

# ALL FRAMES CREATED EQUAL ARE NOT IDENTICAL: ON THE STRUCTURE OF KAHNEMAN AND TVERSKY'S FRAMING EFFECTS

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# All frames created equal are not identical: on the structure of Kahneman and Tversky's framing effects

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## Abstract

This paper revisits Daniel Kahneman and Amos Tversky's work on 'framing'. It shows how various conventions from economic theory allow the establishment of different equivalence relations between pairs of problems in framing experiments. Then, an exegesis of their comments on these experiments is conducted regarding the relation between their theoretical explanation through prospect theory and the positive/normative distinction in models of individual behaviors. Throughout, a methodological framework with a distinction between identity, equivalence and equality (borrowed to philosopher Craig Dilworth) is developed for a critical analysis of the relation between external frames (the empirical structure of a decision problem) and internal frames (the psychological representation of the decision problem by decision makers).

**Keywords:** framing, description invariance, extensionality, consequentialism, prospect theory, behavioral economics, Kahneman and Tversky

**JEL:** D03, D81, B21, B40, B41

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## Introduction

We use the term “decision frame” to refer to the decision-maker’s conception of the acts, outcomes, and contingencies associated with a particular choice. The frame that a decision-maker adopts is controlled *partly by the formulation of the problem* and partly by the norms, habits, and personal characteristics of the decision-maker. (Tversky and Kahneman, 1981, 453, my emphasis)

A significant and perhaps unfortunate early decision concerned the naming of the new concept. [...] [W]e chose to apply the label “frame” to descriptions of decision problems at two levels: the formulation to which decision makers are exposed is called a frame and so is the interpretation that they construct for themselves. Thus, framing is a common label for two very different things: an experimental manipulation and a constituent activity of decision making. [...] The use of a single term blurred the important distinction between what decision makers do and what is done to them (Kahneman, 2000, xiv)

Daniel Kahneman and Amos Tversky [KT] started to use the word ‘framing’ in a series of papers mainly focused on decision under risk in the 1980s. Roughly, KT’s experiments on framing consist in presenting two decision problems that are considered to be equivalent, but to observe different choices by a decision maker in each problem. The first of their papers on framing was addressed to a broad audience (Tversky and Kahneman, 1981, published in *Science*), another one to psychologists (Kahneman and Tversky, 1984, published in *American Psychologist*), and yet another one to economists (Tversky and Kahneman, 1986, published in a special issue of *The Journal of Business* containing the proceedings of the 1985 Chicago conference organized by Hogarth and Reder, who later turn them into the volume *Rational Choice. The Contrast Between Economics and Psychology*, in 1987). This diversity is worth noting as it partly explains the large influence of KT’s work beyond economics and psychology, to political science and medicine for example.<sup>1</sup>

This paper contends that despite such a popularity, there are still some empirical subtleties of KT’s experiments on framing that have not been discussed. The goal of this paper is to highlight these subtleties in a way that give some new perspectives on the relation between their theoretical contributions on prospect theory and their methodological contributions on the positive/normative distinction in models of individual behaviors. Indeed, framing experiments were central in KT’s well-known methodological inputs in the making of behavioral economics (see Heukelom, 2014). Roughly, standard models of economic theory are used as a normative benchmark defining the rationality of choices, i.e., what decision makers ought to do (e.g., maximize expected utility). If what decision makers are actually doing deviate systematically from the benchmark, these deviations are theoretically

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<sup>1</sup>Indeed, taken together, these three papers have been referenced over 20.000 times according to Google Scholar by January 2016.

accounted for by the construction of positive models such as prospect theory, which are not normative in the sense that they do not attribute rationality to the behavioral deviations. . This paper revisits KT's work on framing from the following methodologically oriented and historically situated perspective.

The historical focus is mainly on KT's own works and comments on framing (i.e., mostly 1981-1994), leaving aside economists reactions and eventual later developments. Such a narrow historical focus is motivated by the fuzziness which currently surrounds the uses of 'framing' in both economics and psychology. In psychology, this claim is detailed in most of the surveys on the framing experiments that have been conducted after KT's work on the topic (see esp. Levin et al., 1998; Keren, 2011b). Levin et al. (1998) distinguished three main types of framing effects within the broad class of "valence framing" inspired by Kahneman and Tversky to argue that "All frames are not created equal" (their title). Hence the title of the present paper which further investigates the subtleties of Kahneman and Tversky's own experiments. In economics, there are no such surveys, but the same case could be made: heterogeneous phenomena are increasingly being lumped together as 'framing' (see the use of this term in, e.g., Bernheim and Rangel, 2007; Saez, 2007; Salant and Rubinstein, 2008; DellaVigna 2009).

The methodological focus is mainly on the structure of the decision problems that KT constructed in their experiments on framing. In the words of Kahneman's quote above, the methodological focus is on "the formulation to which decision makers are exposed to"/"experimental manipulation"/"what is done to them" level, which was admittedly *not* KT's primary concern (Kahneman 2000). This level, i.e., the structure of decision problems, can be called an *external frame*, to be distinguished from the *internal frames* constitutive of the psychological processes which where the primary concern of KT, i.e., "the interpretation that they construct for themselves"/"a constituent activity of decision making"/"what decision makers do" in Kahenman's words. In the end, most behavioral phenomena are the result of an interactions of external and internal frames, i.e., the structure of a given problem triggers a given set of psychological processes rather than an other. Much attention has been devoted to the understanding of internal frames, i.e., of the underlying psychological processes in psychology (notably through prospect theory), and their possible representations in terms of choice, preference, belief and utility in economics. Much less attention (if any) has been devoted to the understanding of external frames, i.e., of the structure of decision problems. Obviously, the latter are constructed by psychologists and economists who already understand what they are doing to their decision makers – at least much more than what the decision makers are doing when faced with those problems. Yet, we shall see that a comparison of the designs of some of KT's original framing experiments reveal subtle

contrasts in the variety of ways by which two decision problems can be said to be *the same*. To conduct such a comparison, this paper proposes a framework constituted of two methodological distinctions (besides the internal/external frames already introduced) and takes one framing experiment called ‘the Asian Disease’ as a benchmark for comparison with the other framing experiments, and it will be argued throughout that this decision problem has very specific features.<sup>2</sup>

