomena. The fundamental fact about economics is that all economic phenomena and data are the outcomes of actions – economic and otherwise – by economic actors, that is, persons. It follows from this observation that the central focus of any truly comprehensive theory of economics must be action by persons.

It would seem natural to begin with a full cognitive psychology-based account of human action, and show how economic behaviors and their outcomes are special cases. Such a research program is not practical, because cognitive psychology is not sufficiently broad to serve as a foundation for a complete account of human behavior. A full discussion of why cognitive psychology does not suffice for such a purpose is tangential to our purpose here, but has been done elsewhere (Jeffrey 2010, Bergner 2006, Jeffrey 1998, Ossorio 2006). For our purposes, we simply note that cognitive psychology does not address the concepts of social practices, the relationship between human relationships and actions, motivation, social status, self-concept and identity, the influence of cultural values on choices, ethics, appropriateness, the effect of conflicting social values on an individual holding membership in several different cultures and subcultures, or the hierarchical structure of behavior itself, i.e., that in the common case, one behavior is part of or a step within another, larger, behavior. It is not accidental that cognitive psychology has not subsumed the fields of social psychology, organizational psychology, sociology, anthropology, and political science – other fields that address other aspects of human behavior.

The framework of the new paradigm consists of seven principles:

1. Choice is choice of behavior.
2. By “behavior,” we mean *intentional action*.
3. The paradigm case of human behavior is *deliberate action*.
4. Behavior choices are made in light of the individual’s reasons to engage in one behavior or another.
5. People choose what matters to them.
6. Every behavior is an instance of engaging in a social practice of a community.
7. For any person, a particular state of affairs may be real, actually possible, or merely possible.

The basic approach and certain of these principles (particularly Principles 2, 3, and 6), along with a slightly different formalism, were presented in (Jeffrey 2010a) as the homo communitatis paradigm. This paper may be regarded as a more complete articulation of homo communitatis.

The seven principles are elaborated in the following sections.

Section I: Choice

The first principle of the new paradigm is:

Principle 1: Choice is choice of behavior

Wanting something is not enough; one must act to get it. Persons act to bring about some change in the world, large or small, some state of affairs that is different from the state of affairs before the action. We want an apple, so we buy one; we want a high-return security, so we invest in one. We cannot simply choose to have some state of affairs be

the case; we can only act to achieve it. The fundamental fact about persons and choice is that persons *want* to bring about some state of affairs, which may be having some goods or services, and *choose* behavior to achieve what they want. This is perhaps the most basic shift involved in the new paradigm: a change in focus from the traditional concept of choice of goods and services to choice of behavior(s) by persons or groups of persons. This may initially seem to be a semantic fine point, but is not; it is the anchor for including a much wider range of factors and influences, both traditionally “economic” and others, that influence, often in major ways, both the production and consumption of goods and services.

Before we examine this change in focus, and its consistency with a longstanding recognition of the need to approach economics differently, we show how this principle by itself, with some simple reminders of facts about the human concept of value, resolve the Friedman-Savage “paradox” that people buy lottery tickets and insurance.

The Friedman-Savage “paradox” is this: given that humans are loss-averse, why do they buy both fire insurance (which has a positive expected value) and lottery tickets (which have negative expected value)?

We begin by simply identifying the two behaviors:

1. B_1 : Person P buys fire insurance on her home, valued at \$500,000, for \$100.
2. B_2 : Person P buys a lottery ticket, payoff of \$100,000,000 dollars, for \$1.

Next we articulate some of the facets, or aspects, of each behavior. To say “P bought fire insurance” *is*, tautologically, to say that:

- P engaged in procedure “buy insurance policy”;
- P knows something: that situation F (“home consumed by fire”) can occur, that this loss would be important to her, that the cost of the policy is \$100;
- P wants to accomplish something: she engaged in B_1 in order to bring about a change in the state of the world, from S_1 to S_2 . Specifically, the result of buying fire insurance is that P is protected from a loss she knows can occur;
- P values S_2 over S_1 : being protected from a home fire over not being protected.

Thus, a more complete statement of Behavior 1 would be: “P buys fire insurance for \$100 to be protected against the loss of her home, valued at \$500,000”. This is the uncomplicated case, the one adequately modeled in the usual way of measuring P’s wealth numerically and noting that loss of her home would be a reduction of wealth of \$500,000.

The second behavior, while appearing to be simpler and almost always modeled very simply (expected value of the lottery, i.e., probability times potential winnings), in fact is much more complicated than the first. If we are to have a framework for economics applicable to the real world of persons and choices, it must incorporate this additional complexity. Two considerations are relevant. First, in many cases the concept labeled

“wealth” is not a valid measure of value. Second, numerical measure of cost is not always valid, especially for small costs.

The simple ordinal function mapping world states to the real line, the function called “wealth,” is inadequate for measuring the value *to that individual* of what the individual has. It does not accurately represent the concept indicated by saying, “A values X.” Value is a more complex concept than that, in at least two ways. One of these we shall discuss in Section III below: the fact that the dimensions, or kinds of value, include what is pleasurable to P, what is in P’s interest, what P finds ethical, and what P finds appropriate. The second aspect is the one involved here: the effect on P of changing one’s position in society and the world.

If P wins the lottery, much more than the numerical measure of her wealth is changed. An enormous new range of behaviors becomes possible for P (we say her “behavior potential” has greatly increased). A large number of previously important dilemmas and daily questions evaporate, such as having to make choices between many, many “baskets of goods”, having to save for future needs such as college for her children, and in general the entire range of ordinary daily “can’t have both” choices; and P acquires a new *position* in the world and her society: she is wealthy. “Wealthy” is not simply an attribute measuring the amount of one’s wealth (as that term is used in economics); it identifies a distinct, recognizable, and highly valued position in society. In short, if P wins the lottery, her life is changed overwhelmingly, for the better (according to her existing criteria). Thus, to say “P bought a lottery ticket” is to say that:

- P engaged in procedure “buy lottery ticket”;
- P knows something: that situation W (“win \$100M”) can occur;
- P wants to accomplish something: she engaged in X in order to bring about a change in the state of the world, from S_3 to S_4 . Specifically, the result of buying the lottery ticket is that S_4 (P has \$100M) can occur;
- P values S_4 over S_3 (P does not have \$100M);
- P is engaging in the larger behavior of changing her life position. Unlike buying fire insurance, which results in certain protection, the outcome of this larger behavior is of course not certain, but what *is* certain is that the change *can* occur; it is a *real possibility*.

Finally, we are forced to reformulate the concept of cost. We take it as inarguable that to a large percentage of persons in the USA the cost of the lottery ticket is *effectively* zero. The ticket is not literally, numerically free, but its cost is insignificant to P. Simple arithmetic measures do not suffice to describe what matters to P and how much— i.e., its motivational impact – or any other person in any situation, and we must address this fact. To take this into account, we return to the concept mentioned above: behavior potential. If P buys something costing \$1 and loses it, or (as may happen in this case) fails to win the lottery, her behavior potential is not significantly lowered. Her *wealth* has been reduced by 1, but her *behavior potential* has not been reduced in an amount that matters to her. (While it is inarguable that to many the effective cost is zero, what is arguable, and in fact is an obvious and interesting question for empirical investigation, is how much loss is effectively zero to what portion of the population. Initially, it seems

reasonable to conjecture that this “significant loss function” will be some function of the ratio of change in wealth to wealth, $\Delta w/w$.)

Therefore the more complete articulation of the relevant facets of the behavior of buying a lottery ticket is:

- P engages in procedure “buy lottery ticket”;
- P knows something: that situation W (“win \$100M”) can occur, and **the cost of the ticket is effectively 0**;
- P wants to accomplish something: she engages in the procedure in order to bring about a change in the state of the world, from S_3 (not having \$100M) to S_4 (having \$100M). The specific result of buying the lottery ticket is a different state of affairs, namely S_5 : S_4 can actually occur;
- P values S_4 over S_3 ;
- P has the real possibility of making a massive positive change in her life position.

In summary, P’s situation is this: she can buy protection of her \$500,000 home for \$100, and can buy the possibility of a massive positive change in her life position for an effective cost of zero.

There is no paradox here. In fact, there is no longer any question. Given the description of individual P here and how she assesses the value to her of \$1, what would require explanation would be if P did *not* engage in both B_1 and B_2 .

The Friedman-Savage “paradox” is an illusion. It is the result of insisting on a single characteristic, “loss aversion,” to model that characteristic applied to choices of *goods*, modeled with various more-or-less complex functions (e.g., the Friedman-Savage function) to apply to the entire range of goods. In the new paradigm, choice is articulated as choice of behavior. The values to the individual of the outcomes of the possible behaviors and the *behavioral* cost of engaging in the behaviors are identified; and whether the individual engages in one behavior or another, or both, follows straightforwardly from an examination of the change in behavioral value (not wealth) and the behavioral costs resulting from the change in state of affairs brought about by the behaviors. There is no mystery or paradox here, once choice is articulated as choice by a person of *what to do*, based on what they know and value.

What we have done with Friedman-Savage is to clarify the situation by formulating economics as the outcome of the behaviors of person(s), using a careful examination of the *behavioral* situation. This is what we shall continue to do in this and subsequent sections. We saw that the apparent difficulty in understanding the choices of individuals resulted from the transformation, or mapping, of the behavioral picture into the traditional economic one containing only goods and services, thereby deleting the key human aspects of behavior, significance of behavior, and value as behavior potential. Removing the human aspects results, as many have noted, in a mathematically sound and rigorous system, the basis for doing economics. Behavioral economics has consisted of attempts to restore some of the deleted aspects, while maintaining the traditional economics paradigm as much as possible.

Before continuing, one issue related to the principle that choice is choice of behavior, not product, must be addressed: if choice is always choice of behavior, why then do we so often hear, “I had to choose between the blouse and the shoes,” “We had to choose between a home addition and college tuition,” “I bought the store brand milk because it was cheaper,” etc. – that is, language that clearly indicates making a selection from among the available goods and services? The reason is that in some cases the choice of behavior is a choice of two purchasing behaviors: purchase product X or purchase product Y (the classic “basket of goods”). In this case, purchasing is the activity, and product X or product Y is the particular instance of what is purchased, and common parlance, “He chose X vs. Y.” The new principle encompasses such traditional economic choices but also such choices as, “They chose to go on an extended vacation instead of buying the car (an activity vs. a product),” “They chose a vacation in South America vs. one of the same length in Europe (two versions of the same action), and “He spent \$1000 to visit his grandchildren” (an intrinsic practice) (Abelson 1996). In other words, choosing one product vs. another is a special case of choosing what to do.

Deletion produces incompleteness

The fact that the picture resulting from the deletion of almost all the facets of human behavior is seriously incomplete is a longstanding observation by economists and others. Mill (1844) contains the following description of the logic of the situation:

[Political economy] does not treat of the whole of man’s nature as modified by the social state, nor of the whole conduct of man in society. It is concerned with him solely as a being who desires to possess wealth, and who is capable of judging of the comparative efficacy of means for obtaining that end. It predicts only such of the phenomena of the social state as take place in consequence of the pursuit of wealth. It makes entire abstraction of every other human passion or motive; except those which may be regarded as perpetually antagonizing principles to the desire of wealth, namely, aversion to labour, and desire of the present enjoyment of costly indulgences. These it takes, to a certain extent, into its calculations, because these do not merely like other desires, occasionally conflict with the pursuit of wealth, but accompany it always as a drag, or impediment, and are therefore inseparably mixed up in the consideration of it. Political Economy considers mankind as occupied solely in acquiring and consuming wealth; and aims at showing what is the course of action into which mankind, living in a state of society, would be impelled, if that motive, except in the degree in which it is checked by the two perpetual counter-motives alrove adverted to, were absolute ruler of all their actions.

Because Mill’s comments are as apropos today as they were 160 years ago, it is worth highlighting certain key points:

1. Economics does not treat all actions by persons, but only those whose goal is the acquisition of wealth.

2. Only those actions in pursuit of wealth are studied and analyzed. Any others or other principles are included only insofar as they influence wealth-acquisition-oriented activities, and these are included only “to a certain extent.” All other factors and influences are “abstracted” – i.e., not included in models.
3. Economics’ goal is to show what actions persons would take *if* the sole goal of all actions were to acquire wealth and spend it.

Mill’s comment on prediction is particularly significant today. There is no disagreement that accurate prediction is the goal of economics. A major motivation for introducing the new paradigm is to improve the predictive power of the field. As we shall see below, several of the non-traditionally-economic influences on economic activities have a very significant impact on the production and consumption of goods and services, so much so that failure to include them appropriately severely limits the predictive accuracy of any theory based on the old framework. To anticipate the more extensive discussion below, one clear example of this is the case of intrinsic behavior, i.e., behavior engaged in for its own sake, not in order to accomplish a goal or as a way to implement some other behavior.

Take, for instance, shopping. The United States economy is 70% retail. Retail clothing is a \$150B industry, of which 50% are women’s clothing stores. For a large percentage of women in the U. S., shopping is intrinsic: they shop in order to be shopping, just as a chess player plays chess in order to be playing chess. In some, but by no means all, cases, the outcome of this intrinsic practice is a purchase, just as in some cases the outcome of playing chess is the checkmate of the opponent. There is little doubt that, were shopping not intrinsic to a significant segment of the US populace, the impact on the economic state of the sector would be large. (What is not clear, of course, are the specific percentages: for what percentage of women is shopping intrinsic, what percentage of actual shopping instances of cases are shopping for its own sake and what percentage are instrumental, i.e., solely to acquire goods or services as in the traditional economic model, etc. These are empirical questions.)

We take it as unnecessary to argue that acquiring and consuming wealth is not the sole, or even the highest priority, goal of a very significant portion of the persons in the world. We take it further that it is unnecessary to justify the observation that what is demonstrably the case is that persons are at all waking times engaged in living their lives, that is, engaging in the actions they find called for at the moment, either in order to accomplish some (valued) end, which may be the acquisition of wealth or the acquisition of goods or services, or because the action is intrinsic. This is entirely consistent with the observations of every other discipline whose focus is human action: clinical, social, and organizational psychology, sociology, anthropology, political science, and history, at a minimum, as well as the virtually universal understanding outside of academe in general and economics in particular. Complete and accurate models of production and consumption require articulating and modeling the factors that affect behavior.

This is not to say that economics, as a field, is to be replaced with psychology. The goal of economics has been and is to understand the production and consumption of wealth,

goods, and services. The point of the new paradigm is not to replace that focus of study, but to provide a better set of resources for engaging in it.

It is incumbent on a new paradigm in a field to account for the successes of the old paradigm (Kuhn, 1962), and show how the new one encompasses while expanding the old one. Newtonian mechanics, for example, is a special case of relativistic mechanics. The equations of relativistic mechanics reduce to those of Newtonian mechanics at velocities low compared to the speed of light. The principle that choice is choice of behavior reduces to choice of goods and services *when the behaviors are identical in all aspects other than the actual thing bought*.

It is important to be as clear as possible that the point of introducing the new paradigm is not to invalidate or attack economics as it has been practiced. Criticizing economists as misguided and narrow for their exclusive focus on goods and services, accusing them of sacrificing accuracy for mathematical rigor, and sometimes other, harsher, criticisms, is common today. No doubt this is due in part to the current economic climate. Economists have responded by noting that this focus is what has enabled the field to develop as a science, including the use of mathematics, and we agree with this. One cannot have a science without a precise, systematic formulation of the would-be science's fundamental subject matter, and while the range of human phenomena included in the traditional economic paradigm is a very narrow subset of the full range needed in principle, there has until fairly recently been no way to formally represent that full range. The point of the new paradigm is to make it possible to apply the same degree of mathematical rigor to the full range of human behaviors as related to economic quantities and facts, rather than the narrow subset heretofore possible.

In the next four sections we present a formal articulation of four key concepts – behavior, choice, reasons, and communities – that enable formal representation of the full range of factors necessary for a comprehensive science of economics, i.e., one that does not attempt to model “mankind as occupied solely in acquiring and consuming wealth.” We then use the full articulation of the concepts to analyze several phenomena in behavioral economics, phenomena customarily considered instances of irrationality, and show that the apparent irrationality is an illusion. As with the Friedman-Savage “paradox,” the illusion is not due to the phenomenon itself, but rather due to having an incomplete or inaccurate articulation of the phenomenon – much as a fun-house mirror distorts reality. The larger goal, however, is not only clarity; it is to enable the formal analysis and empirical study of a much wider range of conjectures, theories, and potential policies than has been possible heretofore. The Large Hadron Collider was not designed by assertion of political or ideological belief; neither should economic policies be.