One distinction is between ‘identity’, ‘equivalence’ and ‘equality’, as stated by philosopher Craig Dilworth (1988). According to Dilworth, “the view that identity is a relation may derive from its being confused with equality and equivalence, and that, in the case of the identity of a thing with itself, identity in effect marks the absence of relation” (1988, 83). Roughly, on Dilworth’s account, identity characterizes individuation of things, concepts, terms, or more generally of entities; equivalence characterizes relations between individuated entities; and equality characterizes identity of numerical values, either in its most abstract form in mathematics (especially in number theory), or as the result of measurement procedures in the empirical sciences. This distinction is foreign to the literature on framing, but turns out to be very useful in two manners. On the one hand, the notion of equivalence is central (yet often confused with identity) in comments on the empirical structure of framing experiments. On the other hand, framing experiments involve numerical quantities, and the equality or inequality between some of these quantities is central in the theoretical explanations from economics or psychology.<sup>3</sup>

Dilworth’s threefold distinction nicely reinforces another distinction between ‘strict framing’ and

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<sup>2</sup>Michael Ryan (2005) and Diego Lanzi (2011) also use the terminology of ‘external’ and ‘internal’ frames in related but slightly different ways (it should be acknowledged that I learned about and read these two papers only after the present one was accepted for publication). Ryan uses it to contrast some functions of his model, but do not attach any specific empirical meaning to it. Lanzi uses it as a subdistinction of what is here called internal frames, to contrast the part of an internal frame that is triggered only by the external frame (this is what Lanzi calls ‘internal’ frames) and the part of an internal frame that may be triggered by something beyond the external frame (e.g., social norms, personal values and the like; this is what Lanzi calls ‘external’ frames). Lanzi (2011, 120) proposes another distinction between ‘endogenous’ and ‘exogenous’ frames which corresponds more closely to the use of (respectively) ‘internal’ and ‘external’ frames in the present paper.

<sup>3</sup>Dilworth (1988) defends a position that is controversial regarding the foundations of logic, but that does not really matter here because his distinction and vocabulary will be used for its virtues of clarification regarding the structure of framing experiments, *not* regarding the role of logic in the theories of psychologists and economists. Still some more details on his position are in order here. Individuation by identity is, on his account, marked by the absence of relations, and not by the presence of a reflexive relation, as is more traditionally conceived. Equivalence, by contrast, characterizes the very presence of (conceptual, linguistic, physical etc.) relations between distinct (conceptual, linguistic, physical etc.) entities, i.e., entities that have distinct identities. Furthermore, he argues that “[o]ne can speak of many sorts of things as being equivalent, and the notion is often used in the context of attaining some end”, for instance: “certain actions may be equivalent – running twelve minutes is equivalent to walking one hour, when it comes to the burning of calories” (Dilworth, 1988, 86). Finally, in  $1 + 1 = 2$ , the two 1s in the left side of the equation are identical and equal, and the mathematical expression  $1 + 1$  is not identical to 2, though it is equal to it because both have the same numerical values, namely 2 (ibid, 88). And “in the case of physical laws expressed by equations what are equated are measurable properties (parameters)” (ibid). In  $U = IR$ , which expresses Ohm’s law whereby “in a closed circuit voltage is equal to current times resistance”, “voltage is not being said to be identical with current times resistance – what is identical in this case, as in the purely mathematical case, is the numerical value of that which is represented on each side of the equation” (ibid).

‘loose framing’, as stated by psychologist Deborah Frisch (1993). The latter does come from the literature in psychology that has specialized on framing phenomena after the work of KT (i.e., circa 1993). To clarify the fuzziness in this literature mentioned above, Frisch (1993, 399) distinguished ‘strict framing’ as “pairs of problems that involve a redescription of the exact same situation” from ‘loose framing’ as “pairs of problems that aren’t exactly the same, but which are equivalent from the perspective of economic theory”. By “equivalent from the perspective of economic theory”, Frisch means identical in terms of *final* (monetary or other) outcomes, which are thus equal.

To this conceptual apparatus, consider KT’s most famous framing experiment, which will be discussed throughout this paper: the so-called Asian Disease (Tversky and Kahneman, 1981, 453). It is a paradigmatic example of strict framing because notice how, in its *external frame*, the consequences of choosing *A* or *C*, and *B* or *D* are *identical* and *equal* regardless of economic theory; only their descriptions are not identical, but equivalent from the perspective of ordinary language uses:

Imagine that the U.S. is preparing for the outbreak of an unusual Asian Disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the programs are as follows:

If **Program A** is adopted, 200 people will be saved.

If Program B is adopted, there is 1/3 probability that 600 people will be saved, and 2/3 probability that no people will be saved.

Which of the two programs would you favor?

If Program C is adopted, 400 people will die.

If **Program D** is adopted, there is 1/3 probability that nobody will die, and 2/3 probability that 600 people will die.

Which of the two programs would you favor?

The modal preferences are bolded: when presented with only the choice set  $\{A, B\}$ , decision makers tend to choose *A*, but when presented with only the choice set  $\{C, D\}$ , they tend to choose *D*. Even though the information presented in  $\{A, B\}$  and  $\{C, D\}$  may be said to be equivalent from some perspective, the choice reversal shows that the uses of the words “saved” and “die” may not trigger equivalent psychological representations of them. This might be due to, e.g., emotional, attentional, moral, etc. reasons that economists and psychologists try to theoretically capture in their accounts of decision makers’ *internal frames*.

The paper is organized in two sections. In a first section, the Asian Disease will be used as a benchmark for comparison with some other of KT’s loose framing problems. This strategy makes it possible to scrutinize the role played by various conventions of economic theory in establishing equivalence relations between frames, and thus the different ways by which two problems can *loosely* said

to be the same problem. In a second section, an exegesis of KT’s comments on framing experiments’ implications for the normative/positive distinction is conducted.

## 1 Contrasting framings

In the Asian Disease, experimental subjects are traditionally presented with the same *decision scenario* (“Imagine that...”) and *decision question* (“Which of...”), but in only one of the two *frames*: either in ‘saved frame’ where the choice set is  $\{A, B\}$ , or in the ‘die frame’ where it is  $\{C, D\}$ . Notice that, though the wordings of  $\{A, B\}$  and  $\{C, D\}$  are not identical, they refer to identical consequences and thus are equal in terms of these consequences: *the same* 200 people lives and 400 people dies in  $A$  and  $B$  (and the same reasoning applies to the probabilistic consequences). Hence they *only* differ in their descriptions of these consequences, i.e., in the *framing* of their objects of choice. This was a rather crude account of the structure of the problem, i.e., of its external frame, which will be refined in this section through comparison with other framing experiments. KT were more interested in its internal frame, i.e., in the psychological processes underlying the *framing effect* that is usually observed, whereby subjects tend to choose  $A$  over  $B$  but  $D$  over  $C$ . They reveal a preference reversal that Kahneman and Tversky sought to explain, mainly through their prospect theory (Kahneman and Tversky, 1979). We shall also explain exactly how in this section.

### 1.1 Framings in the isolation effect, and in the Asian Disease

The first framing experiment with which we shall contrast the Asian Disease is a decision problem leading to the ‘isolation effect’ (Kahneman and Tversky, 1979, 273), which is usually taken to be a framing effect. This is right in the loose sense, but misleading in the strict sense. In the following reproduction of this decision problem, notice how the decision scenario is not identical across frames, though the decision question is identical across frames:<sup>4</sup>

[Decision scenario:] In addition with whatever you own, you have been given €1000. [Decision question:] You are now asked to choose between  
[Objects of choice:] **A**: (1000,.50), and **B**: (500) [i.e., **A**: 50% chance of winning €1000 and 50% chance of winning nothing; **B**: 100% chance of winning €500 for sure]

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<sup>4</sup>Throughout this paper, decision problems are presented with some information in brackets that make some elements of their structure explicit, the modal preference is bolded, and the different currencies used in the original experiments have been homogenized in €. (conversion rates do not matter here because the framing effects under discussion have been shown are *not* magnitude effects, i.e., they do not depend on the absolute amounts of money; though with small amounts of money, they tend to disappear, see Küberger et al. 2002).

[Non-identical decision scenario:] In addition with whatever you own, you have been given €2000. [Identical decision question:] You are now asked to choose between [Non-identical objects of choice:] **C**: (-1000,.50), and **D**: (-500) [i.e., C: 50% chance of losing €1000 and 50% chance of losing nothing; D: 100% chance of losing €500 for sure]

In this loose framing, the decision scenario needs to change across (here ‘gains’ and ‘losses’) frames for the choice sets  $\{A, B\}$  and  $\{C, D\}$  to have equivalent consequences from the perspective of economic theory. The equivalence is established through the convention of counting as consequences, not the mere outcome of a choice, but the consequence of such outcome on the decision maker’s wealth. Hence the necessity to integrate the gains or losses with the endowment given in the decision scenario. Once this integration is done, then the consequences are identical and equal, and thus obviously equivalent from the perspective of economic theory. The consequences of choosing  $A$  or  $C$ , and  $B$  or  $D$  are, by themselves, not identical as they involve either gains or losses; only the consequence of winning nothing or losing nothing is identical in the two frames. By contrast, in strict framing of the Asian Disease, the decision scenario is identical across (‘saved’ and ‘die’) frames so that it does not need to change for the consequences to be equivalent from the perspective of economic theory. In terms of external frame, there is no strict framing experiments in KT’s 1979 paper.

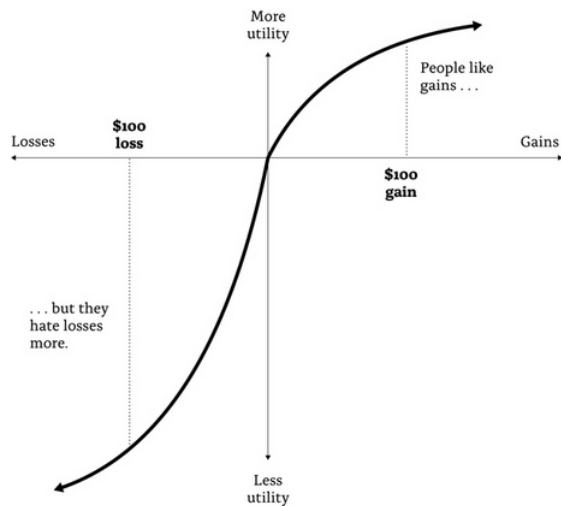
In terms of internal frame, however, KT claimed from the early 1980s onwards that strict framing effects were predicted and explained by their 1979 prospect theory. As is well-known, their 1979 prospect theory paper shook the decision theory community in economics on several grounds, notably due to two features of the paper. The first is that KT focused as seriously on probable losses in addition to the more traditional study of probable gains, to make the case for the pervasiveness of asymmetrical attitudes towards risk depending on whether losses or gains were being evaluated, from a reference point which need not be zero. The second is that their 1979 prospect theory did not formally imply a preference for first-order stochastic dominance, maybe the most widely shared theoretical convention in the models of economists working in decision theory. Both these features explain specific characteristics of framing phenomena. KT’s 1979 prospect theory is essentially a combination of a value function and a weighting function. The weighing function represents decision makers’ perceptions of the probabilities; we shall not discuss it until the next-subsection. The value function represents decision makers’ asymmetrical attitudes towards risk. In his last book, Richard Thaler provides a very pedagogical depiction of the value function:<sup>5</sup>