Section II Behavior

Behavior is one of the two core concepts in Principle 1. What exactly do we mean by “behavior”?

We would ordinarily expect to look to the field of psychology, the study of what people do and why they do it, to find an accepted definition, just as we would look to physics to find an accepted definition of energy or momentum. Unfortunately, we cannot do so. In the field of psychology today there is no commonly accepted definition of behavior.

Perhaps the most commonly used definition of behavior in psychology is “an overt movement of the organism” (Bergner 2010), the definition that characterizes the behaviorist school. Cognitive psychology incorporates the same concept, but adds to it “processes by which the sensory input is transformed, reduced, elaborated, stored, recovered, and used” (Neisser, (1967). Functional psychology, a precursor to behaviorism, defined behavior as “purposeful activities to satisfy needs.” (Though functionalism is not a current school of psychology, the functional concept of buying, an activity to satisfy needs, is central to the study of consumer behavior.) Freud took behavior to be the expression of drives or instincts, themselves fundamentally neurological, but did not define behavior *per se*.

The inadequacy of the behavior-as-movement definitions (including the cognitive one) as a general foundation is illustrated by the Friedman-Savage “paradox”. What matters is buying the ticket or the insurance, not the physical motions of doing so. It is irrelevant whether the individual writes a check, takes cash out of a wallet, types and clicks on a computer, or makes a telephone call to buy the insurance. Further, the fact that the individual is protected against damage after purchase is not representable by any set of statements involving physical quantities. That P “has” a policy is a legal relationship, not a physical one. Somewhat similarly, for P to have the actual possibility of winning, she must have “possession” of the ticket, but that concept also cannot be defined in with any possible set of statements involving physical quantities and physical relationships. Further, whether P engaged in “cognitive processing” in buying the policy, ticket, or both is irrelevant to the case; the case rests on the fact that individuals do buy both. Processing only enters the picture if a researcher insists on devising a process whose outcome would be the decision to buy. In other words, cognitive processes are a theoretical construct, not a part of the articulation of the facts of the case.

The point of a definition is to have an articulation of the subject matter and an identification of what is to be studied. It may be tempting to address the lack of a consensus definition of behavior by introducing a new one. However, the failure to achieve a consensus definition in the more than 100 years the formal discipline of psychology has existed, and in the more general study of people and their behavior reaching back at least to the ancient Greeks, would seem to urge caution. While traditional definitions of “behavior” have proven highly problematical, a different approach has proven much more fruitful. That approach is parametric analysis: rather than define what something *is*, identify the ways in which instances of that thing can vary, and treat each such dimension of variation as a parameter, whose values come from a known set of possibilities.

The classic example of the parametric formulation of a concept is its use to articulate the concept of color. We have no definition of color that identifies the set of all “things” that

would be considered colors and excludes all that would not be. There is, however, is a highly successful long-standing parameterization of color, used by artists and others who concerned with careful identification of colors, that identifies every color in terms of three values: brightness, hue, and saturation. A specific color is identified by specifying three values, brightness, hue, and saturation, which can be written $\text{Color} = \langle B, H, S \rangle$; the parameters B, H, and S identify the ways in which colors may differ from one another (Gleitman, Fridlund, & Reisberg, 2004, pp. 190–191).

(Parenthetically, we note that the usual approach of defining terms is much more limited in applicability that is commonly recognized. Every student of mathematical logic learns early that virtually *all* everyday concepts cannot be defined by statement that identifies all the exemplars of the concept and excludes those that are not. It is not, for example, possible to *define* “table” or “chair.”)

In the early 1960s, the psychologist Peter G. Ossorio used the method of parametric analysis to articulate the concept of human behavior. That articulation, “Intentional Action” (IA) has since become a central concept in the field of Descriptive Psychology and has been used by a number of researchers to address difficult research problems in a number of areas, including economics (Jeffrey 2006, Jeffrey 2010), artificial intelligence (Jeffrey and Putman 1983, Jeffrey et. al. 1989, Jeffrey 1981), clinical psychology (Ossorio 2006, Bergner 2005), organizational psychology (Putman 1990), and modeling of social systems (Jeffrey 2007, Jeffrey 20003). Just as specification of the values of B, H, and S completely specifies a particular color, specification of the IA parameters completely specifies a particular behavior, such as the one identified by saying “P bought a lottery ticket” or “P bought fire insurance.”

Principle 2: By “behavior,” we mean *intentional action*.

The intentional action formulation of the concept of behavior is:

Behavior = IA = $\langle I, W, K, Kh, P, A, PC, S \rangle$, where

- I (Identity) identifies the individual whose behavior this is.
- W (Want) identifies what the actor wants, that is, the state of affairs that the actor intends to bring about by engaging in the action.
- K (Know) identifies what the actor takes to be the case and the distinctions he must make to carry out the behavior. “What the actor takes to be the case” includes what are informally called perceptions, beliefs, verified fact, and more generally whatever the actor can, in principle, act on.
- Kh (Know-how) identifies competencies (“know-hows”) the actor must have, to do this behavior.
- P (Performance) identifies the actual process the actor performs to carry out the behavior.
- A (Achievement) identifies the state of affairs that the behavior actually achieves.

- PC (Personal characteristics) identifies the characteristics of the person that behavior is an expression of, when there are such: traits, attitudes, interests, styles, abilities, knowledge, values (motivational priorities), states, and capacities.
- (Significance) identifies the larger behavior this one part of, i.e., what larger behavior the actor is doing by doing this.

Several of the parameters require some elaboration. Before that, we illustrate the analysis with the two behaviors we have previously seen, buying fire insurance and buying a lottery ticket

The parametric formulation of P buying fire insurance is:

1. I: P
2. W: to be protected against financial loss due to a house fire
3. K: the distinction between fire vs. something else, fire insurance vs. something else, protection from damage and something else, the actual possibility of serious loss from fire, the amount she must pay, the coverage provided, various fire insurance providers; various policies
4. Kh: competencies required to seek out and purchase fire insurance and to assess one provider and policy vs. another
5. P: all procedures involved in purchasing the insurance
6. A: P is protected against loss from fire, as specified in the purchased policy
7. PC: We do not have enough information to conclude that this behavior is an expression of a particular characteristic of P. However, the behavior is congruent with P being a prudent person, rather than acting on, for example, seeing a neighbor's house burn and acting "in a panic" – i.e., in that state (which is a PC). If additional examples of this kind of behavior are observed such a conclusion would be warranted.
8. S: by buying fire insurance, P is protecting herself against catastrophic harm, which is itself a behavior.

Buying the lottery ticket is formulated as:

1. I: P
2. W: to have the actual possibility of winning \$100M.
3. K: the distinction between a lottery and something else, a lottery ticket vs. something else, the dollar cost of the ticket, the effective cost of the ticket, the possibility of winning \$100M; distinction between what P's life is like now vs. what would be if she won \$100M
4. Kh: competencies necessary find a location selling lottery tickets and actually making transaction
5. P: the procedure involved in purchasing the ticket.
6. A: P has the possibility of winning \$100M.
7. PC: We do not have enough information to conclude that this behavior is an expression of a particular characteristic of P. However, the behavior is congruent with P being in a state of financial anxiety, or having at least some interest in gambling
8. S: makes possible a major improvement in her life circumstances

Elaborations on the parameters

Extensive discussion of these parameters may be found in Bergner (2010) and particularly Ossorio (2006), but certain aspects of them need some clarification here, for the purposes of this paper.

- The parameters are not theoretical constructs, and the formulation is not a theory about behavior. A specification of values for the parameters is a list of facts about it or aspects of it, not theoretical objects and processes that produce it. An explanation of behavior, or choice of behavior, in terms of what the actor wants, knows, and knows how to do is not a theoretical account. In sharp contrast, a cognitive process account of some aspect of behavior is a stipulation of theoretical constructs such as “underlying” or “mental” processes that produce the behavior.
- The state of affairs P wants (W parameter) to bring about is also P’s reason for acting. Colloquially, we say P “has reason enough to act.” W is a state of affairs, but a state of affairs maybe comprised of several other, constituent, states of affairs, related in various ways. Thus, P may want a piece of pie *and* a cup of coffee.
- It is often the case that what P wants is to *be doing* B, i.e. the value of W is the state of affairs “P is doing B.” This is the case of intrinsic behavior, behavior done “for the sake of doing it,” not for the value of the result of the behavior, as the above-mentioned examples of playing chess and going shopping illustrate. W is not, therefore, the traditional concept of incentives.
- “What the actor takes to be the case” is intentionally non-committal as to traditional truth-value. It includes what are informally called perceptions, beliefs, verified fact, and more generally whatever the actor can, in principle, act on. None of the reformulations and technical elaborations, such as cognitive structures and processes, belief networks, etc. found in cognitive models and artificial intelligence are part of this concept. In particular, the K parameter and its values are not probabilistic concepts; we do not assume that probabilities are associated with what the actor takes to be so, nor that that any rules involving probability calculations, such as Bayesian calculations, are or are not appropriate models of the K parameter values.
- Competencies and skills are not the same concept. Competencies are a parameter of behavior, whereas having a skill is a Personal Characteristic, attributable on the basis of having observed the individual engaging in a a sufficient range of behaviors, in a wide enough circumstances. Skills are acquired by having had an learning history involving behaviors requiring the relevant competencies.
- The value of A is a single state of affairs, as with W. Paradigmatically, the value of A is the same as the value of W, i.e., in the paradigm case P achieves what he sets out to achieve. However, as noted above, a state of affairs may be comprised of several other SAs, so it may be that what is achieved is a complex state of affairs comprised of other related ones, which may need addressing – side effects, unintended consequences, or simple errors. What is achieved is this single, overall, state of affairs A, with various constituents. The formal structure of states of affairs is greatly elaborated Ossorio (2005) and (Jeffrey 2010a). For example,

- in the case of buying fire insurance, A is having protection *and* the state colloquially referred to as “peace of mind,” a fact that is universally recognized and acted on by sellers of home insurance.
- While the values of the W, K, Kh, and A parameters in the above examples are ordinary English phrases, the Intentional Action specification of a behavior is not simply a discursive exposition arranged in a particular way. The common language locutions specifying the parameter values are identifiers of states of affairs (or a process, in the case of the P parameter). Once so identified, these locutions may be used as formal names in the formal state of affairs system (Ossorio 2005, Jeffrey 2010a, Jeffrey 2010b, Jeffrey 2007). In systems using formal state of affairs representation, additional formal names may be used in addition, such as PF100, ProtectedAgainstLoss (a style found in modern computer programming languages), W100M, Z33.1, etc. As with behavior itself, most states of affairs cannot be formally defined, but they can be articulated, using the approach of identifying a state of affairs by name and further specifying it by specifying its constituents and their relationships, again by name. This methodology is discussed at length by Ossorio (2005), and formulated in a mathematical style in Jeffrey (2010a). The central concept is that an actor acts to bring about a state of affairs, which can be identified by a name, a common language expression that serves to identify it, whether or not it can be defined in the classic mathematical sense.
 - In contrast with virtually all other current conceptualizations, W and K do not denote anything “internal,” such “internal states,” “cognitive structures,” “mental objects or processes,” etc. They also do not denote any physiological state, structure, or process, including neurological or hormonal ones. K, for example, identifies what the actor takes to be the case and the distinctions he is acting on, not a “state of mind,” thought process, mental construct, etc.
 - The parameters provide the logical link necessary for doing non-reductive neuroeconomics and other neurophysiology. They formally specify how discovered neurophysiological processes and states are related to what the actor does in the real world, i.e., his behavior. For example, one may investigate what neurological processes and structures are involved in recognizing instances of concepts (K parameter), what neurological structures and processes are involved when an individual is presented with an opportunity to get something they value (W parameter), etc. It is not the case, however, that these processes and structures are constitutive of the behavior or any aspect of it, other than the P parameter, the steps involved (which, as articulated below, can be described in terms of sub-processes, sub-sub-processes, etc., in the usual way).
 - The Kh parameter is responsive to the need to address the fact that persons commonly do things – that is, engage in behaviors – for which we cannot specify a procedure, and in many cases for which no procedure has ever been specified, behaviors which we customarily say they “learned how” or “know how” to do. A major league baseball player can routinely hit a baseball over the fence in batting practice; a trained physician can diagnose many diseases with a high degree of accuracy; some investors can select a basket of securities whose collective performance far exceeds that of a randomly selected basket. The values of the Kh

parameter are the states of affairs the actor has the competencies to bring about, but not via a procedure. Physicians do not identify a disease or condition by engaging in a procedure (though they may engage in procedures, such as getting test results, before they make the diagnosis); financial analysts do not select securities by engaging in a procedure (though they may engage in procedures, such as studying a company and an industry, before they make the selection).

The traditional formulation of this kind of fact has been to assume that there is an “unconscious process” doing the calculation. This methodological assumption is seen clearly in the writing of Kahneman and Tversky (1974, 1986, 2000), in which they explicitly describe decisions in terms of Bayesian probability calculations and flaws in how those calculations are carried out. It is almost universal, for example, to refer to choice as a process (Kahneman and Tversky 2000, p. 32). The intentional action formulation deliberately refrains from making such assumptions, taking the most conservative approach possible, namely, incorporating only what is observable about a behavior, rather than including hypothesized “mental processes.”

- The P parameter, the observable “behavioral episode” or performance, itself has extensive structure, specified by a Process Description (Ossorio 2006):
 - The Stages of the process, a task description of the steps involved in a process
 - The Options for one or more stages: alternative processes that produce the same outcome of a Stage
 - Constraints on the occurrence of a Stage or Option, in terms of the occurrence of some other Stage or Option, or on some object (which may be a person) involved in the process having some attribute.
 - The logical roles in the process, which Ossorio terms Elements
 - The actual Individuals that may serve as each of the Elements
 - The Eligibilities of each individual to be each Element, which include governing rules
 - Versions, the actual sets of Stages (and Options for a Stage) that may occur and be considered to be occurrences of the process.
- The Eligibilities parameter encodes the precise change in state of affairs that is accomplished by buying a lottery ticket: a ticket-holder is *eligible* to win the lottery.
- An important point for our purposes here is that what actually occurs is the *instantiated version* of a process. Thus, a complete specification of an actual behavior is specified by specifying the values of the IA parameters *and* the instantiated version of the P parameter.
- Personal Characteristics are a parametric analysis of the ways in which persons – economic actors – can vary. The direct connection to behavior is that 1) sometimes a behavior reflects one or more characteristics of the actor, rather than the circumstances, and 2) observed patterns of a kind of behavior give a describer reason to ascribe a characteristic to the person. A cautious investor, for example, is one who repeatedly and regularly chooses the cautious investment option, when presented with the choice.

Where does money fit?

Our purpose here is to formulate a new paradigm for economics, not discuss behavior in general, and we therefore must identify where money fits in the conceptual framework. Money appears in Intentional Action in several places:

1. Money may be a constraint on the occurrence of a Stage, and therefore on engaging in a practice at all. Since practices are parts of other, larger, behaviors, this represents the common situation of having an insufficient amount of money to complete a small but necessary step in a larger behavior, preventing it from taking place. For example, a new university graduate wants to take a job as a programmer, to engage in the larger behavior of deciding on a career, but lacks money to pay for gasoline to get to the job, which is 1000 miles away. Unless remedied, the “small” amount of money prevents the occurrence of the behavior. This is the issue of credit and capital, an issue currently of extreme micro- and macro-economic interest a number of national economies of the West. For impoverished people, this situation is a common fact of life.
2. Money may be a constraint that determines which version of the behavior is engaged in. Consider, for example, a couple celebrating their anniversary. This may be done in a number of ways: going out to dinner, taking a cruise, taking an anniversary trip, buying gifts, etc. Which one is done is constrained by the money available to the couple. Further, the particular version of the behavior is similarly constrained: the cost of the particular restaurant, cruise, trip, and so on.
3. Personal characteristics including values, traits, attitudes, and styles related to money affect the behaviors a person will choose and the versions of it, as illustrated by the anniversary celebration example. For example, a wealthy but extremely frugal person may go to a cheaper restaurant to celebrate than will his poorer cousin.
4. The traditional “medium of exchange”: referring to the structure of the P parameter above, behaviors involve actual existing “things” (Individuals) serving as Elements in the performance of the behavior. If there is no version of a behavior for which the requisite Individuals for the Elements are present, the behavior cannot occur. In the behavior of baking a pie, for example, there are Elements including ingredients, pie, baker, oven, pie plate, and so on, and there must be actual Individuals to fill each role, or the behavior of baking a pie does not occur. In many purchasing behaviors, money is an Element in the specification of the P parameter, and there must be an actual amount of money to serve in that role, or the behavior cannot occur. The specification of the P parameter may involve a note, bond, or other promise to pay, in a particular amount. The specific instrument is then an Individual serving as an Element in the Performance, and as with the simpler case of the direct medium of exchange there must be such an Individual for the behavior to take place.
5. The amount of money a person has – their wealth – is a Personal Characteristic of the person. As articulated here, the value of money to an individual is that it provides *potential for behavior*: a given amount of money affects the potential for engaging in some set of behaviors, and crudely speaking, the larger the amount, the larger the set of behaviors.