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<sup>5</sup>Thaler (1980) is the main economist that introduced KT in economics leading to the creation of behavioral economics. More precisely, he introduced two features of KT’s work into consumer choice theory. One is KT’s value function. The other is the ‘descriptive’/normative distinction regarding models of individual behaviors. The latter comes from decision theory and is not strictly speaking KT’s methodological contribution, though their contributions insisted on the



Figure 1: Thaler’s (2015, fig.3) version of KT’s 1979 value function



The curvature of the function implies risk-seeking when the consequences are losses and risk aversion when the consequences are gains. The point at which the curvature reverses, the so-called reference point, determines what counts as losses and what counts as gains. The isolation effect was meant to show that the reference point is not necessarily one’s total wealth or even one’s given endowment in a decision problem’s external frame. But it’s not necessarily zero either, so that losses (resp. gains) are not necessarily negative (resp. positive) quantities. Thus it is more appropriate to say that the value function depicts asymmetrical attitudes towards risk depending on *perceived* losses and gains rather than losses and gains *tout court*.

The value function is supposed to do all the work in KT’s explanations of both the isolation effect and the Asian Disease. For the isolation effect, the reference point changes across external frames (from €1000 to €2000), but not in the internal frame, i.e., the decision maker evaluates both frames with a same reference point of zero and hence sees the outcomes of  $\{A, B\}$  as involving gains, and the outcomes of  $\{C, D\}$  as involving losses. For the Asian Disease and according to KT,  $\{A, B\}$  “implicitly adopts as a reference point a state of affairs in which the disease is allowed to take its toll of 600 lives”, while  $\{C, D\}$  “assumes a reference state in which no one dies of the disease” (Kahneman and Tversky, 1984, 341). But who “adopts” and who “assumes” here? KT speak of an external frame as if it had the intentionality of an internal frame. But  $\{A, B\}$  and  $\{C, D\}$  are just written words in experimental importance of this distinction (see Heukelom, 2014).

situations, they do not adopt or assume anything by themselves. At best they can be said to come from the experimenters' (i.e., KT's) internal frame. Though KT clearly have in mind the decision maker here, notice that it is only because the Asian Disease is carefully designed as it is by the experimenters (KT) that different reference points are induced, i.e., the experimental manipulation is successful.

The specific structural feature of the Asian Disease that is worth noting at this point is this. It is the framing of the choice set that gives a specific meaning to the decision scenario, while this is the contrary in the isolation effect. Strict framing effects *can*, as in the Asian Disease, be induced only by framing the choice set, without touching anything to the framing of the decision scenario. Under an interpretation from prospect theory, it means that changes in reference points for the latter *can* be induced from framing the choice set only. To see that more vividly, do the following. Hide the choice sets from both the isolation effect and the Asian Disease, and notice what's the reference point in each external frames. In the isolation effect, the reference points are obvious and different: +€1000, and then +€2000. In the Asian Disease, the reference point is the same: "expected to kill 600 people" (and is arguably less clear because of the temporal dimension). Now hide the decision scenarios and notice whether the outcomes are gains or losses in each external frames. Again, it is obvious in the isolation effect:  $\{A, B\}$  and  $\{C, D\}$  are, taken in isolation, gains and losses respectively; so it is not surprising that they are *seen as* gains and losses respectively in the internal frames. By contrast, in the Asian Disease's external frames, the sets of outcomes taken in isolation are neither gains nor losses, they are mixed gains and losses. But it seems pretty obvious that  $\{A, B\}$  are seen as gains and  $\{C, D\}$  as losses in the internal frames, because of the semantics of "saved" and "die" respectively.

This is a first illustration of the contrast between the establishment of equivalence between frames through a theoretic convention (integration of gains and losses with the endowment) and through an atheoretic convention (semantics of "saved" and "die" in ordinary language). Further contrasts are provided in the next subsection, by continuing our comparison with the so-called framings of acts, and of contingencies.

## 1.2 Framings of acts, and of contingencies

In their 1981 paper KT provided a tripartition of external frames, into the framings of "acts", of "contingencies", and of "outcomes". Both the isolation effect and the Asian Disease are framings of outcomes. Let us then turn to the contrast between these and the two other types of framing. Roughly, in the framing of acts, it is the object of choice that decision makers have to choose that are framed

(i.e., not only the consequences inside). In the framing of contingencies, it is the ways by which a consequence can occur that are framed (mainly by playing with the names of the events within the same probability distribution).

In the following loose framing of acts (Tversky and Kahneman, 1981, 454), notice how some of the objects of choice  $A, B, C, D$  in the first frame are combined through the logical operator  $\&$  to make new objects of choice  $A\&D, B\&C$  in the second frame:

[decision scenario  $\&$  decision question:] Imagine that you face the following pair of concurrent decisions. First examine both decisions, then indicate the options you prefer.

Decision (i). Choose between:

**A.** a sure gain of €240

**B.** 25% chance to gain €1000, and 75% chance to gain nothing

Decision (ii). Choose between:

**C.** a sure loss of €750

**D.** 75% chance to lose €1000, and 25% chance to lose nothing

[non-identical (because absence of) decision scenario  $\&$  identical decision question:] Choose between:

**A & D.** 25% chance to win €240, and 75.% chance to lose €760.

**B & C.** 25% chance to win €250, and 75% chance to lose €750.

In this framing of acts, there is no equivalence strictly speaking, but inclusion. In the first frame, the two choices have to be made, one in  $\{A, B\}$  and one in  $\{C, D\}$ , so that the choice set is in fact equivalent to  $\{A\&C, A\&D, B\&C, B\&D\}$ , in which the second frame  $\{A\&D, B\&C\}$  is included. From the conventions of decision theory, however, one can see a loose equivalence between these two frames by considering that the part of the former not included in the latter, i.e.,  $A\&C$  and  $B\&D$ , are not relevant: the former because it is a strict loss, the latter because you would have a non-binary lottery with three consequences, i.e., +€1000 (with probability  $\frac{9}{16}$ ), €0 (with probability  $\frac{6}{16}$ ) and -€1000 (with probability  $\frac{1}{16}$ ). Arguably, the irrelevance of the latter is more disputable than the irrelevance of the former.