The logical relationship between money and behavior is well known. Kahneman and Tversky (2000) state, “Any discussion of the utility function of money must leave room for the effect of special circumstances of preferences. For example, the utility function of an individual who needs \$60,000 to purchase a house may reveal an exceptionally steep rise near the critical value,” acknowledging the direct connection between money and behavior. However, they continue in a way that reveals a profound and fundamental flaw in their analysis and more generally in the concept of value in their work and in the traditional paradigm of economics: “...the derived value (utility) function of an individual does not always reflect ‘pure’ attitudes to money, since it could be affected by additional consequences associated with specific amounts.” The flaw is that *there is no such thing as the pure value of money*, nor a “pure” attitude toward it. The value of money is *always* the value of a specific amount for the specific person in the specific circumstances of their life at that moment. Attempting to identify the “pure” value of money is analogous to attempting to identify the “pure” shape of a triangle: there is no such thing. There are specific values of specific angles and lengths of sides. At best, the attempt to define the “pure” value of money may be an attempt to find some value that is the average over a particular population with a specific range of circumstances, but this is no more a pure value than an average value of the angles of a set of triangles is a pure angle value.

Buying fire insurance and buying a lottery ticket have the Significance of protecting oneself from catastrophic harm and making possible a drastic improvement in one’s position in life, respectively. We noted that these are recognizable as behaviors – things people do – but we have not yet addressed two important related questions: 1) Recognizable by whom, and 2) What behaviors are available to be the values of the S parameter? How do we know, for example, that by buying a lottery ticket P is not engaging in giving to charity (a different larger practice)? These questions will be addressed in Section IV, Communities, below.

Partial specifications

Full specification of an actual behavior requires specification of the eight parameters of Intentional Action, but this does not mean that only complete specifications are used or are correct. Many ordinary language descriptions of behavior are partial specifications, omitting one or more parameters. “P bought fire insurance” is such a description: the locution identifies only I and A, but nonetheless identifies a recognizable behavior; on hearing the sentence, “Jane bought fire insurance”, we do not ask, “What did she do?”

Ordinary language does not, however, have standard linguistic “markers” for one kind of specification or another. It is having the fully specified parametric form that allows the identification of the kind of description being used, by comparison with the full one. It is sometimes useful to identify various kinds of behavior description such as the achievement description (specifying only A), performance description (specifying only P), and so on (Ossorio 2006). “P bought fire insurance” and “P bought the security” are achievement descriptions; “buying the fire insurance” and “buying the security” are performance descriptions of the respective behaviors.

While a partial description such as an achievement description is not defective, it is partial, and like any partial specification it may be seriously misleading if the partial description becomes accepted as “what is really going on.” In such a case the *aspect* of the phenomenon the description refers to may come to be seen as the entire phenomenon. When this happens the partial phenomenon becomes the focus of study, and the omitted aspects become uncontrolled variables and “outside influences.” This is precisely what has happened in economics: the focus of study has become numerical measures applied to some, but not all, aspects of the A parameter. This situation has not been repaired by current behavioral economics. The form of behavior description used virtually universally is a particular kind of partial description, an *incomplete achievement description* (IAD): a description referring only to the direct outcome of the Performance aspect of the behavior. “P buys X at cost C,” identifies the achievement of having X and C less total wealth, but omits all other aspects of the behavior, particularly S, as illustrated by “P buys fire insurance” and “P buys a lottery ticket.” Gambles and analyses of them in terms of numerical utility are presenting and analyzing IADs of behaviors. We saw earlier that the appearance of paradox in buying fire insurance as well as lottery is due to using IADs and in particular to the failure to consider the Significance parameter of the behaviors.

Intentional Action and gambles

Let us see how Principles 1 and 2 apply to the gamble, a device used routinely to analyze economic decisions. A gamble defines an experiment that is a choice between two or more options, each of which is a partially specified behavior. In the simplest form, each behavior specifies only the outcome and its probability; W, Kh, P, PC, and S are omitted. For example, the classic Allais paradox consists of the following two experiments:

| Experiment 1 | | | | Experiment 2 | | | |
|--------------|-------------|-----------|-------------|--------------|-------------|-----------|-------------|
| Gamble 1A | | Gamble 1B | | Gamble 2A | | Gamble 2B | |
| Amount | Probability | Amount | Probability | Amount | Probability | Amount | Probability |
| \$1M | 100% | \$1M | 89% | 0 | 89% | 0 | 90% |
| | | 0 | 1% | \$1M | 11% | | |
| | | \$5M | 10% | | | \$5M | 10% |

Each choice defines a particular behavior. Behavior 1A, for example, is:

- I = P
- W: having \$1M more money
- K: \$1M vs. other amounts; winning vs. other things; certainty of getting \$1M
- A: P has \$1M more money
- Kh, P, PC, S: omitted

Or, using θ to indicate “omitted” or “null value,”

- Behavior 1A = $\langle P, W_{1A}, K_{1A}, \theta, \theta, A_{1A}, \theta, \theta \rangle$

While it is straightforward to specify the behavior, i.e. the IA parameter values, for Gamble 1A, the other cases are not, due to an important subtlety of what the parameters represent. The IA parameters represent what the actor wants (W), what distinctions he is acting on (K), the significance (S) for the actor, and so forth. In particular, consider Gambles 2A and 2B. The experimenter presents the 2A as having an 11% probability of winning \$1M and 2B as 10% of winning \$5M, and therefore is distinguishing between 10% and 11%, but this does *not* mean that the actor acts on the distinction of 10% vs. 11%. Whether the actor makes the same distinctions as the experimenter presenting the gambles depends on the personal characteristics of the actor. Unless the subjects of the experiment have had specific learning histories, one would not expect them to distinguish between probabilities of 0.10 and 0.11. It is substantially more common for actors to make distinctions such as, “very unlikely – unlikely – half-and-half – likely – very likely,” and in fact the empirical data on choices by subjects presented with these experiments is consistent with subjects not distinguishing between probabilities 0.10 and 0.11 in these behaviors. Historically, humans used concepts such as “probably” and “far-fetched but possible” for millennia before the development of mathematical probability theory, and because so many events in the real world require acting on such concepts it is reasonable to suppose that an ordinary person, such as an experimental subject in a behavioral economics experiment with no other training, is competent in their use. Imagine, for example, a person in any ordinary environment (social or natural) unable to act on the distinction between “probably” and “unlikely.”

This is a very common methodological error in behavioral economics: failing to verify that the distinctions the experimental subject is acting on when they answer a question are the same as those the experimenter is acting on in asking it. This is discussed in more detail in Jeffrey (2010).

The Allais paradox will be further discussed in Section III, in which we examine the concept of choice.

Section III Choice, behavior, and reasons

Principle 3: Human behavior is *deliberate action*. In the paradigm, and almost the universal case, human actors know what they are doing, and want to do it. This situation is captured technically via specifying that the values of the W and K parameters in the Intentional Action formulation include the behavior the individual is engaging in.

The K parameter of Intentional Action represents what the actor knows, i.e., the distinctions he is acting on and what he takes to be the case, with a list of formal names, and the W parameter identifies, also by formal name, what the actor wants, i.e., the state of affairs he is acting to bring about. By having W and K include the (name of) the behavior, we obtain a formal representation of an actor knowing what they are doing and choosing to do it.

For example, buying a lottery ticket is deliberate action: a buyer wants to buy a ticket and knows they are doing so. The Deliberate Action description of buying a lottery ticket is:

- W: buying a lottery ticket; to have the actual possibility of winning \$100M
- K: buying a lottery ticket; a lottery and something else, a lottery ticket vs. something else, the dollar cost of the ticket, the effective cost of the ticket, the possibility of winning \$100M.

Principle 4: People act on their reasons. We noted at the outset of this article that “rationality” has been defined, in economics and more broadly as acting in one’s self-interest, as quantified by expected value. More recently it has been used to refer to the fact that when presented with gambles a number of factors outside the gamble itself influence the choice: framing, mental accounting, the endowment effect, and social influences being the most significant. Ariely (2008) exemplifies the use of the term in the broader sense, namely that persons are controlled by effects beyond their knowledge that drive them to do things that do not reflect the “real” value of the different outcomes.

There is a much older concept of rationality, stretching back at least to Aristotle, that we use and formalize here. That is the concept that in the typical situation people have a number of reasons to do different things, many of which conflict, and their choice reflects the relative priority that the various reasons have for the person. In this sense persons are completely rational all of the time: they always act on the reasons they have, in ways that reflect their traits, attitudes, knowledge, and state at the time. A behavioral choice that appears irrational appears as such only because the situation, including the actor’s reasons, has not been sufficiently articulated in terms of the circumstances as perceived by the actor and the reasons each circumstance give the actor. The appearance of irrationality, the theme of this article, is due to having an incomplete specification of the actor’s circumstance and the reasons those circumstances give him to act. We noted earlier that the Friedman-Savage “paradox” is the result of insisting that single characteristic, “loss aversion,” defined on a mathematical model of an actor’s self-interest. With the concepts of deliberate action and reasons we present a complete formulation of what is actually happening when an actor makes a choice, and thereby show exactly what the dual principles of loss aversion and expected value omit.

All choices of behaviors are made in light of all the individual’s reasons to engage in one behavior or another. A reason is a “ground for action,” that is, a state of affairs that carries tautological implications for action – to engage it, to refrain from it, to find out more about it, etc. An actor values some states of affairs over others, and that value may be of four distinct kinds: hedonic (what is pleasurable), prudential (what is in the actor’s interest), ethical (what is morally right or wrong), and esthetic (what is appropriate, including acting on relationships the actor has with other persons or things, or artistically valued). Or, less formally, circumstances give a person reason to act, and those reasons may be multitudinous and conflicting. The relationship of reasons to action is somewhat similar to that between forces and motion of an object: a force on an object will cause it to move in the direction of the force, unless there is another force acting on it. If P recognizes that behavior B has outcome A, which he values, he will engage in B, unless

he has reasons to do otherwise – such as recognizing an opportunity to do B’ with outcome A’ which he values more highly.

Further, for a given individual, different reasons have different priorities or “weights.” A cautious individual, for example, may refrain from buying a security with high potential returns if he takes it that there is substantial risk, while a risk-taker would not. The pattern of priorities that reasons have for different individuals is a major type of Personal Characteristic, as the “cautious” and “risk-taker” characterizations illustrate.

The relationship between outcome-based economics (homo economicus or current behavioral economics) and the behavioral paradigm is that the values of the W and A parameters of the behaviors are circumstances, and the values those circumstance have to the actor constitute reasons to act in one way or another. The articulation of the behaviors is the “full story” of which a specification of outcomes is an incomplete version. The choice of outcome X is in fact the choice to engage in behavior B_k, whose outcome is X, of the behaviors B₁,...,B_n that could be engaged in.

Thus, a decision is not a process; it is a state of affairs involving behaviors, reasons to engage in each, and the fact that one behavior was actually done. The phrase “decision making process,” is an unfortunate misnomer, based on the *a priori* assumption that there “must be” a process that produces the choice. The observed facts are that 1) actors choose to do one of the things they could do, and 2) some actors, in some circumstances, do other things before they choose their behavior – evaluate consequences, get additional information, examine their priorities, etc. That is not a process that produces a choice; it is what sometimes occurs when people make choices between available behaviors. (This does not mean that neurophysiological events do not occur when actors make choices, nor that the study of those events, processes, and structures is in any illegitimate. The substantial data about what occurs in the brain when people are presented with a situation requiring a choice is precisely that: data about processes and structures in the brain when the individual has a choice of what to do. All such data is correlative: it states that *when* subjects do task T, neurophysiological event E occurs.)

The relationships between circumstances, reasons, weights, and the decision can be represented in the following schematic, the CRJ diagram (Ossorio 2006, p.228):

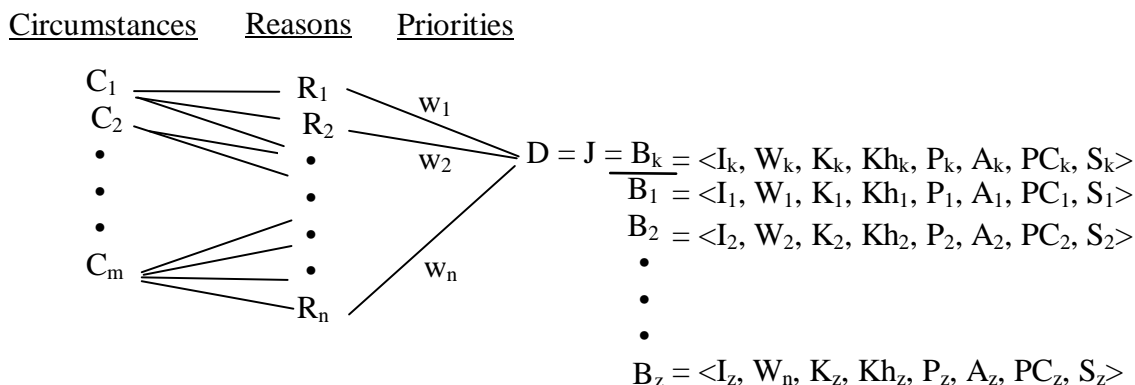


Figure 1: Circumstances, Reasons, and Judgment

(The possible behaviors are $B_1 \dots B_z$ because there may be more than one reason to do or not do a given behavior.)

The diagram incorporates the behavior parameters for each of $B_1 \dots B_n$ to represent the fact that a difference in a single parameter denotes a different behavior, and therefore a different choice. In particular, the S parameter is very important in understanding choice in economics, as we saw with the lottery ticket example. The parameters articulate how it makes sense to say, “P is buying a chance to make a major improvement in her life.” A similar case is the one due to Abelson, a psychologist who gave a counter-example to the notion that incentives are always why people do what they do: he (Abelson) visiting his granddaughter, for the sole purpose of “doting” on her (Abelson 1996). As we noted briefly above, one kind of reason is esthetic, and one kind of esthetic reason that having relationship R gives an actor reason to engage in some behaviors and refrain from others. Having the relationship “grandfather-granddaughter” gives Abelson reason to visit his granddaughter. The specification of this behavior therefore includes the specification $S = \text{“visit granddaughter”}$.

Many behaviors are purchasing behaviors, in which some good or service is purchased for money, and neither the buyer, seller, a third party setting a price, nor an economist studying a market knows the significance of the purchase. This is virtually always the case, for example, when a provider sets a price for a group of buyers. (The clearest exception may be certain segments of the healthcare market. The significance of, e.g., cancer surgery, is known to all.) Because of this, the cost of a good or service may be much less than the value to a particular actor. If, for example, Abelson pays \$10 for a taxi to get from the airport to his granddaughters home, he is getting much more than \$10 value. A market price is the effective aggregation of the value of the item to all potential buyers, that value being the value of the behavior or behaviors the item makes possible.

As the diagram indicates, a particular circumstance may provide more than one reason. While the priorities may be modeled as numerical values (thus the term “weights”), a behavioral priority is not numerical concept, and indicate relative priority, not absolute values or quantities. The lines between the C_i and R_j , and the R_j and D, indicate only the logical relationships between circumstances and reasons and between reasons and behaviors, *not* steps of a process.

That there are four kinds of value, not only one, has important implications for economics as it has been mathematically formulated heretofore. Because there are four distinct kinds of value, value is a 4-dimensional vector, not a scalar. The axioms of expected utility – completeness, transitivity, convexity, and independence – are all therefore invalid, because one cannot order 4-vectors. Mathematically, this means that a series of behaviors with outcomes A_1, A_2, \dots traces a curve in 4-space, not a progression on the real line. This is the mathematical form of Mill’s observation that economics “makes entire abstraction of every other human passion or motive.”

That a person has an object, or has purchased a service, is a state of affairs, and thus all the development above applies to traditional economic choices. However, states of affairs are a much more complex and wide-ranging concept than this. In particular, as we saw with the purchase of the lottery ticket, that something is possible is itself a state of affairs. (This is not to be confused with probability; to say that X is possible is to assert nothing as to the probability of X, and in particular it is not to assert that applying probability to X is valid at all.) To say something is possible is to say that there is some actual process or event that can bring that state of affairs about.