In the following framing of contingencies (Tversky and Kahneman, 1986, S263-4), notice how the blue marbles in the  $\{A, B\}$  frame disappears but not their consequences, as they are redistributed into the yellow marbles in  $C$ , and into the green marbles in  $D$ , and how the green and red marbles in  $B$  had the same consequences and have been combined into the red marbles in  $D$ :

[decision scenario] Consider the following lotteries [...]. [decision question] Which lottery do you prefer?

<i>Marbles</i>	<i>White</i>	<i>Red</i>	<i>Green</i>	<i>Blue</i>	<i>Yellow</i>
Option A	90%, €0	6%, win €45	1%, win €30	1%, lose €15	2%, lose €15
<b>Option B</b>	90%, €0	6%, win €45	1%, win €45	1%, lose €10	2%, lose €15

[identical decision scenario & decision question]

<i>Marbles</i>	<i>White</i>	<i>Red</i>	<i>Green</i>	<i>Yellow</i>
<b>Option C</b>	90%, €0	6%, win €45	1%, win €30	3%, lose €15
Option D	90%, €0	7%, win €45	1%, lose €10	2%, lose €15

In this framing of contingencies, the equivalence is achieved by combining marbles that yield the same distribution of expected values. The blue and yellow marbles in *A* yield the same expected consequences, and are combined into the yellow marbles in *C*. The red and green marbles in *B* yield the same expected consequences, and are combined into the red marbles in *D*. Thus the overall expected values and distributions of outcomes of both lotteries are preserved between frames, which make them equivalent from expected utility theory.

In the framings of acts and of contingencies, despite the equivalence from the point of view of expected utility theory across frames, the underlying consequences are not physically identical across frames. In the framing of acts, the opportunity to make one binary choice *disappears* (explaining the change in the decision question) and sums of money are *added*. In the framing of contingencies, marbles are *removed* and *added*. Hence, changes in the written words (that are thus non-identical across frames) imply changes in the physically implemented experimental setups (that would thus be non-identical across frames). In the Asian Disease, by contrast, there are physical identity of the consequences: 200 people live and 400 people die in both *A* and *C*, and this reasoning carries over to the probabilistic consequences. The non-identical features in the Asian Disease’s objects of choice do not concern the consequences but only the words describing them. To illustrate the contrast more vividly, if you remove the words “blue: lose €15”, you ought to remove the blue marbles in the underlying experiment, but the redescription of “200 people will be saved” (out of 600 people) into “400 people will die” (out of 600 people) only implies changes in the written words used in the experiments.

One implication is that it is impossible to observe violation of first-order stochastic dominance in strict framings. This is so for the simple reason that such relation of dominance is necessary between two things in the world that are non-identical (i.e., two different probability distribution), and strict framings are only about things in the world that are identical. Intuitively, one lottery first-order

stochastically dominates another one if you can win more money without taking more risk. In both the loose version of these framings there was such a relation of dominance.  $B\&C$  dominates  $A\&B$  for the acts, and  $B$  and  $D$  dominate respectively  $A$  and  $C$  for the contingencies. First-order stochastic dominance is the most important type of *relation between lotteries* ('in the world', i.e., in external frames) about which expected utility theory has something to say concerning individuals' preferences ('in the head', i.e., in internal frames) regardless of risk attitudes: namely, individuals should prefer the dominating lottery over the dominated one. The loose framings are about just that. Unlike the frames being either *positive* ('save') or *negative* ('die') in the Asian Disease, the frames in the loose framings either made the relations of dominance *transparent* ( $\{A\&B, B\&C\}$  for the acts,  $\{A, B\}$  for the contingencies) or *nontransparent* ( $\{A, B, C, D\}$  for the acts,  $\{C, D\}$  for the contingencies). Indeed, in the transparent frames, decision makers do not violate preference for first-order stochastic dominance, certainly because they see such relation of dominance much clearly than in the nontransparent frames. There was no violation of preference for first-order stochastic dominance in the Asian Disease for the simple reason that there is no such relations of dominance within its choice set.

In terms of explanation and prediction from prospect theory (i.e., about internal frames), notice that in both the framings of acts and of contingencies, there are no changes in reference points. In all of their lotteries, all gains and losses are so with respect to zero, regardless of the framings.

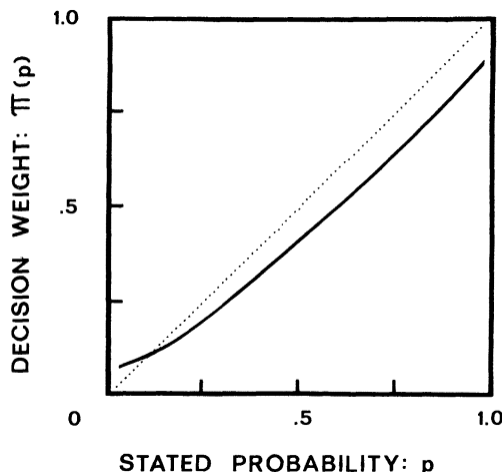
As in the Asian Disease, the value function from prospect theory still do much of the work in explaining the framings of acts, because in the nontransparent frames, the two decisions are evaluated in isolation, thus the risk-averse/risk-seeking asymmetry. But unlike in the Asian Disease, no changes of reference points need be postulated.