The Allais Paradox revisited: numbers and Significance

The Allais experiments showed conclusively that expected utility was not an accurate model of human choices.

When asked, most people choose 1A over 1B, reflecting their assessment that the value of the outcome of 1A is greater than that of 1B, i.e., they had stronger reason to choose Behavior 1A than 1B. We noted in the discussion of partial specifications above that utility is defined on the outcome of the behavior, omitting all other aspects, including S. It has been intended as a measure of the value to the person of the achieved state of affairs, in this case of 1A and 1B. Comparing utilities, as currently done, is comparing numerical measures defined on seriously incomplete descriptions of the actual phenomena, in particular descriptions that omit the aspect most important to an actor and therefore whose inclusion is most important if the goal is mathematics representative of actual economic decisions: the S parameter. Persons who buy lottery tickets know exactly why they do so: having a lottery ticket makes possible a massive improvement in their life circumstances. Basing utility on incomplete achievement descriptions, incorporating only those states of affairs whose value can be numerically measured, is the phenomenon to which Mill was speaking, namely, that economics addresses only those aspects of human behavior devoted to acquiring wealth. The utility of a lottery ticket, for example, is defined as probability of winning times u(amount to be won), not u(new life circumstances).

The value of a utility measure depends on how carefully the correspondence between it and actual value, including S, is maintained by the experimenter and analyst of experimental results. Numerically the utility of the outcomes of 1A and 1B are $u(1M)$ and $0.01 * u(0) + 0.89 * u(1M) + 0.1 * u(5M)$. If $u(1A)$ and $u(1B)$ accurately represent the values of these outcomes, the choices show that

$$u(1M) > 0.01 * u(0) + 0.89 * u(1M) + 0.1 * u(5M). \quad (1)$$

Subtracting the term $0.89 * u(1M)$ from each side, (1) yields

$$0.11 * u(1M) > 0.01 * u(0) + 0.1 * u(5M), \text{ or}$$

$$\text{or} \quad -0.01 * u(0) > 0.10 * u(5M) - 0.11 * u(1M) \quad (2)$$

Formula (2) represents the value $u(0)$ as having 10 times the motivational effect as the difference between the 10% chance of winning \$5M and an 11% chance of winning \$1M. Allais noted that this was implausible, an assessment echoed by Kahneman and Tversky (1979), in work leading to their introduction of the prospect function $\pi(p)$.

However, Kahneman and Tversky's work is not based on the classic Allais experiments, but rather on a series of experiments which they treat as equivalent. In particular, Kahneman and Tversky make the following two assumptions:

1. They drop without comment the utility of winning nothing, which is to assume that $u(0) = 0$.
2. They greatly reduce the amounts to be won, from \$1M and \$5M to \$2400 and \$2500.

Here we see the impact of analysis based on achievement descriptions, in particular the omission of the S parameter. Omitting S yields conflation of distinct behaviors, as we shall see below.

Is $u(0) = 0$?

Since utility is defined as measuring the value of the outcome, it is trivial that $u(0) = 0$, but examination of S shows that the simple numerical fact represents a seriously deficient picture. The outcome of the case of winning nothing is not 0; it is the loss of the possibility of being rich. Winning nothing is one possible result of Behavior 1B, a constituent of the state of affairs resulting from choosing Behavior 1B (the others being winning \$1M and \$5M). The larger behaviors the subject is engaging in by engaging in 1A or 1B are:

1. Behavior 1A-S: Making a great improvement in their life circumstances, or
2. Behavior 1B-S: Accepting the offer of the *possibility* of a great improvement in their life circumstances.

In other words, by choosing Behavior 1A, a subject chooses to be rich (that is to say, the state of affairs whose customary name is "being rich"), whereas by choosing 1B a subject chooses the state of affairs comprised of the possibilities of being very rich and of having no additional wealth.

Kahneman and Tversky (1979) argue that the carrier of utility is change in wealth, not total wealth. It is neither. The carrier of utility is value, to the actor, of the states of affairs brought about by the behavior, *including* its Significance. Since choice is choice of behavior, and behavior includes S, any specification of the basis of choice, and any numerical measure defined on that basis, that does not include Significance is defective and misleading, an inappropriate model of choice by human actors. The numerical value $u(0)$ is defective in precisely this way: it ignores Significance and therefore cannot be used in any calculation intended to represent the basis choice by human subjects.

Is winning \$2400 equivalent to winning \$1M?

Kahneman and Tversky's second assumption particularly illustrates the importance of the S parameter in experimental design. For ease of comparison, the Allais and Kahneman-Tversky gambles are:

| Allais Experiment 1 | | | | Allais Experiment 2 | | | |
|---------------------|-------------|-----------|-------------|---------------------|-------------|-----------|-------------|
| Gamble 1A | | Gamble 1B | | Gamble 2A | | Gamble 2B | |
| Amount | Probability | Amount | Probability | Amount | Probability | Amount | Probability |
| \$1M | 100% | \$1M | 89% | 0 | 89% | 0 | 90% |
| | | 0 | 1% | \$1M | 11% | | |
| | | \$5M | 10% | | | \$5M | 10% |

| K-T Experiment 1 | | | | K-T Experiment 2 | | | |
|------------------|-------------|-----------|-------------|------------------|-------------|-----------|-------------|
| Gamble 1A | | Gamble 1B | | Gamble 2A | | Gamble 2B | |
| Amount | Probability | Amount | Probability | Amount | Probability | Amount | Probability |
| \$2400 | 100% | \$2400 | 66% | 0 | 66% | 0 | 67% |
| | | 0 | 1% | \$2400 | 34% | | |
| | | \$2500 | 33% | | | \$2500 | 33% |

For the K-T gambles, most subjects again show violation of expected utility predictions, choosing KT-1A over KT-1B (Kahneman and Tversky, 1979). However, the Allais gambles and the K-T gambles have very different Significance. The Significance of winning \$2400 or \$2500 is, for most American students in 1979 (Kahneman and Tversky's experimental subjects) an increase in behavior potential that could be fairly considered substantial but by no means overwhelming: purchasing a car, paying rent for year, paying one year's tuition at a public university, etc. These are obviously significant increases in a subject's behavior potential, but are equally obviously not life-changing, as \$1M in 1953 was.

Fruit flies and gambles

Gambles are a universal tool for decision analysis in economics and behavioral economics. It is acknowledged that they are artificial in the way that laboratory experiments are artificial, and that generalization of results of experiments based on them is an important issue. Kahneman and Tversky (1979, p. xi) address using gambles, whose "domain of application [to choice in real situations] is so restricted and artificial," stating, "choice between gambles is the fruit fly of decision theory," containing many essential elements of much larger problems. They continue, "...we study gambles in the hope that the principles that govern the simple case will extend in recognizable form to complex situations."

Fruit flies have the role they do in genetics because they have the crucial characteristic that makes them useful for studying genetics: sexual reproduction. By contrast bacteria, reproducing by fission, lack it. What enables biologists to determine that fruit flies and not bacteria can be used to study genetics is that biologists have a specification of the characteristics of organisms – the ways in which they can vary – including mode of reproduction, and can therefore identify which variables may be omitted in selecting a simplified case: weight, body dimensions, life span, etc. Because of this, biologists do not merely hope that the genetics principles they find will generalize; they *know* they do. Economists and behavioral economists have not been in a similar position because they have not heretofore had a precise systematic articulation of the ways in which human behaviors vary, analogous to the ways in which organisms vary, and therefore not had a precise and systematic way to identify how gambles do or do not model choice of behavior by actual economic persons.

Gambles cannot serve as the fruit flies of decision theory because, as we have seen, they omit crucial variables, most notably Significance. Attempting to generalize from incomplete achievement descriptions to actual behavior is at best a matter for hope.

The significance of numbers

Mathematicians do mathematics; engineers *use* mathematics. The difference is crucial. To a mathematician, the elegance, beauty, and internal consistency of the work are the sole criteria; applicability to actual cases is irrelevant. In sharp contrast, when engineers use mathematics, they are continually aware of the crucial importance of the correspondence between the mathematics and the real world. A good deal of the training of engineers is in exactly this arena. Engineers examine the aspects of the real world situation – its variables – and make sure the variables that can affect the outcomes are modeled by the mathematics.

The central concept here is that numbers are *inherently* not significant, and it is as true of economics as engineering. In economics, it means that the correspondence between the numerical/mathematical model and the behavioral situation is of central and continually ongoing concern. Unlike engineers, economists have lacked a necessary resource for ensuring that correspondence: a systematic framework for specifying how behaviors can vary, and the relationships between facts, reasons, behaviors, outcomes, and value. The articulations above constitute exactly such a framework, thereby making possible the precise articulation of the ways in which a laboratory situation such as a gamble does or does not represent choices in the real world.

Choice and Significance

The logic of choice of behavior (Principle 3) and reasons (Principle 4) can be summarized in the following:

Principle 5: People choose what matters to them. By “what matters” we are referring to the value of the *entire* state of affairs that results from the action, including Significance. To avoid misunderstandings such as the history of the tension between rationality and bounded rationality, we emphasize that this is a summary formulation. In a bit more detail, people choose on the basis of significance, subject to:

- Having the requisite knowledge, skills, abilities, and other Personal Characteristics to be able to recognize the outcomes of the respective behaviors and assess their effects
- Their individual values, that is, their behavioral priorities.

Choice is never on the basis of numerical measure of outcome; when numerical measures are a good model, it is because the measure represents what matters.

Section IV Communities

Social psychology, clinical psychology, organizational psychology, sociology, political science, anthropology, and indeed every academic or scientific discipline whose focus is humans and human behavior recognize that every person is a member of one or more organized, cohesive groups of people, and that the individual’s behavior is intimately related to their position in the group and the group’s principles governing conduct. The connection between behavior and group membership is reflected, for example, in Mill’s references to “human nature as modified by the state” and “man in society.” The actions of a person or population of persons cannot be understood, adequately specified, modeled, or predicted without incorporating the relevant facts about the groups of which they are a member, and how those facts are related to the behavior. Such groups, which we call *communities*, include families, businesses, ethnic group, nations, work teams, street gangs, military organizations, professions, churches, academic disciplines, and a wide variety of others.

Further, a person is not *just* a member of a community; they occupy one or more recognizable positions within it: father (in their family), cousin (in their extended family), investment advisor (in a bank), Certified Financial Analyst (in their profession), citizen (of their country), deacon (in their church), respected economist (in the economics profession), Full Professor (in a university), etc. This structure of positions and their relationships is usually referred to as the “social structure” of the group.

An aspect of communities of particular importance to a paradigm for economics is that communities have principles governing choices to which members are expected to adhere. An observant Jew will not engage in business on the Sabbath, Mormons do not drink alcohol, Muslims do not charge interest (a fact of enormous macroeconomic impact in Muslim countries). Recalling Principle 4 and Fig. 1, the direct effect of a community’s choice principle on actor choice is that it gives the actor reason to engage or not engage in a practice.

A further, and central, aspect of the intimate relationship between individual behavior and the communities the individual is a member of, is that behaviors are what group members do *as* member of the community. A physician diagnosing a patient is acting as a member of the medical community, in the position of physician; an investor is acting as a member of the investment community, in the position with that name; similarly with a financial advisor, a hedge fund CEO, and so on. In other words, there is a range of behaviors available to members of a community.

As Ossorio did with behavior, Putman (1981) used the various recognizable aspects of communities to give a parametric formulation of the concept of community, as follows:

A Community is a 7-tuple $\langle M, P, Cp, S, L, C, W \rangle$, where:

- M (Members) identifies the individuals in the community.
- P (Practices) identifies behaviors available to members of the community. Following customary usage, the behaviors are termed the *social practices* (or practices).
- Cp (Choice Principles) identifies states of affairs related to Practices that are grounds for choosing among practices or versions of a practice.
- S (Statuses) identifies the recognizable positions in the Community.
- L (Locutions) identifies the specific words and phrases used by Members of the Community in talking about what there is to talk about in the life of the Community: events, objects, states of affairs, and practices.
- C (Concepts) identifies the distinctions on which Members of the community can act.
- W (World) identifies the community's World, which includes all the states of affairs that are or could be the case, everything that can be done (the Practices), and all the objects and their parts involved in any of the practices.

As with the parameters of Intentional Action, several of the Community parameters require some elaboration.

- As with the IA parameters, each parameter is identified by a name that is an ordinary language locution, but which acts as a formal identifier, not a "definition." This is particularly significant in specifying Choice Principles and World, as discussed below.
- The Members of a Community are typically the humans involved, but they can include any actor. In some applications it is useful, for example, to include certain animals, and in technical implementations, including software simulations, it may be useful to include some computers and software.
- The Practices are what are commonly called "social practices" in the social sciences. A practice is a pattern of behaviors; the pattern is described by Practice Description format, in which each Stage or Option is a behavior. Thus, behaviors are Practices. A Community's Practices encompass everything that a member of that community can do, as a member of that community. Although common usage is to refer to actions done by a single person as behavior, and organized sets of actions by two or more persons as "practices, the two are equivalent: one can say,

- “He did X,” or, “He engaged in Practice X.” (Combining the Intentional Action and Process descriptions results in a form termed the Social Practice Canonical Form in Jeffrey (2010a).)
- Choice Principles refer to the aspect of community life often referred to in the social sciences as “social attitudes” or “norms”. They identify the priorities Members are expected to demonstrate in their choice of what to do and how to do it, i.e., choice of practice and version of the practice. In other settings, such as organizations, Choice Principles are often referred to with terms such as “our priorities,” “principles and practices,” “our philosophy,” and so on. Choice principles are the direct representation of the widely recognized influence of community membership on member behavior: choice principles give a Member reason to act, in choosing what Practice to engage in or what version of it to carry out. They are a large part of what is often called “culture”, both ethnic or religious subcultures and organizational culture. Culture is often considered “slippery,” i.e. difficult to specify, in part because locutions commonly used to refer to Choice Principles do not refer directly and literally to behaviors (practices). For example, a major automobile manufacturer for many years had a Choice Principle known as, “Quality is Job 1.” This language cannot be taken literally, but is an effective identifier of a state of affairs having high priority in the company: producing high quality automobiles. In general, as previously, a state of affairs is identified by a name, but that name need not be a definition. Also as previously, while the name is an ordinary language locution, it is treated as a formal name and may have other equivalent formal names. This is of considerable use in technical implementations of the concept of Community, such as computer simulations of communities, including economic simulations.
 - The Statuses of a Community are all the positions identifiable by members of that community, both formal and informal. “President”, “Senator”, “husband”, “child”, “suicide bomber”, “respected leader”, “doctor”, “farmer”, etc., are all names of positions in different communities. An important logical connection is that each Status has associated with it certain practices that are intrinsic to a person in that Status, that is, practices done simply because the member has that Status. A person in that status will therefore always have reason to engage in such a practice. The practices intrinsic to a status are analogous to a “job description” for a Status; they are what a Member does for no other reason other than having that position in the Community. Thus farmers farm, doctors treat the sick and injured, chess players play chess, and homemakers shop because it is their “job.”
 - A Status represents a set of Eligibilities for behaviors (recalling that Eligibility is an aspect of the procedural aspect of a behavior). Without the requisite position, a person cannot do the action, regardless of whether they have the necessary motivation, knowledge and skills. As a result, a person’s Statuses in the Communities of which they are members matter to them. In the paradigm case, people act to preserve their statuses and to acquire new ones, and loss of a Status is important – usually, a significant loss. (There are of course cases in which the person prefers to lose the Status, for example, when enacting the Status requires actions the Member dislikes or has some other objection to.)

- Engaging in practices intrinsic to a Status is the typical way a Member acquires a Status. Consider, for example, a common scenario: a special purpose task force is created by identifying a group of members of a firm and identifying the purpose, but not otherwise structuring the group. One member “takes charge”: leading efforts to define a clear vision of the goal along with principles to be followed in carrying out the work of the task force and evaluating results; creating or deciding on practices the members will follow in accomplishing the purpose; and identifying positions and responsibilities. That member is acting as a leader, a recognizable position with the task force, which is, on agreement by the task force members of the practices, statuses, principles, and statuses, a Community. The member who took charge has become the leader in that task force, by engaging the practices leaders engage in.
- Conversely, certain behaviors can lead to a Member losing a Status. Consider again the leader of the task force. If the leader refuses to participate in discussions setting direction, resolving differences, and ensuring that the task force is making adequate progress toward the assigned goal, he or she is not acting as a leader, and in short order will not have that Status in that Community, undergoing a degradation (as it is known in the social sciences and as articulated in (Ossorio, 2006) and (Putman, 1981)). In other words, to refuse to engage in a practice is itself a behavior, and certain behaviors have the effect the loss of the relevant status – a degradation.
- The Concepts of a Community are the distinctions shared by Members of the Community. They are the distinctions that may appear as specifications of values of the K parameter in Members’ behaviors, i.e., the concepts Members can, in principle, act on, *as* Members
- The locution “world” is used to mean a number of different things in common usage. Physical scientists typically use it to refer to the world consisting of all physical objects, whose ultimate constituents are sub-atomic particles (or tiny vibrating strings, depending on which physicist you talk to.). By contrast, social scientists of all kinds typically use “world” to identify the whole whose parts are the things, persons, relationships, states of affairs, objects, events, behaviors, and everything that matters to a Member of the Community. In everyday usage people often use it to refer to both concepts, sometimes interchangeably. It is the latter concept, sometimes called “the behavioral world,” that is indicated by the World parameter here. A Community’s World is specified, as with the other parameters, via an ordinary language locution (and optionally, in technical applications, other additional formal names) that identifies the single complex configuration consisting of everything that is or could be the case: all actual and possible states of affairs, all the Members and relationships between them, everything the Members can do (their Practices), and all the objects or parts of them that have any role in any of the Practices. The objects can be thought of as “co-extensive” with the Community’s world, but are not constitutive of it. The Community’s World is everything a Member takes, or could take, to be the case, and therefore can, in principle, act on. Common examples are the world of art, the world of medicine, or the world of business. As discussed in (Jeffrey 2010a and Jeffrey

2010b), a Community's World is described in greater detail by specifying its immediate major constituents and their inter-relationships, in each case by name.

Whenever a person is doing anything, i.e. is engaging in some behavior, that behavior is a practice of some community of which they are a member. (One important special case is the community whose Members are the set of all humans.) Conversely, every actor is a member of at least one, and in practice almost always more than one, community: their family, their church, their neighborhood, their circle of friends, their employer, their profession, their religion, their nation, their ethnicity, and so on, and any Community a person is a member of gives them, via Statuses and Choice Principles, reasons to engage in one or more practices of it. This logical relationship between behavior and practices is articulated in:

Principle 6: Every behavior is a case of engaging in a social practice of a community.

Further, examining the concept of Status and behavior, an individual is always engaging in a practice *intrinsic to some status he holds in some community*, either directly or because the practice is part of an intrinsic practice or has an outcome that supplies a necessary resource for the engaging in the practice. This is the standard case of labor economics: the actor does work for which he is not otherwise motivated (or insufficiently motivated), and is compensated with something of value, typically money, which he can use for other behaviors, some of which may be purchasing behaviors.

Examples:

- In his study of the spread of birth control, Chattoe (2003) points out that, even with all other factors taken into account, the choice to adopt birth control practices depends critically on non-economic factors such as the potential-adopter's religion and devoutness, a clear example of a person acting on one reason – the Choice Principle of the Catholic religion – rather than another, namely her prudential reason to use birth control.
- The brief list of examples of communities cited at the beginning of this section illustrates the ubiquity and centrality of communities in an individual's life. Chattoe's example is a simple case. In fact, in the modern world (and perhaps in ancient ones as well) an adult is a Member of a number of Communities, frequently holding two or more Statuses in several of them, and each position one holds give one reason to engage in a practice of the Community involved. Further, and of central importance, these reasons often conflict. Representation of aspects of communities that actors in a population of interest are members of plays an important role in modeling and predicting economically significant behavior: the more complete the specification of Communities in a model, the more comprehensive the representation of reasons to act, and therefore the greater the potential for precision and accuracy of prediction.
- As Putman (1985) elucidates, organizations are Communities; an organization is a Community with a mission, the single Practice that all its other Practices are part of, at some level of detail. As Communities, organizations have Choice Principles that govern their Members' choices of behavior, sometimes to the

benefit of the organization and sometimes not. The recent financial debacle of General Motors illustrates the impact on competitiveness of following the Choice Principle of having a high priority on short- and near-term profit, rather than on innovativeness. As this example also shows, in the case of a large organization an organization's choice principles can have major macroeconomic impact. When an organization is characterized as "aggressive" or "conservative," the description is referring to one or more of the organization's Choice Principles. Further, Choice Principles can change. Examination of the history of the (formerly) Big 5 accounting firms shows that their Choice Principles changed dramatically in the early 1990's, from placing highest priority on their auditing responsibilities to at least equivalently high priority on consulting profits. (The ways in which a Community's Choice Principles change, in particular those of a firm, is a fascinating subject for empirical investigation.)

- A profession is a Community, and indeed it may be that being a Community is what distinguishes a profession from an occupation. Professions are often characterized as "conservative," "slow to change," "forward-looking," etc., and while such language is sometimes a generalization about the Personal Characteristics of the profession's Members, sometimes it is an identification of a Choice Principle, such as, "Woodworking is a fundamentally conservative profession." (*Woodworker's Journal eZine*, 2003).
- A financial market is a Community, with Members, Practices, Statuses (institutional investor, small investor, analyst, advisor, etc.), Locutions, and in particular Choice Principles that govern the behaviors of the members. The value of characterizing a market as a Community is that in some cases investment behavior by Members is responsive to Choice Principles of the market, not only individual reasons and Personal Characteristics.

Let us see how the facts about a person's life in a Community explain certain otherwise puzzling experimental results.

"Would you do me a favor?"

Ariely (2008) describes an experiment in which a professor asks students, "Would you do me a favor? I need some help moving some furniture from my apartment." The students respond immediately in the affirmative. And yet, if asked, "How much would you demand as payment for this task," the students refuse entirely or demand an exorbitant sum. The experiment is taken to be a measure of what dollar value the students put on their time and effort, a conclusion that appears inescapable. However, it is inescapable only if key variables are omitted from the description of the experiment: the facts about the community the students and professor are members of.

By occupying the Statuses of Student and Professor in a university, the individuals have a relationship, one which every student (and some professors) recognize, the one called "Professor-Student." As with every relationship, some behaviors are consistent with this relationship, some are irrelevant to it, and some are violations of it. Doing a favor for a professor is a practice in every American university community, one which, again, all

students and some professors recognize *as* a behavior. Because students, with a high probability, will recognize this relationship and that doing the professor a favor is consistent with it, they have reason to do the behavior.

On the other hand, paying the students for their effort in moving furniture is decidedly not consistent with the Professor-Student relationship. By engaging in an action inconsistent with this relationship, and consistent with another one, the one called Employer-Day Laborer, the professor in question gets the students to act on the second (and thereby changes the relationship he has with the students to one more like the latter (Ossorio 2006).) Acting on the Employer-Day Laborer relationship, the students demand compensation commensurate with doing an unpleasant task they have no other reason to do.

The Duke basketball ticket lottery

Ariely (2008) presents a particularly instructive experiment involving tickets to Duke University basketball games. He first describes the place basketball has at Duke: “somewhere between a passionate hobby and a religious experience,” and the basketball ticket lottery. Because the arena is too small to hold the number of fans, students engage in an elaborate practice involving going to the arena days before a game, staying in tents outside, and a representative of each tent having to check in within 5 minutes of a randomly-sounded air horn. Further, for national championship games, the student at the front of the line at the end of this practice does not get a ticket, but only a lottery entry that may result in a ticket. Those who win the lottery get an actual ticket to the game.

He then describes an experiment he and a colleague carried out with Duke student ticket holders. They contacted ticket holders and asked what price they would take for their ticket, and contacted other fans who participated in the lottery but not won and asked what they would pay for a ticket. The usual situation in a market is of course that some sellers demand too much, some buyers offer too little, but in some proportion of cases the buyers and sellers agree on a price. This was not at all the case with the Duke basketball tickets: the average price offered for a ticket was \$170, while the average price demanded was \$2400, and no ticket holder was willing to sell for what someone was willing to pay. These results are quite striking, and clearly call for explanation. Ariely accounts for the large difference in terms of emotional attachment and “imagined glory of the game.” Further, he quotes self-reports by subjects, such as, “How can you put a price on [defining memories of life at Duke],” illustrating another difficulty of behavioral economics as it has been practiced: subjective reports cannot be used literally.

These results are customarily described, and are described by Ariely, as an example of the “endowment effect,” the fact that people value what they already own over what they could get. The full explanation of the results, including a reformulation of the “endowment effect,” will be given in Section VI, after discussing the distinction between an actual state of affairs and a possible one, but the case, and particularly Ariely’s presentation of it, is an excellent illustration of the omission of important variables from the depiction of an experiment. As is very common in economics and behavioral

economics, Ariely presents the context – in this case, the entire state of affairs involving the place basketball has at Duke – as context of the real question, not part of the question itself, an interesting but informal precursor to definition of the real experiment. The problem with such an approach is that in this case, and in many others like it, what is called “the context of the experiment” is not context at all, but is a crucial part of the experiment, as much a part as, e.g., asking what a ticket holder would sell for or recording results. It is a truism, indeed a cliché, that humans are not rats, and know the context, but methods from animal psychology persist in psychology and behavioral economics, and this is an example.

The specific Community aspects of the ticket lottery relevant here are: 1) the Status of a ticket holder in the Duke community, and 2) The practice that, *specifically at Duke*, could be called “Going to the Championship Game,” a practice that is much more extensive than the act of going to a basketball game. That practice has the following structure:

- Practice: Go to the Championship game
1. Get a ticket
 - a. Go to the arena and stay there, days before the game
 - b. Check in, when the airhorn sounds
 - c. Get a lottery ticket
 - d. Find out who won
 - e. Get the game ticket
 2. Go to the game
 3. Celebrate after the game
 4. Reminisce about the events leading up to and during the game

Figure 2: Going to the Game at Duke

This elaborate and extended-time practice is an intrinsic practice for a Fan – a Status at Duke. Winning the lottery makes a Fan a Ticket-Holder, a different Status that is highly honored at Duke. Other Fans congratulate a Ticket-Holder, express envy, talk about the Ticket-Holder’s luck to the Ticket-Holder and others, and so forth. In short, being a Championship Ticket Holder, and later an Attendee at the Championship game, are very highly-respected and envied Statuses in the Duke community.

In addition, in the Duke Community, to sell a ticket to a championship game is a serious violation of the status of Fan; to do so is to degrade oneself from Fan to non-Fan, a significant loss of status in the Duke community.

Omission of the Community aspects leaves a behavioral economist with little option other than inventing theoretical concepts such as “emotional attachment,” an ill-defined concept that is of little value in identifying exactly what a person actually values. Including them, by contrast, directs an investigator to examine what other aspects of the subjects’ World they find valuable – and would therefore demand compensation for – in addition to the simple outcome.

Section V Actual vs. possible

A Community's World is a configuration of all that is or could be the case, for a Member, *as a Member*. Equivalently, it includes all states of affairs that are or could be the case, as well as any and all events, relationships, behaviors, and objects involved in them that can be recognized that are recognized by paradigm-case Members, and typically by all Members. It is important that a World includes states of affairs that *could be* so. Thus, for example, the woman buying the lottery ticket recognizes that winning the lottery *could* happen, and therefore that being rich is a state of affairs that is possible.

There is a further distinction that is very useful here. It is a commonplace that people recognize some states of affairs are possible but, if asked, acknowledge these are not something they would ever, under ordinary circumstances, think about, work for, hope for, or in fact take into account in their actions. People will sometimes refer to such states of affairs as “merely” or “theoretically” possible, and will often respond to a question about such states of affairs with answers such as, “I suppose so,” or, “Sure, but who cares?”

Additionally, individuals vary significantly as to what they take to be the case, what they take to be an actual possibility in their lives, and what they take to be merely, theoretically, possible.

The importance of these facts for economics and behavioral economics is that people value these kinds of states of affairs quite differently. To understand, model, and predict choices it is therefore very important to identify exactly what kind of state of affairs a behavior brings about. Having \$1M is an actual state of affairs; having *the possibility of* \$1M or \$5M is a quite different actual state of affairs, and we would not expect a person to value a possibility the same as an actuality.

Principle 7: For any person, a particular state of affairs may be actual, possible, or merely theoretically possible, and is valued accordingly.

Merely theoretical states of affairs are those recognized by the person as logically possible, but not something they take into account under ordinary circumstances. Their actions will not reflect such states of affairs; descriptions of their actions in terms of the relevant circumstances, reasons, and priorities, as shown in Fig. 1, will not include any such states of affairs, precisely because they are not considered relevant by the individual.

An actual state of affairs is one that a person takes into account, i.e., that gives an individual reason to act, that can be an item in the specification of the K parameter of their behavior, and can appear in a CRJ diagram (Fig. 1) of their behavior. A possible state of affairs is one that is recognized (K parameter) as something that can occur under current circumstances, and will therefore be acted on *as* an actual possibility. A merely possible state of affairs is one that is not acted on, unless some other event makes it an

actual possibility. The hedonic, prudential, ethical, or esthetic value to an actor of any given actual state of affairs is, in the paradigm case, greater than the value to them of the possibility of that state of affairs, which is greater than that same merely, theoretically, possible state of affairs. In view of the virtually ubiquitous use of the language of probability in economics and behavioral economics, we stress that the concept of actual or mere possibility is not the same concept as probability. Probability, as customarily used, refers to a ratio of outcomes of repeated trials. There may be some correlation of usage of the concepts, but they are fundamentally different, and any such correlation is a matter for empirical investigation. It could be, for example, that a probability of 0.001 is highly correlated with mere possibility, in certain populations or communities.

The endowment effect

The “endowment effect” is the name behavioral economists give to the phenomenon that, in general, people value something more highly if they already have it. The Duke basketball ticket case discussed above is presented by Ariely as an example of this effect: subjects would only pay an average \$170 for a ticket, but would not accept less than an average of \$2400 for one they already have. It applies to virtually anything a person owns: houses, free coffee mugs (Kahneman et al, 1991), pens, wine, etc. etc. etc.

The treatment of the endowment effect in current behavioral economics is a good example of the treatment of all the deviations from neoclassical value maximization theory in current behavioral economics:

- It is considered an error, a cognitive bias that leads economic actors to make bad decisions
- It is considered a prime example of “irrationality,” of actors being influenced by factors that “should” not influence them. Ariely, for example, describes it as “the ills of ownership.” (It seems to us remarkable that behavioral economists explicitly reject utility maximization as a basis for economics but retain the pejorative descriptions of behaviors that deviate from it.)
- No explanation for the effect is given, other than to posit an “emotional attachment,” which is merely a metaphor restating the same facts, not an explanation.

Principle 7 explains the endowment effect and shows why it is normal human behavior, not pathology. Owning something makes it possible for the owner to engage in the behaviors for which that object is needed; it embodies behavior *potential*. Owning the object is therefore actual value. In the case of the Duke tickets, having a ticket has the Significance that the owner is actually *currently* engaged in the practice of Going to the Game, having completed Stage 1.e of Figure 2, a practice much more extensive and important in the Duke community than simple game attendance. Money, in contrast, is *possible* value: one *may* exchange it for a home, a ticket to a game, a coffee mug, a beer, etc., but those things, and the behaviors they make possible, are possible, not actual, until the purchase has been made. The endowment effect is simply shorthand for Principle 7 -- the fact that a person values the actual over the possible.

It may appear that we have only “kicked the explanation can down the road” here: we do not explain why persons value an actual state of affairs over a possible one. A thought experiment shows why – and why this is not merely the substitution of one non-explanation for another. Imagine a person – the imaginary utility maximizer no actual person resembles – who did not place a higher value on his car key than on the money it would take to buy a new one. Such a person would freely exchange his car key for the price of the key at a store, plus 10 cents as his profit. That actor would, with some frequency, find himself without his car key – and therefore unable to go where he needed to. This illustrates why actual is valued over possible: actual means the person can act to bring about *other* valued states of affairs, whereas possible does not.

Identifying Principle 7 as the reason for the endowment effect reveals an important methodological consideration in experiments intended to investigate the effect: the goal of the experiment is to determine something about the relative values assigned to actual, possible, and merely possible states of affairs. The interesting question is not whether there is such an effect; we know there is, because people value actual over possible. The questions worth investigating are the impact on prices of the effect among various groups for various states of affairs (not only object ownership), and in investigating those questions, several other conflating behavior effects must be accounted for. We point out this risk because the history of investigation of the endowment effect includes a number of experiments that suffer from conflation effects. In the case of the Duke tickets, to sell the ticket would be to degrade oneself in the Duke community, losing a highly valued status, as well as the loss of the actuality of engaging in the highly valued practice of Going to the Game. Thus, \$2400 is the average price a ticket holder demanded to be compensated for the *whole* loss, not just the loss of attending the game. The experiment yielded good data on the average monetary value assigned by non-ticket-holders, for whom attending the game is a *possible* state of affairs, but no information on the proportion of the \$2400 demanded due to giving up the actuality of Going to the Game.