In the framing of contingencies, it is the probability weighting function that plays the main explanatory role, so a few explanations are in order about both how it works and about its implied violations of preference for first-order stochastic dominance. The function has the following shape (fig.2):<sup>6</sup>

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<sup>6</sup>As is well-known, KT's weighting function changed between the first version of prospect theory (Kahneman and Tversky, 1979) and the latter 'cumulative' version (Tversky and Kahneman, 1992), where it does not imply violations of first-order stochastic dominance anymore. We shall be concerned only with the former version here, as it is this one that KT use to explain violation of dominance in the framing of contingencies under discussion. Some contrast between the two versions will be made in the first subsection of the second section of this paper. For a thorough comparison, see Hein Fennema and Peter Wakker (1997).

Figure 2: Kahneman and Tversky's (1979, fig.4) weighting function



The dotted line represents objective values of probabilities, while the plain curve represent how such values are transformed into non-linear decision weights in decision makers' internal frames. Violation of dominance in the framing of contingencies discussed above is mainly explained through this function's property of subadditivity. The weights attributed to the probabilities of getting €45 by drawing a red marbles (with probability .06) *and* a green marble (with probability .01) in the transparent frame  $B$  is superior to the weight attributed to the probability .07 of getting €45 by drawing a red marble in the nontransparent frame  $D$  (i.e.,  $\pi(.06) + \pi(.01) > \pi(.07)$ ); hence explaining the shift of a preference for  $B$  to a preference against  $D$  (Tversky and Kahneman, 1986, S263).

We shall now continue our comparison with two further types of framings: under certainty, and related to social preferences.

### 1.3 Framings under certainty, and related to social preferences

So far, we have been concerned with KT's work on framing in decision under risk. However, from the very beginning of their work on framing, KT emphasized that the framing of outcomes was not confined to decision under risk, and carried over to decision under certainty. Quite similarly, in the late 1980s papers of Kahneman, Knetsch and Thaler, it is emphasized that the framing of outcomes carries over to social preferences. In both framings under certainty and related to social preferences, equivalence between frames do not anymore rely *only* on the numerical equalities of the distributions of the expected values. It relies on further conceptual equivalence from economic theory. Here is a clear example of a loose framing of outcomes under certainty (Tversky and Kahneman, 1981, 457):

[decision scenario:] Imagine that you have decided to see a play where admission is €10 per ticket. As you enter the theater you discover that you have lost a €10 bill.

[decision question:] Would you still pay €10 for a ticket for the play? **Yes** No

[non-identical decision scenario:] Imagine that you have decided to see a play and paid the admission price of €10 per ticket. As you enter the theater you discover that you have lost the ticket. The seat was not marked and the ticket cannot be recovered.

[non-identical decision question:] Would you pay €10 for another ticket? Yes **No**

There is a sunk cost that, in both frames, is equivalent to €10. From the conventions of economic theory, sunk costs should not affect economic choices. In the first ('lost bill') frame, sunk costs indeed do not affect economic choice, unlike in the second ('lost ticket') frame. Changes in the form of sunk costs should obviously not affect economic choices either, but this is what happens in the second frame.

Here is an example of a loose framing of outcomes related to social preferences for fairness (Kahneman, Knetsch, and Thaler, 1986, 731, discussed by Tversky and Kahneman, 1986, S262):

[decision scenario:] A company is making a small profit. It is located in a community experiencing a recession with substantial unemployment but no inflation. There are many workers anxious to work at the company. The company decides to decrease wages and salaries 7% this year.

[decision question:] Acceptable **Unfair**

[non-identical decision scenario:] A company is making a small profit. It is located in a community experiencing a recession with substantial unemployment and inflation of 12%. There are many workers anxious to work at the company. The company decides to increase salaries only 5% this year.

[identical decision question:] **Acceptable** Unfair

There is a change of real income (i.e., purchasing power) that, in both frames, is equivalent to a 7% decrease. From the conventions of economic theory, economic behaviors should be based on real, not nominal, prices. Hence social preferences for fairness should not be influenced by money illusion, as it is the case here.

By contrast with the Asian Disease, and in line with all other types of framings discussed above, changes in words across frames should, in the corresponding experimental setups or real world counterparts, imply physical changes in the consequences beyond mere words. This is because, once again, the frames do not have identical consequences. This is easy to see in the framing of outcome under certainty, where it is not the same things that are lost across frames, namely, a bill or a ticket. In the framing of outcomes related to social preferences, not only the amount of money written in the workers' bank account would differ, but so would the speech acts from the company, as declaring a decrease or an increase in wages do not have identical propositional contents. The reasons behind both speech acts are however identical, i.e., "a recession with substantial unemployment" and "There

are many workers anxious to work at the company”, as are the consumption bundles available in both frames.

In terms of internal frames, KT’s contention is that the value function of prospect theory provides explanation and prediction for both these framing effects, as in the Asian Disease. In the former, the reference point is to buy a ticket. When it is not yet bought, buying it is not seen as a loss, and the loss of €10 is not considered as part of the same economic decision. When it was already bought, buying another one is seen as a loss, and so the refusal of doing it is explained by loss aversion. In the framing of outcomes related to social preferences, decision makers reasoning on nominal wages will see the decrease as a loss (which it is) and loss aversion will tend to steer social preferences towards unfairness, i.e., the decision would be rejected if given the opportunity, which is not the case for the increase which they see as a gain (which it is not, in real terms).

This completes our analysis of the empirical structure of KT’s framing experiments. We have seen how different conventions from economic theory allow the establishment of equivalence relations between frames, which do not seem to match (at least ‘intuitive’) equivalence relations withing the decision makers’ internal frames. Let’s now turn to an exegesis of KT’s comments on these experiments.

## **2 Kahneman and Tversky’s comments on framings**

This section highlights the meaning of ‘framing’ in KT’s comments on the rationality of framing effects. It focuses mainly on the comments they made in their joint work, and more briefly on the comments they made separately.