A different conflating effect is found in the famous Cornell coffee mug experiment (Kahneman et al, 1991). Half of the students in a classroom at Cornell University were given free Cornell coffee mugs, and then a market created for the mugs in the classroom. The median owner was unwilling to sell for less than \$5.25. The conflating effect here is that for a significant portion of persons in the United States today, to get something for free is *itself* a significant value. Thus, for the students who received the free mug, they were not selling a mug; they were selling a *free* mug; the change in state of affairs brought about by the behavior would be from owning a free Cornell mug to not having a free Cornell mug; the experiment gathered data on the combined effect. Ariely (2008) devotes an entire chapter to the phenomenon that people value what they get for free.)

A third such potentially troublesome variable is the relationship between the thing owned and the owner, referred to as the Ikea effect: people value what they have built more than they value the same object purchased assembled. “I built that” is an expression of this relationship, and such relationships are valued. Offering someone money in exchange for something they have assembled therefore involves both phenomena: the greater value of

real vs. possible states of affairs, and the greater value to an owner of an object with which they have the I-built-that relationship.

Section VI Irrationality illusions

“Irrationality” in economics is problematical. Technically, it refers to decisions that do not conform to expected utility theory, and as a technical term of art there is no issue. However, it also has a long history of use as a prescriptive concept, both within economics and in the world at large. As Kahneman and Tversky (1979) put it, “it is assumed that all reasonable people would wish to obey the axioms of [expected utility] theory, and that most people actually do, most of the time.” Perhaps because of this assumption, “irrational” is currently used much more broadly, both by economists and in the popular literature. The subtitle of Ariely’s *Predictably Irrational* is illustrative: “The hidden forces that shape our decisions,” forces that make us act irrationally, i.e., force us to make decisions not in our best interests.

Various empirically observed effects and theoretical constructs such as mental processes, including loss aversion, framing, mental accounting, and biases have been added to standard economics, but the resulting combination of empirical fact, cognitive psychology, and expected utility theory amounts to a theory plus a set of exceptions, not a coherent whole. It is not broad enough to encompass the observed behavioral facts. Those facts include that (1) human preferences satisfy none of the axioms that define expected utility theory (because value is a 4-vector, not a scalar, as discussed in Jeffrey, 2010a), and (2) humans choose behaviors, not goods, that bring about the state of affairs they value, limited by what they take to be the case and their capacities at the moment. In this section we use Principles 1 through 7, which constitute an integrated set of related concepts that does encompass the full range of observed facts about persons and behavior, to show that the various “anomalies” of behavioral economics are completely logical – but the logic is the logic of human behavior, i.e., homo communitatis, not homo economicus.

The discussions of the Friedman-Savage “paradox” and the endowment effect showed they are not paradoxical or irrational (other than in the narrow technical sense of not following expected utility theory). This was done by showing how the phenomena are explained directly by applications of the principles comprising the paradigm, not by introduction of additional theoretical constructs. These principles are the principles of the domain of interest to economists: economic effects both on and due to persons acting in the real world. In the following sections Principles 1-7 are used to show that the phenomena studied in behavioral economics – loss aversion, framing, mental accounting, biases, and “social norms” (as Ariely labels them) – are not irrational, but are in every instance a matter of persons acting on what they take to be the case in order to achieve what they value – the very core of rationality.

Loss aversion

Loss aversion refers to the general phenomenon that “losses loom larger than gains” in decisions (Kahneman and Tversky 2000, p. 150). A loss of \$100 is regarded as more serious than a \$100 windfall. Loss aversion implies the endowment effect and status quo bias (Kahneman and Tversky 2000). Kahneman and Tversky formalize the phenomenon via the concept of a reference structure, a set of preference curves indexed to identifiable reference states, noting that losses and gains are with respect to the reference state at the moment of choice, though “reference state” itself is relatively ill-defined. Loss aversion neatly accounts for diminishing sensitivity (to loss or gain), represented by the well-known S-shape of the value curve (Kahneman and Tversky 2000, p. 144). Reference states, for example, clarifies why the difference between raise to a \$70,000 salary vs. one to \$60,000 one matters more to someone earning \$40,000 than it does to someone making \$50,000.

It was noted at the outset of this paper that current behavioral economics consists of neoclassical economics with a number of experimentally verified effects and factors added, but without a theoretical framework encompassing them. Loss aversion is a good example. Behavioral economics provides no explanation of loss aversion; it simply says, “Actors are loss averse,” albeit in a mathematical formalism. The formalization in terms of reference structure and reference state is a formal restatement of the phenomenon, not an explanation. Kahneman and Tversky (2000, p. 149) note that the reference state may be affected by current position (of goods), aspirations, expectations, norms, and social comparisons, but no precise and comprehensive definition of the reference state has been possible because cognitive psychology does not include the necessary concepts to formally articulate the imprecisely-stated notions of aspirations, norms, and social comparisons. Any adequate formulation must, for example, include the concept of status in the world, a concept missing from cognitive psychology, since, as Principle 6 and the Community parameters articulate, an actor’s place in a community matters, i.e., gives him reason to act in certain ways, and people act in light of their reasons (Principle 4).

Principles 6 and 7, and careful attention to the values of the parameters of behaviors involved in a choice, account for loss aversion. The reference state is what the actor currently takes to be the case – the K parameter. This includes the actor’s place in the world, their Statuses in all Communities of which they are a Member. Gains and losses are gains and losses of behavior potential, frequently as embodied in objects, and includes actual, possible, and merely possible behavior potential. Loss may be a change from actually having the good or service or, more generally, having the behavior potential the good or service embodies (as with the Duke basketball tickets), or from the possibility of that behavior potential to the merely theoretical possibility. The converse is of course also possible: a merely possible state of affairs may become an actually possible one, and a possible state of affairs may become actual. The value to a person depends on the direction of the change and the value of the state of affairs itself: having a merely possible negative state of affairs become an actual possibility is a change in a negative direction and therefore what economists consider a cost to the person. If a lion in

a zoo behind a 20-foot fence jumps that fence and lands 100 feet from a zoo attendee, the attendee's situation has deteriorated: he is now in possible danger.

Buyers at an auction sometimes pay a far higher price for an item in “the heat of the bidding,” a situation informally referred to as the bidder considering the item “theirs,” described by Kahneman and Tversky as a change in reference state. The bidder has not become psychotic; they know the item does not actually belong to them, but owning it has become an actual possibility, not a merely theoretical one, and they accordingly value that state of affairs over that of the mere possibility of ownership. They bid to avoid the loss of the actual possibility, much as the Duke ticket holders demanded \$2400 for a ticket to the game to avoid loss of going to the game and the status of Fan. In some cases bidders see the object as “rightfully” theirs, a particular status of the object, and bid in order to avoid loss of an actual value, namely something that is rightfully theirs becoming the property of another bidder.

Principle 6 is a reminder that, as illustrated in the discussion of the endowment effect above, the “context” of the purchase, or the experiment, must always be identified and articulated. By making a purchase, an actor is *always* engaging in a behavior that is a practice in some community he is a member of, a behavior specified by the 7 parameters of Intentional Action (Principle 5), one of the most important of which for economics is the Significance parameter. Descriptions of choices in terms of “objective states” (Kahneman and Tversky 2000, p. 157), i.e., owning a coffee mug, having a specific salary, having a commute of specific time, etc., are the incomplete achievement descriptions discussed earlier, the incompleteness that results in the illusion of irrationality.

Framing effects

Invariance is one of the most basic axioms of expected utility theory (Kahneman and Tversky, 1986). It says that different representations of the same choice problem should yield the same results, i.e., preferences should not be affected by the description of the options. Kahneman and Tversky (1986) show that it does not hold, noting that violations of invariance are ubiquitous, and cite several examples:

- Choices between medical treatments are different, depending on whether they are presented in terms of probability of mortality or survival.
- Choice of option depends on whether the cost of one over the other is presented as a discount on one or a surcharge on the other.
- Experimental subjects choose a sure gain of \$240 over a 25% chance of winning \$1000, but choose a 75% chance of losing \$1000 over a certainty of losing \$750.
- Describing a tax policy as a tax exemption for children in a 2-child family or a tax premium on a childless family makes a large difference in how subjects evaluate the policy, extending even to judgments of desirable family size.

Perhaps the most striking example of the failure of invariance is the following (Problems 5 and 6 in Kahneman and Tversky, 1986):

Experiment 1: You are preparing for an epidemic that is expected to kill 600 people. Two programs are available to treat the disease.

- If Program A is adopted, 200 people will be saved.
- If Program B is adopted, there is a 1/3 probability that all 600 will be saved, and a 2/3 probability that none will be saved

Which of the two programs do you favor?

Experiment 2: You are preparing for an epidemic that is expected to kill 600 people. Two programs are available to treat the disease.

- If Program A is adopted, 400 people will die.
- If Program B is adopted, there is a 1/3 probability that no one will die, and a 2/3 probability that all 600 will die

Which of the two programs do you favor?

In Experiment 1, Program A is chosen by 72% of the subjects, while in Experiment 2, Program B is chosen by 78%, even though the expected values of A and B in the two cases are identical.

These results are startling, virtually forcing one to the conclusion that the value attached to the outcome is strongly biased by “mere labeling” – Kahneman and Tversky’s conclusion. Prospect theory accounts for the incorrect predictions of expected utility theory by postulating that outcomes are evaluated by a 2-phase mental process: one of framing and editing and one of evaluation (Kahneman and Tversky, 1986). “Framing effects” refers to the idea that a number of factors affect the framing phase, and therefore the eventual valuation of the outcomes, including social norms, individual habits and expectations, and the wording of the presentation of the choice.

Experiments 1 and 2, and virtually all economics experiments, have been stated and analyzed in terms of outcome. Therein lies the problem. When a subject makes a choice it is a choice between behaviors, including the larger behavior this one is part of. Stating the experiment as a choice between outcomes obscures the actual situation: subjects are engaging in a deliberate action, a choice between behaviors, as depicted in Fig. 1. Outcome is one of the 7 ways in which behaviors may vary. It is not that choice of outcome is affected by factors that control mental processing; it is that the outcome is one aspect of a practice of a community, and choice reflects all the facts of the situation (to the best of the actor’s ability to discern them). The parameters of behavior and community are not theoretical constructs, but enumerations of facts about behavior in the real world. “Framing effects” is an explanation, in theoretical language, of facts about choices that do not call for explanation when the full range of facts about those choices is articulated.

Choosing between two apples and three oranges is choosing to *buy two apples* or *buy three oranges*: two versions of the practice, “Buy fruit.” That is not the case with

Experiments 1 and 2, in which the significance of the outcomes of the behaviors matters greatly. Further, as every military commander with combat experience knows, if you condemn 400 soldiers to death, you become a commander who sentences his people to death, a *highly* undesirable Status, but if you command your troops to take on a dangerous but important mission and 2/3 die, you do not acquire such a Status. The markedly incomplete achievement descriptions used to state the experiments produce appearance of irrationality and the need to explain it.

Stated in language that makes the actual choice, not only the outcomes, explicit we have the following:

Experiment 1: You are preparing for an epidemic that is expected to kill 600 people. Two courses of action are available to you:

- Action A: Save 200 people by adopting Program A.
- Action B: Attempt to save all 600, knowing there is a 2/3 chance all may die, by adopting Program B.

Which action do you favor?

Experiment 2: You are preparing for an epidemic that is expected to kill 600 people. Two courses of action are available to you:

- Action A: Condemn 400 people to death, by adopting Program A.
- Action B: Take a 2/3 chance that all 600 will die, knowing there is a 1/3 chance none may die, by adopting Program B.

Which action do you favor?

Thus, Experiment 1 gives subjects a choice between two ways of saving lives; Experiment 2 gives them a choice between two ways of condemning people to death. That subjects make different choices in these two radically different cases does not call for explanation. There are no errors to be accounted for here, and no need for hypothesizing a process for calculating an expected value.

What Kahneman and Tversky discovered is not the need for “effects” on a “framing process,” but the power of seemingly small changes of wording to change what is actually portrayed, a power long recognized by novelists, poets, clinical psychologists, ethnographers, linguists, computer systems analysts, and public opinion researchers, among others. Kahneman and Tversky refer to the difference in presentation of Experiments 1 and 2 as “mere labeling” (“save” vs. “die”), the difference in presentation of medical treatments (Kahneman and Tversky, 1986, Problem 1) as “inconsequential,” and the difference between the two presentations of the tax policy as “seemingly innocuous.” The differences in wording are highly consequential, for they identify real world behavioral choices that are very different, even though the possible behaviors have outcomes in common.

It could be argued that people *should* base choices such as those in Experiment 1 and 2 on outcome alone, but that is an issue for moral philosophers, not economists or scientists. Outcomes are a subset of the circumstances people base choices on (as shown in Fig. 1); that additional circumstances provide other reasons does not constitute irrationality. It seems likely that different groups of people will assign different priorities to outcome-based reasons, and that within a group there will be substantial differences depending on the kind of situation. A systematic empirical investigation of this range of facts would in all probability yield fruitful and interesting results.

Mental accounting

As with framing and framing effects, mental accounting and associated concepts such as transaction utility were introduced to explain a certain discrepancies between observed fact and traditional economic principles. The discrepancies are due to two problematical assumptions: 1) the same assumption that led to the necessity for inventing “framing effects,” namely that choice is choice of outcome, and 2) money is perfectly fungible. Mental accounting is a partial re-incorporation of some of the facets of behavior excluded by the *a priori* policy of analyzing only outcomes, and further limiting those outcomes by treating all monies as a single quantity.

It is described by its inventor, Richard Thaler, as “the set of cognitive operations used by individuals and households to organize, evaluate, and keep track of financial activities” (Thaler, 1999). Observing that all organizations have a system of managerial accounting for recording, summarizing, and categorizing assets and debits in various categories, Thaler states, “Of course” individuals and households need to do the same thing, “to keep track of where their money is going and keep expenses under control,” and labels these presumed activities as mental accounting. A central concept of mental accounting is that, as with managerial accounting but contrary to expected utility theory, the assets and debits in the categories are not fungible, i.e., substitutable across categories (Thaler 1999).

Mental accounting may be summarized as consisting of two kinds of assertions:

1. People distinguish between different kinds of financial activities and associated assets and costs; they do not consider assets to be interchangeable across categories; and they assess “where they stand” – the degree to which they have achieved or are in the process of achieving valued states of affairs, including possessing goods and having services – with varying frequency and under varying conditions.
2. The categorizations and assessments are the result of mental operations.

In more detail, financial activities are processes that are aspects of behavior, just as walking, talking, eating, driving, buying, and selling are performances of a number of behaviors. By talking, one may be chatting with a friend, planning a lecture, working on a research problem, or giving the State of the Union address – four entirely different behaviors. Framing is a way of re-incorporating some of the aspects of behavioral choice

(Fig. 1) excluded from the traditional outcome-based analysis; mental accounting is another.

For example, a central concept of mental accounting is transaction utility, the difference between a postulated reference price and the actual price. Recall that the Significance of buying a lottery ticket is to make possible a major improvement in one's life circumstances; that is what one is achieving by buying the ticket. Similarly, by buying a quilt that normally costs \$300 for \$150 (Thaler, 1996, p. 184), one is achieving a second, larger, state of affairs: getting a great deal. The transaction utility of the quilt purchase is a numerical measure of the value getting a good deal. It is not second kind of value; it is the value of a second outcome, the Significance of the quilt purchase in this case.

Activities and facts about them, *per se*, are unimportant to most people; they do not matter (to use the term from Thaler 1999). Referring to Fig. 1, the diagram depicting choice of behavior in light of reasons, an activity *per se* may be a relevant circumstance, but it is not a basis for choice – i.e., a reason. People do not know how many steps they take in a day, how many times they turn the steering wheel in driving to the grocery store, or how many mouthfuls of food they eat. (In fact, certain mental disorders, notably autism and schizophrenia, involve an unusual focus on activities, and inability to recognize the behavior the activity is part of.) Given sufficient reason, people can and do devise accounting systems they use to keep track of such quantities – a step-counting exercise program, a calorie-counting diet regime – but in general a person “keeps track of” – i.e., knows about – what they care about: states of affairs that are important to them, and behaviors they recognize as relevant to those states of affairs. One of us (Jeffrey) went to breakfast with his wife recently. He reports, “I have no idea how many seconds it took to walk from the cashier to the table.”