### **2.1 Kahneman and Tversky’s comments in their joint work**

Both of KT’s 1981 and 1984 papers end on some comments regarding the normative dimension of framing, hence on the possible underlying rationality of decision makers revealing framing effects. Both these comments anticipate Kahneman’s later developments around the notion of experienced utility, which we shall not comment here (see the references in Kahneman and Thaler 2006). The idea is that if the framing of some outcomes not only influence the decision makers’ choices, but also his experience of the outcomes of his choices, then there is an hedonistic rationale to explain the choices. As KT puts it, “In such cases, the evaluation of outcomes in the context of decisions not only anticipates experience but also molds it” (Kahneman and Tversky, 1984, 350). Their 1981 comments



on the issue is worth quoting at length because it might also be responsible for the confusion between internal and external frames acknowledged by Kahneman (see the second quote in the introduction):

Further complexities arise in the normative analysis because the framing of an action sometimes affects the actual experience of its outcomes. For example, framing outcomes in terms of overall wealth or welfare rather than in terms of specific gains and losses may attenuate one's emotional response to an occasional loss. Similarly, the experience of a change for the worse may vary if the change is framed as an uncompensated loss or as a cost incurred to achieve some benefit. The framing of acts and outcomes can also reflect the acceptance or rejection of responsibility for particular consequences, and the deliberate manipulation of framing is commonly used as an instrument of self-control. When framing influences the experience of consequences, the adoption of a decision frame is an ethically significant act. (Tversky and Kahneman, 1981, 458, fn22 omitted)

Notice how there is a tension in every sentences between both an 'internal' and an 'external' notion of frames (especially in the last sentence). Acknowledging that any behavioral phenomena is the result of an interaction of internal and external frames is an easy way to resolve this tension (which would then just dissolve through an explicitation of such interaction). Since a charitable interpretation of the two last sentences can be taken to support this claim, it can be referred to as 'KT's early position' on the normative dimension of framing. Two evolutions are worth noting in KT's subsequent uses of 'framing' regarding the rationality of decision makers. But a little more background on prospect theory is first required to understand these two evolutions.

In the original prospect theory, violations of first-order stochastic dominance were formally implied systematically by the weighting function, but were theoretically avoided by KT's postulation of an "editing phase" and an "evaluation phase". Roughly, the editing phase consists in the decision maker turning the presentation of an external frame into a representation in his internal frame. And the evaluation phase consists in a standard evaluation of the objects of choice, but as they are represented in the internal frames, not as they are presented in the external frames. Several operations are postulated by KT as constitutive of the editing phase, among which is "the detection of dominance": "the scanning of offered prospects to detect dominated alternatives, which are rejected without further evaluation" (Kahneman and Tversky 1979, 275). As is well-known (see esp. Wakker, 2010, 153), economists were very dissatisfied with both the formal implication of violation of first-order stochastic dominance, and with KT's theoretical strategy of postulating that dominated objects of choice just did not make it to the evaluation phase. Hence, the empirical violations of first-order stochastic dominance in the 1986 paper are presented by KT as a response to their critics: the implication happens to occur empirically, which reinforced the empirical soundness of prospect theory (though, one could add, not

of the detection of dominance part of its editing phase).

Even though there is no violation of preference for first-order stochastic dominance in the Asian Disease (by virtue of the problem’s structure, as we saw), it is usually said that there is a violation of an implicit axiom of the standard model, often called *description invariance*. Intuitively, this axiom states that preference should be invariant to equivalent descriptions of the same problem. And the exact meaning of equivalence is usually implicitly defined to be ‘equivalent from the perspective of economic theory’, with all its conventions as we have seen in the previous section. In the 1980s, KT made “the general point that failures of invariance are likely to produce violations of stochastic dominance and vice versa” (Tversky and Kahneman, 1986, S256). This statement is a little confusing because failures of invariance in strict framings cannot lead to violations of stochastic dominance by the very structure of such decision problems. And we have seen that the redescription of frames in other loose framings (e.g., of contingencies) require a different and less minimal notion of equivalence than in strict framings if preferences are to be interpreted as violating invariance.

With this background in mind, the first evolution in KT’s uses of ‘framing’ regarding the rationality of decision makers occur in the 1986 paper and is related to the little confusing statement on the likely interdependence of violations of invariance and of stochastic dominance. This statement along with their empirical demonstrations of violations of first-order stochastic dominance, were seen together to warrant the following claim:

Because framing effects and the associated failures of invariance are ubiquitous, no adequate descriptive theory can ignore these phenomena. On the other hand, because invariance (or extensionality) is normatively indispensable, no adequate prescriptive theory should permit its violation. Consequently, the dream of constructing a theory that is acceptable both descriptively and normatively appears unrealizable. (Tversky and Kahneman 1986, S272)

KT’s 1986 paper is indeed often referenced as providing the ultimate argument for their main methodological inputs in the making of behavioral economics through the work of Thaler. As said in the introduction this methodological input consists in keeping the standard models of economic theory as a normative benchmark to evaluate decision makers’ actual choice behaviors. But the latter are to be explained and predicted through models such as prospect theory that are purely positive with no normative ambition (for a detailed historical background, see Heukelom 2014). So far, we have seen two ways by which such a claim could be relativized. First, by considering the implications of the strict/loose framing distinction and the fact that no violation of first-order stochastic dominance can arise in strict framing (see section 2.2). Second, by considering the possibility that the framing

of a decision problem influence not only the decision makers' choices, but also his experience of the consequences; by contrast with the 1981 and 1984 paper, no discussion of that possibility occurs in the 1986 paper. In the previous quote, KT consider another term for invariance, "extensionality", which will occur again later; in our exegetical remarks, we shall stick with the convention of the literature on framing effects that takes invariance and extensionality to be synonymous.<sup>7</sup>