“Keeping track” is language in the grammatical form of a verb to talk about the fact that in general a person knows what they do, have done, and what matters to them, and knows the state of affairs consisting of what they have achieved and are still attempting to achieve. “Updating” is verb language to talk about the fact that from time to time these states of affairs change and the person notices. (The phrases “in general” and “from time to time” are used here to indicate that we would expect significant differences – Personal Characteristics – in what various groups of persons know and the frequency or circumstances under which they re-assess the states of affairs involved, a fruitful topic for empirical investigation.) This customary language is convenient and useful, but it is a mistake to take that language as referring to actual processes. “Mental processes” are theoretical constructs whose origin lies in that mistake: assuming that verb language means there “must be” a process, and since in general no such process is observable, the scientist making the assumption has no choice but to further assume that the process is “mental.” “Mental operations” is a way of saying, “What people do with facts about money is like what people do with budgets in an organization” – it is metaphorical language for talking about a range behavioral facts related to money.

A person does not keep track of activities at all, unless they are engaged in some behavior that requires those facts, as the dieting example illustrates. What they do keep track is he

behaviors the activities are part of, and facts about those behaviors. The categories used to keep track are behaviors and facts about them. The categories differ according to the individual's Personal Characteristics and situation. They are not, however, "notional" or "mere labels" (Thaler 1999, p. 197), subject (as the phrase "mere label" connotes) to arbitrary change and redefinition. They are aspects of the real world, namely facts about what the person is doing and what they value.

Using Principles 1-7 and focusing on the behavior and all its aspects from the outset yields articulations of the behavioral facts in which nothing remains to be explained.

Sunk costs. Standard economic theory holds that (unrecoverable) sunk costs should have no effect on choice. The cost has been paid; what should matter is the value of the outcome. Thaler's classic (1980) example is:

A family pays \$40 for tickets to a basketball game to be played 60 miles away. On the day of the game there is a snowstorm. They go, but note that had they been given the tickets they would not have.

The cost of the tickets is sunk, spent whether the family attends the game or not. The choice, according to economic theory, should depend on the net value of driving through the snowstorm and attending the game, but experimental data shows that very commonly is not. Thaler asks, "Why do buyers not ignore sunk costs, as economists say they should," and proposes an explanation in terms of mental accounts.

The answer is that they do not, but they have other, stronger, reasons that economists ignore. The net benefit of going to the game or staying home, as calculated by economists, is only one reason. In this case, having purchased the tickets, the buyers have completed stage 1 of the *practice* called "going to a basketball game"; they were *already engaging in* that practice. If they had stayed home, they would have been giving up something they valued and were already doing. The cost, in other words, was loss of engagement in an intrinsic practice. Similarly, for a chess player, i.e., someone for whom playing chess is intrinsic, being forced to stop playing a game is a loss, whether or not she has paid to play. When an actor continues to carry out an intrinsic practice, it does not call for explanation. Economists ask questions such as this one because they have an improper model of buyer behavior, just as the circular orbit was an inappropriate model of planetary behavior.

In general, the problem with sunk cost analyses in behavioral economics is that they are solely in terms of outcomes and the monetary measure of them, as in business accounting. Again recalling Fig. 1, outcomes are circumstances, but only circumstances, and not the only relevant circumstances. If a person faces a decision in which the only relevant circumstances are cost, as is sometimes the case in and outside of business, traditional sunk cost analysis is appropriate. In other cases, such as this one, it is not, because it fails to incorporate the other reasons to act.

A different kind of deviation of sunk cost handling from standard economic theory is illustrated by the Shoreham nuclear power plant case and Iridium phone cases.

- The Shoreham nuclear plant was begun in 1973, spending \$5.5 billion by 1987. Due primarily to political pressure from protests, the plant was scrapped, although, ignoring the \$5.5 billion sunk (as economic theory dictates), the plant would have been somewhat cheaper than the next best alternative.
- The Iridium satellite phone project, which failed after spending billions, is often cited as an example of failing to treat sunk costs properly: “Iridium's backers seem to have fallen into a classic 'sunk-cost' fallacy. Having already spent billions of dollars and years of effort on the project, they were loath to abandon it. Instead, they redoubled their efforts, and spent more billions” (Sheth and Sisodia).

In both cases, the economic argument ignores the behavioral situation. Building a nuclear power plant is a behavior – a social practice – involving billions of dollars and thousands of workers. The practice was, as with attending the basketball game, *already taking place*. The decision was therefore whether to continue engaging in the practice taking place, a practice with a reasonable expectation of benefit: lower operating costs for supplying electricity. Any decision is made *by persons* in an organization; language describing organizations starting or abandoning projects, or doing anything else, is shorthand that cannot be taken literally. The literal description of initiating project X in organization Y is, “Persons in X, acting on their respective Statuses in X, initiated Y.” If project Y is then abandoned as a failure, the persons who initiated it thereby lose standing in their organization, i.e., their Status changes, negatively. They acquire the status of “one who made that terrible decision,” “an unreliable leader,” or at minimum “the guy who spent a great deal of company resources for nothing.” In any organization, this is a serious loss. The same analysis applies to the Iridium project. Indeed, the executives were loath to abandon it, for sound reasons. Far from irrational aversion to loss, the persons making the decision are acting entirely rationally, taking into account all their reasons to continue or abandon a project.

Transaction utility. Thaler (1983) describes a number of experiments in which the now-familiar phenomenon of failure of results to conform to traditional economic theory. In order to explain them he introduces a new type of utility, transaction utility, defined as the difference between a postulated reference price and the actual price. He describes it as representing “the pleasure (or displeasure) associated with the financial terms of the deal per se. It is a function of the difference between the selling price and the reference price.”

Transaction utility is an attempt to re-incorporate and quantify the value of certain kinds of reasons to act, particularly especially Significance and reasons based on it, as the quilt example illustrates. Another kind of transaction utility is the difference between the actual price and a fair (as perceived by the actor). As an attempt to recapture facets of behavior in addition to outcomes and their monetary measure, transaction utility is a valuable concept. It is more useful, though, to focus directly on the actual behavioral phenomenon: the reasons and actor has to engage in the particular behavior choice, rather

than introducing a postulated abstract concept such as reference price, which may or may not be a good way to talk about what is actually happening: choice based on reasons.

The lottery ticket example above illustrated the basic logic of significance and reasons: by purchasing the ticket, the person is acquiring the actual possibility of a major change in life circumstances, and they value that state of affairs – that is, it provides a reason to buy the ticket. The Significance of purchase of the \$300 quilt for \$150 is to have gotten a good deal. As with the possibility of a massive improvement in one's life, that a person values getting a good deal, does not call for explanation. People value that state of affairs, and act accordingly. There is no need to postulate a new kind of utility. Rather, there is a need to include all the relevant circumstances, including Significance, in analyzing questions of choice.

Let us see how Principles 1-7 can be used to analyze some of the classic experimental results that have been explained with transaction utility. The following are from Thaler (1983):

1. The World Series Ticket

You are a big baseball fan. You have always wanted to go to the World Series. Your team has finally won the pennant. The games are on television but you would much rather go in person.

(a) You win a ticket from a local radio station. The retail price for the ticket is \$20. Someone offers you \$200 for the ticket. Do you sell or go to the game?

(b) You win \$200 (after taxes) from a local radio station. A couple weeks later someone offers to sell you a ticket to the game for \$200. Do you buy or stay home?

A large majority of subjects say they will go to the game in version (a) but not go in version (b), although the questions are formally identical.

Case (a) is one we have seen before: the reluctance of someone to sell something they already own. Principle 7 explains this phenomenon: having the ticket is having the actual, not merely theoretical, possibility of going to the game; selling it is exchanging an actual possibility for a theoretical one, a loss. In addition, in this case the ticket was free, so there is a Significance effect: getting something valuable for free is seen as a valued outcome itself by many people.

In case (b), the majority of subjects state they will not pay \$200 to go to a baseball game, “even though” they have won \$200 two weeks earlier. The effect here is even simpler than the others: subjects do not consider having won \$200 earlier as relevant to the decision of whether to go to the game. That an economist, calculating net wealth over the two-week period, can add

the value of the winning and the cost of the ticket, concluding that that the ticket has zero cost is irrelevant.

2. The Good Deal Across Town

You set off to buy a new (radio) [color television set). At the store where you expect to buy it, you find that the price is (\$35) [\$650]. A clerk informs you that the same item is available at another branch of the same store for only (\$25) [\$640]. The store is a 20-minute drive away and the clerk assures you that they have what you want there. Do you buy here or go to the other store?

A large majority of subjects report that they will drive to the other store to save \$10 on the radio but almost no one is willing to make the same trip to save \$10 on the TV.

When the monetary measure of the value of getting a good deal accurately represents value to the actor, transaction utility is a reasonable metaphor for what is actually happening: a person making a choice based on the value of the Significance: getting a good deal. This is such a case. Subjects regarded paying \$25 for a \$35 radio as a sufficiently valuable good deal, but not “saving” \$10 on \$650. This case illustrates the straightforward application of Significance, and that once it is included in the facts of the situation, nothing remains to be explained. Transaction utility here is a convenient shorthand for the facts, not an explanation of them.

3. The Price of Beer

You are lying on the beach on a hot day. All you have to drink is ice water. For the last hour you have been thinking about how much you would enjoy a nice cold bottle of your favorite brand of beer. A companion gets up to go make a phone call and offers to bring back a beer from the only nearby place where beer is sold (a fancy resort hotel) [a small, run-down grocery store]. He says that the beer might be expensive and so asks how much you are willing to pay for the beer. He says that he will buy the beer if it costs as much or less than the price you state. But if it costs more than the price you state he will not buy it. You trust your friend, and there is no possibility of bargaining with (the bartender) [store owner]. What price do you tell him?

The results from this survey were dramatic. The median price given in the fancy resort hotel version was \$2.65 while the median for the small run-down grocery store version was \$1.50.

Thaler notes that paying \$2.50 for a beer is an expected annoyance at the resort hotel, it would be considered an outrageous “rip-off” in a grocery store.

This case illustrates the use of transaction utility to encode entirely different kinds of reasons. Subjects are deciding based on what they consider a fair price, an ethical concept, not a prudential one such as the value of a good deal. The logic here is not calculation of transaction utility; it is that the subjects have strong reason not to engage in the behavior. Again recalling Fig. 1, being “ripped off” is a strong reason to not engage in the behavior, and many persons will not do so. As with the above cases, nothing remains to be explained here. Inventing a new language for talking about an ethical concept as though it were a prudential one (“utility”) does not explain anything, and has the additional harmful side-effect of obscuring what is actually happening: a conflict between hedonic and ethical reasons to engage in an action.

Budgeting Mental accounting is fundamentally a metaphor, and mental accounting language is metaphorical language for talking about patterns of behavior and behavior-related facts, including priorities. People know what they do, have done, and are in the midst of doing; they know what matters to them; they know the overall state of affairs consisting of what they have achieved (though they may not know details of those achievements); they know what they are still attempting to achieve; and they have priorities that their behavioral choices reflect. “Mental categories” and “opening and closing accounts” are particularly clear examples of the use of the accounting metaphor to talk about behavior.

Expenditure categories are kinds of behavior. Housing, for example, includes behaviors related to one’s domicile: paying rent, home repairs, home improvement, etc. Similarly, “clothing” includes buying clothing, dry cleaning, etc.; and so on. The experimental data (and informal observation) are unequivocal: people make these distinctions. It is equally clear that a person distinguishes an amount of money they are willing to spend on a kind of behavior. The quantities and distinctions are like an actual budget, which is to say that “budget” is a good metaphor for capturing these distinctions. The relative amounts the person is willing to spend on various kinds of behavior reflects the person’s values, i.e., their demonstrated behavioral priorities. Non-fungibility across expense categories is reflective of the non-interchangeability of priorities of kinds of behaviors. The priorities and degree to which a person is willing to change the amounts “budgeted” are Personal Characteristics.

A similar situation holds with the concepts of “wealth accounting” and “income accounting.” People know where what behaviors result in ordinary income, and when some income is unexpected and not to be repeated – a windfall. To say that individuals have “income categories” is to say that they know where their money comes from, a set of distinctions that is like income categories in an actual budget. “Wealth accounting” reflects the fact that individuals distinguish kinds of quantities of money, and that they

know what kinds of behaviors the various quantities are for: retirement, college, a vacations, etc. A checking account is the quantity maintained for the kind of behaviors called “everyday expenses.” The various distinctions are, in fact like those a firm makes in an actual budget, i.e., “wealth accounts” is good metaphor for these distinctions.

“Closing an account” is a metaphor for ceasing a behavior, or a recognition that something no longer matters to the person. Making an investment is a behavior; selling that investment at a loss is a failure to achieve the intended outcome. We do not wonder at an individual’s reluctance to fail at achieving a goal; that circumstance constitutes a reason to not give up. Further, if the individual holds the currently-losing investment, he retains the actual possibility of that investment becoming a winner. The individual thus has two reasons to hold a losing investment. While an economist or a financial advisor may counsel an investor to group all investments together, the behavioral fact does not change: to invest in X is a specific action, and selling a loser is exchanging a possible win for an actual loss (Principle 7). Thaler (1999) gives the following example of the phenomenon: an investor needs to raise some cash and must choose between two stocks to sell, one of which has increased in value and one of which has decreased. “Mental accounting” – analysis of the choice as a behavioral, not outcome, choice, and Principle 7 – favors selling the winner. Traditional “rational” analysis favors selling the loser. Both experimentally and in statistical studies of actual investor behavior, it is found that the behavioral analysis, not outcome-based analysis, more accurately models actual investor decisions. As Greenblatt and Hann (2005) note, selling winners too soon and holding on to losers too long is one of the most well-documented investing phenomena.

Social norms

The case of students doing a requested favor for a professor, discussed above, illustrates the difference between an analysis of choices based on the traditional economic paradigm of a transaction and one based on the Community formulation. Analyzing the students’ behaviors, including doing the favor and refusing payment or demanding exorbitant compensation, omits a wide range of significant aspects of the situation, including the relationship between the professor and the students, the fact that having that relationship gives the students strong reason to do the favor, and the fact that paying the students would be a violation of the relationship and therefore a behavior that would change it to one much less valued by the students.

Ariely’s 2008 thought experiment presents these factors in a beautifully clear imagined situation. you stand up at the end of a sumptuous family Thanksgiving dinner and offer to pay your mother \$300 for it. Predictably, she and everyone else is outraged. Ariely asks, “What’s going on here? Why does an offer for direct payment put such a damper on the party?” Ariely’s answer is the usual one in behavioral economics currently. He notes, correctly, that people live in several distinct worlds, and that what is considered appropriate in one is often not in another. However, he then describes the behaviors and the situation in terms of exchanges, and that description omits the very factors that are of interest: “So we live in two worlds: one characterized by social exchanges and the other

characterized by market exchanges. And we apply different norms to these two kinds of relationships. Moreover, introducing market norms into social exchanges, as we have seen, violates the social norms and hurts the relationships.”

The real world, in which behaviors take place, is not one of “social exchanges.” “Social exchange” is metaphorical language for referring to the outcome, and only the outcome, of a limited number of behaviors, namely those engaged in because the actor has a particular relationship with another person, which are engaged in order to achieve some result, rather than intrinsic practices. The students move the professor’s furniture because the Significance is that they are doing him a favor, and they have a relationship that gives them reason to do him a favor. They are not doing it because they value having his furniture in a different location, as would be the case of their own furniture, or of a customer’s furniture if they were furniture movers. The situation is even clearer with the Thanksgiving dinner case: having Thanksgiving dinner is intrinsic, i.e., done for its own sake, not instrumental. There is no exchange taking place in either case.

Offering to pay for moving help, or for Thanksgiving dinner, is treating the help or the dinner as instrumental, i.e., behavior engaged in order to achieve some other state of affairs. Offering payment is treating the behavior as an expression of a buyer-seller relationship, a relationship of much less value to the other person. That change in relationship would thus be a serious loss. It does not call for explanation that the students would demand exorbitant compensation, or that everyone at the Thanksgiving table would be outraged, the mother most of all. It is not that there is a transaction influenced by conflicting norms; it is that a significant relationship is being violated by treating an intrinsic behavior as a transaction.

The Community parameters enumerate the various connections between social factors and behavior. “Norms” is a way of talking about a number of the fact that social factors influence behavior, but it is a loosely defined term, confounding at least three distinct kinds of facts about human communities, Choice Principles, Practices, and Statuses, intimately related to behavior and choice of behavior. The value of the systematic articulation provided by the Community parameters, rather than the loose concept of “norms,” is illustrated by the Duke basketball ticket case. We noted earlier that an important reason to not sell the championship ticket is that to do so would violate the individual’s Status of Fan. That reason translated directly into higher demand price: the holder of a ticket would be losing something of significant value and is demanding a higher price in compensation. Thus, both experimentally and in analysis of real-world decisions any of the Community factors may have significant economic impact.

A more subtle effect is revealed in an entirely different experiment, devised to study a different phenomenon, anchoring. Ariely reports an experiment in which subjects had the opportunity to buy or sell sounds, some pleasant and some very unpleasant. However, as Ariely noted, there is no existing market in sounds, which means there is no group of investors with existing repeatable patterns of behavior (Practices), principles governing choice of behaviors (Choice Principles), recognizable positions within the group (St), or World, that is, no coherent configuration whose various aspects comprise everything that

is or could be the case for people trading sounds. In short, there is no community of sound-traders, and therefore few if any results about choices among people trading sounds apply to choices among people engaging in the practices of an existing market.

Biases, Worlds and the K parameter

Central to the view that people are irrational is the belief that in general a person's assessments of the facts are flawed, biased by unconscious mechanisms that distort probabilistic assessments. This belief in judgment biases assumes that persons commonly base their actions on beliefs about the mathematical probability of events. The assumption is so basic that it goes unquestioned and almost unstated, other than in almost cursory restatements of it as though it were verified fact. When the experimental results are examined separately from the assumption, they show that in the overwhelming majority of cases people are not mis-applying probability; they are not using probabilistic reasoning *at all*. The apparent "biases" are illusions, resulting from the *a priori* commitment to the probability assumption.

In their early, foundational work on judgment, Tversky and Kahneman (1974) experimentally demonstrated a number of phenomena involving what a person takes to be the case based on observed or reported observations, including:

- Representativeness: if a person is presented with a description of an individual in terms of attributes they consider characteristic of a class, the person will take it that the individual is a member of that class, regardless of other statistical data.
- Availability: the ability to recall data accurately.
- Anchoring: accuracy of quantitative estimation is affected by a person's skill (or lack of it) and other Personal Characteristics such as confidence in their estimate.

Acting on their assumption that subjects are using probability to assess the facts and answer the experimenter's questions, they label the results "biases." Tversky and Kahneman give the following example of representativeness: Subjects are given a description in terms of personality traits, such as,

Steve is very shy and withdrawn, invariably helpful, but with little interest in people or the world of reality. A meek and tidy soul, he has a need for order and structure, and a passion for detail.

When asked Steve's likely occupation (pilot, librarian, physician, farmer, salesman), people base their assessment on the degree to which Steve resembles each occupation, and do not take into account several factors that should influence a probability estimate, including prior probabilities, sample size, accurate mathematical chance, predictability, ability to recall data accurately ("availability"), and so forth.

A similar example is cited by Barberis and Thaler:

Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations.

When asked which of “Linda is a bank teller” (statement A) and “Linda is a bank teller and is active in the feminist movement” (statement B) is more likely, subjects typically assign greater probability to B.

They then analyze the subjects’ responses in terms of probability theory, including Bayesian probability calculations, noting for example that it is mathematically impossible for statement B to have higher probability than statement A.

The design and interpretation of these experiments and all others of this genre are based on substantive and methodological assumptions, without apparent consideration of their validity:

- The assumption that people assess facts using probabilities. A basic premise of Tversky and Kahneman’s work, and the entire body of literature dealing with decision making under uncertainty, is that persons commonly base their actions on beliefs about the mathematical probability of events, i.e., relative frequency. They state, “Many decisions are based on beliefs concerning the likelihood of certain events” (Tversky and Kahneman, 1974, p. 1124). Rationality is defined as updating beliefs consistently with Bayes’ law, and behavioral economics as understanding the errors in applying mathematical probability theory, such as Bayesian calculations and sampling theory (Barberis and Thaler). The premise is virtually unchallenged in the economics and decision theory literature. Nevertheless, it is an assumption, not empirical fact. Furthermore, the above statement of Tversky and Kahneman’s actual results, as distinguished from their interpretation of them, shows clearly that in general persons do not base their assessments of the facts on probabilities.
- The assumption that “likely” is taken to mean “mathematically probable.” Tversky and Kahneman assume that their use of the word “likely” means that persons in general and experimental subjects in particular, are acting on the concept (K parameter) of mathematical probability. In point of fact language is far more ambiguous than that. In the Barberis and Thaler example, subjects might be taking the question to be about mathematical probability (the assumption), or any of the following (Jeffrey 2010a):
 1. “Which statement is a better description of Linda?”
 2. “Which statement best characterizes what kind of person Linda is?”
 3. “Which statement best states what is most important about Linda?”
 4. “Which statement is the most important thing to say about Linda?”
 5. “Which statement is most like what you would say of Linda?”

Tversky and Kahneman’s describe their results as follows:

Apparently, subjects evaluated the likelihood that a particular description belonged to an engineer rather than to a lawyer by the degree to which this description was representative of the two stereotypes, with little regard for the prior probabilities of the categories.

In other words, subjects appear to have taken the question to be, “Which occupation does the subject most resemble?”

(We are, of course, describing the phenomenon commonly called “misinterpretation.” We have avoided that term because it has a long history of use as referring to a mental process, a concept which, as noted earlier, we consider to be at best highly problematical.)

If it were demonstrated that subjects take questions using the terms “likely,” “probably,” etc., as referring to mathematical probability, and further that subjects then did as asked and attempted to determine mathematical probability, the customary re-labeling of experimental results on judgment as “bias” and “errors” would be appropriate. But no such thing has been demonstrated.

Further, Tversky and Kahneman note that persons *do* use probabilities when they have no other information:

“In the absence of a personality sketch, the judged the probability that an unknown individual is an engineer to .7 and .3, respectively, in the two base-rate conditions. However, prior probabilities were effectively ignored when a description was introduced, even when the description was totally uninformative.”

It is very illuminating to examine the description they consider uninformative:

Dick is a 30 year old man. He is married with no children. A man of high ability and high motivation, he promises to be quite successful in his field. He is well liked by his colleagues.”

Given this description, subjects judge the probability that Dick is an engineer, rather than a lawyer, as 0.5, in spite of “worthless evidence” (Tversky and Kahneman, 1974, p. 1125). That the evidence is worthless is an assumption by Tversky and Kahneman, who have not demonstrated, empirically, that there is no correlation between the attributes cited and profession, and more importantly they have not demonstrated that subjects know that there is no such correlation (if in fact there is none). What they have discovered is that subjects use information given, and giving information of one type or another can change what subjects take the question to be.

In general, a person takes the world to be as he has found it to be (Ossorio 1998), and what a person takes to be the case is what they act on. (This of course does not mean that the person is correct.) All aspects of the real world – all the objects, processes, events, and states of affairs that are actual or possible – are related (Ossorio 2005, Jeffrey 2010b), i.e., there is *some* relationship between them (though in many cases there is no single word for the relationship). Thus, for example, people take librarians to be meticulous, helpful, shy and withdrawn; salesman outgoing and friendly; engineers to be obsessed with detail, good with math and poor at interpersonal relationships; etc. Presenting a person in terms of those attributes is acting on those concepts. It does not call for explanation that an experimental subject would then continue to act similarly, identifying the occupation they know that most fits those attributes. When there is no other information presented other than frequencies, we would expect subjects to use that information, to the best of their ability, and that is exactly what the experimental data shows.

Investigations of judgment and probability involving actual, rather than presumed, use of probabilistic concepts has yielded interesting and useful results. Tversky and Kahneman, for example, found that people do not properly take into account sensitivity to sample size and improperly assess the probable outcomes of a truly random process such as repeated coin tosses or a roulette wheel (the well-known gambler's fallacy). In some cases, such as regression or the laws of large numbers, they misunderstand the concept. These results illustrate skill (or lack of it) in using concepts of probability, a Personal Characteristic. Tversky and Kahneman complain that people do not learn about regression in the course of their lives, and offer a psychological explanation for that failure: the belief that output should be "maximally representative" of input. We suggest that the answer is much simpler than that: people do not learn about regression, or the other probabilistic concepts, because they have not, in general, had any learning history that could be expected to lead to such understanding and skill. That an academic observer recognizes regression to the mean in, for example, heights of fathers and sons (Tversky and Kahneman, 1974, p. 1126) does not mean an otherwise untrained person does so.

The world and probability A person takes the world, or any aspect of it, to be as he has found it to be. "Found" means that the person has had some history of action and observation in which the world or aspect appeared that way: socially incompetent engineers, friendly salesman, shy librarians, etc. This does not mean only direct interactions; the history may include actual instances, reports of instances, pictures, assertions by others or in print, etc. It includes the entire range of events, objects, situations, processes, and actions involving that aspect in some way. In a typical (but certainly not universal) case, a person comes to consider the world to be one way rather than another by encountering it that way many times repeatedly, and encountering few exceptions. If almost all the librarians one meets are shy, meticulous, and helpful, we do not look for an explanation for someone taking it that librarians are shy, meticulous, and helpful, and in fact it would clearly call for explanation if one did not. Conversely, if every engineer one encountered were interpersonally sophisticated and considerate, one

would not take it that engineers were social inept, and it would call for explanation if one did.

An observer, such as a social scientist, could therefore observe a series of events in a person's life and count numbers of instances of various kinds: count the number of shy vs. effusive librarians, outgoing vs. reticent salesmen, etc., and thereby calculate various probabilities. Probabilistic descriptions are of that sort: observer re-descriptions of just one kind of fact, namely the number of times some aspect of the world is observed. Those re-descriptions are based solely on frequency counts; all other facts and relationships of any kind between aspects of the world are omitted. They are specialized and incomplete descriptions of the real world, useful as part of a description of a situation, but not the foundation of what a person knows about the world.

If such an observer were operating within the distorting lens of a paradigm including an *a priori* commitment to the idea that persons are generally, routinely using probability to assess the world and use of terms such as "likely" or "probably" reflects internal probabilistic calculations, they would almost inevitably conclude that assessments of the facts are determined by biases and inappropriate heuristics. The conclusion would be an illusion.

Section VII Implications for future work

High-fidelity models of economically significant communities

The parametric analyses of Intentional Action and Communities enable formal representation of the full range of facts about socio-economic systems. Work has been done building such formal models of significant sets of Practices of organizations (Jeffrey and Putman 1981, Jeffrey et. al. 1989), showing that producing such representations of actual human communities is practical. These resulting formal descriptions constitute high-fidelity models of the structure and dynamics of socio-economic systems, meaning that they accurately represent the entire range of the situations, processes, and events in the system. The level of resolution is limited only by the available information and amount of effort. One important area for future development is the elaboration of the practices, choice principles, and statuses (and associated relationships) of economically significant communities: nations, ethnicities, religious groups, professions, and particularly firms.

Quantification

In foregoing applications of Principles 1-7 to actual human behaviors and situation, terms such as "in general," "normally," "typically," and the like are employed. A wide-ranging research program quantifying these terms in two ways: a) Quantifying the relative frequency of the usual case and the various exceptions to it, and 2) Quantifying the relative strength and/or importance of logical relationships such as the relative strength of reasons (see Fig. 1) to act in various ways, across different communities.

Simulation

Having formal models of socio-economic systems makes possible a new kind of simulation of them. Akin to agent-based simulation, these simulations are high-fidelity simulations of the economic system of interest: team, firm, or nation. The fact that the descriptions of all aspects of a system are multi-level and complete at each level is extremely important, because it means that both macro- and micro-level simulation is done and both macro- and micro-level results obtained. Large-scale development of computer simulations of socio-economic systems, based on the Community and Intentional Action parametric formulations and quantified specification of communities and practices is possible and desirable. Such simulations can, when validated via the usual simulation validation procedures, can and should be a fundamental tool in design of economic policies. Any policy is the instantiation of a number of assumptions and conjectures about the personal characteristics of various groups of people, and the choice principles of various communities. (For example, it is sometimes claimed the reducing taxes on the rich will result in more jobs, because the rich will create companies or invest in companies that will create jobs.) Use of simulation tools made possible by the foregoing conceptual framework involves:

- a. Explicit articulation of all assumptions
- b. Representation of the assumptions formally and quantitatively, as input to the simulation
- c. Running the simulation program
- d. Using the results to confirm or disconfirm various of the assumptions.

A detailed outline of a simulation algorithm using formal specifications of community practices and choice principles is presented in (Jeffrey 2010a).

These simulations differ from current agent-based work in several ways:

- They are designed to operate with highly dis-similar agents, in contrast with the standard assumption of agent-based simulation.
- Actions of agents are described with hierarchically-organized sets of descriptions of Practices, not single-level processes.
- Descriptions of the practices incorporate not only the Procedure, but the full range of aspects of each behavior, : K, Kh, A, PC, and S.
- Community influences on behaviors are explicitly represented, in two ways: Choice Principles and their relationships with Practices are represented, and Practices are organized by Status. Each agent engages in a practice intrinsic to its status, by engaging in the Practices that comprise the selected version of the chosen intrinsic practice.

Macro-level simulations, most commonly computable general equilibrium models based on macro quantities related via equations, are relatively common, but the information that can be derived from them is limited. The quantities represented are the statistical aggregate of IADs, which omit most of the important variables involved in modeling behavior, both individually and in groups.

Mathematical theory of economic behavior, not outcomes

We have a mathematical economics. It is not, unfortunately, the mathematical economics of real persons, because it is based entirely on IADs, descriptions of only the state of affairs that is the direct result of the Procedure of the behavior. Because all of the aspects of behavior and communities are formal, the formulations constitute a framework for developing a different kind of mathematical economics, one which mathematically represents the entire range of facts about economic behavior in human societies, rather than only the outcomes. In short, we are now in a position to develop a mathematical theory of economic behavior, rather than what we have had, which is a mathematical theory of partial economic outcomes.

Controlling all the variables

The economics profession and the world at large would benefit greatly from the explicit recognition of the need to take in to account, in economic experiments and theories, the range of facts related to the subjects being persons in communities. Subjects are already members of specific communities with principles, practices, and statuses, and they know they are engaging in an experiment rather than the actual behavior, and these facts are unrecognized and uncontrolled variables. When variables are not accounted for, no conclusions can be drawn as to what the specific outcomes show about economic behavior outside the experiment.

When a professor does an experiment involving a group of MBA students in a class, those students 1) are members of the business community, 2) are MBA students, a Status having quite specific practices, 3) are members of the University community in the university at which they are students, 4) know that the professor is acting on his Status as a professor (rather than, e.g., an actual software vendor), and 5) they are engaging an experiment, not the real thing.

Ariely (2008) presents an experiment involving refrigerator contents in MIT undergraduate common rooms. He reports that a 6-pack of Coke disappears in 72 hours, but 6 one-dollar bills placed in the refrigerator are treated entirely differently, remaining untouched after 72 hours. Ariely attributes the difference to irrational influences on cheating, but as Putman (2010) points out, his analysis fails to take into account the many other variables involved: the practices in undergraduate MIT dorms, the fact that one-dollar bills are not treated the same as cans of Coke in that community (regardless of the approximately equally numerical value), the fact that MIT students have established practices with respect to Coke in common rooms and none with respect to dollar-bills. In other words, the observed outcomes are more readily and sensibly understood in light of the social reality of the experimental situation, which Ariely takes as mere background to the experiment.

Everywhere else in science experimenters are expected to identify and control all the variables in the situation. The same should be the case in economics. Homo

communitatis, as articulated in Principles 1-7, is an explicit list of what those variables may be. That MIT students, for example, constitute a community with identifiable practices and principles is not a theory; it is a reminder of various aspects of the context in which Ariely conducted his experiment, aspects that are uncontrolled variables.

A Specialized Lens

Finally, in our view it would be a significant advance in the economics profession and finance industry to recognize and incorporate into professional practice the (logical) fact that IAD-based analysis is a specialized form of analysis, analogous to lenses polarized in a specific direction, and therefore only one form of analysis. In our view, economic and finance professionals should as a matter of course analyze decisions and, where clients are involved, discuss those decisions as *behavioral* decisions, i.e., decisions to engage in one action or another, and therefore explicitly address the aspects of the various behaviors under consideration, particularly Significance. As we have seen repeatedly above, ignoring Significance leads to poor understanding and poor decisions.

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