The second evolution in KT's uses of 'framing' regarding the rationality of decision makers is in their 1992 paper on cumulative prospect theory. After a decade of explanations of framing phenomena through prospect theory, it is understandable that framing came to play a central role in KT's 1992 paper on cumulative prospect theory. Straight in the second page of the paper, "*Framing effects*" are number one on KT's list of the "five major phenomena of choice, which violate the standard model and set a minimal challenge that must be met by any adequate descriptive theory of choice" (Tversky and Kahneman, 1992, 298). Furthermore, the editing phase of the 1979 version came to be replaced by "the framing phase, [where] the decision maker constructs a representation of the acts, contingencies, and outcomes that are relevant to the decision" (ibid, 299). KT are keen on emphasizing at the beginning of the paper that

Although no formal theory of framing is available, we have learned a fair amount about the rules that govern the representation of acts, outcomes, and contingencies (Tversky and Kahneman, 1986). The valuation process discussed in subsequent sections is applied to framed prospects. (ibid)

But it can be argued that the centrality KT put on framing in the 1992 paper is more rhetorical than substantial. We saw above that KT emphasized that violations of first-order stochastic dominance were observed in the framings of acts and of contingencies. Somewhat paradoxically, the 1992 prospect theory and its "framing phase" does not explain such violations. Indeed, as already mentioned, the

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<sup>7</sup>A deeper analysis of the roots of these technical terms would reveal some subtle differences, however, especially if 'consequentialism' is taken along with invariance and extensionality for such a comparative exercise, as it is also used as a synonymous of these two terms in some instances (e.g., Tversky and Kahneman 1986, S253). 'Invariance' refers to the mathematics of measurement theory, in the making of which Tversky played a certain role (see Heukelom 2014). In this context, invariance roughly means: what needs to remain invariant in a measurement procedure for the numerical outcome to be meaningful (see Luce et al., 1990, chapter 22; Chao, 2007; Boumans, 2005, 144-119; 2007). 'Extensionality' was first used in a discussion of framing by Kenneth Arrow (1982), whose well-known background in the symbolic logic of Tarsky easily led us to infer that extensionality here indeed refers to a famous foundational issue in the philosophy of logic. Roughly, the issue is about the establishment of equivalence relations (and about the thorny issue of defining 'logical consequences'), and seem to have always been controversial (see e.g., Chisholm, 1941, sect. III; Anscombe, 1969; Quine, 1994; Thiel, 2003, 2009). And so have been the implications of 'extensionality' for economics (see e.g., Bacharach, 1994; Vilks, 1995; Cubitt and Sugden, 2003; Moscati, 2012). And so have also been its implications in psychology within the debates on the psychology of inductive and deductive reasoning in which KT's work are central (see e.g., Cohen, 1981). Finally, KT themselves refer to the work of Daniel Hammond (1988) on consequentialism in (dynamic yet atemporal) decision theory, indeed a formally complex and controversial foundational issue (see Wakker, 1999). Understanding the structure of framing phenomena could allow to understand the interconnections among invariance, extensionality, and consequentialism in the standard model. This is obviously beyond the scope of this paper.

new probability weighting function of their 1992 version prevent violation of stochastic dominance so that

it is no longer necessary to assume that transparently dominated prospects are eliminated in the editing phase – an assumption that was criticized by some authors. On the other hand, the present version can no longer explain violations of stochastic dominance in non-transparent contexts. (Tversky and Kahneman 1992, 302)

On a closer reading of the paper, none of the new experimental data presented by KT in the 1992 paper are about framing phenomena, and cumulative prospect theory does not shed more light on them than what they already said in the 1980s from prospect theory (that does *not* mean that cumulative prospect theory does not shed more lights on other, non-framing phenomena). Despite the fact that the ‘framing’ phase cannot explain the violations of dominance that were previously one of the main reasons for the claim that there was no normative justification for framing effects, the latter are still taken to be not rational, and the hedonic justifications of the early papers don’t appear anymore: “the conviction that only rational behavior can survive in a competitive environment [... is] questionable [... because] the evidence indicates that people can spend a lifetime in a competitive environment without acquiring a general ability to avoid framing effects” (Tversky and Kahneman, 1992, 317).

KT never worked on (at least ‘strict’) framing effects after the early 1990s, a period after which they increasingly started to work separately on different topics, as Kahneman (2000) retrospectively confirms. But that does not mean that they stopped commenting on framing. The following two subsections discuss two respective instances of such comments that are useful to characterize the evolution of the meaning of ‘framing’ in KT’s separate work.

## 2.2 Tversky’s comments in “Support theory”

Tversky and Koehler (1994) propose a theory of the formation of probabilistic beliefs called support theory, where the objects of judgments are not events but descriptions of events. As they put it,

The common failures of extensionality, we suggest, represent an essential feature of human judgment, not a collection of isolated examples. They indicate that probability judgments are attached not to events but to descriptions of events. (Tversky and Koehler, 1994, 548)

They “distinguish two sources of nonextensionality”: “memory limitation” and that “different descriptions of the same event may call *attention* to different aspects of the outcome and thereby affect their relative salience” (ibid, my emphasis). One of the main analytical goal of their paper is to ground the subadditivity assumption that we saw was central in prospect theory’s original probability weighting

function to explain violations of dominance in nontransparent framing of contingencies. It is therefore quite natural that the framing of contingencies presented above figures among the many experimental data they sought to explain (562). Their position on the underlying normative dimension of the phenomena they study is the following:

The failures of extensionality demonstrated in this article highlight what is perhaps the fundamental problem of probability assessment, namely the need to consider unavailable possibilities. The problem is especially severe in tasks that require the generation of new hypotheses or the construction of novel scenarios. The extensionality principle, we argue, is normatively unassailable but practically unachievable because the judge [i.e., the decision maker] cannot be expected to fully unpack any implicit disjunction (565)

In a way, Tversky can be seen as having focused more on prospect theory's probability weighting function, commenting more on the framing of contingencies, and emphasizing more on the fact that invariance was normatively appealing yet impossible to apply constantly in decision making. By contrast (and as we shall see), Kahneman can be seen as having focused more on prospect theory's value function, commenting more on the implications of experienced utility (i.e., KT's early position) but on other types of decision problems than the ones involving strict or loose framing effects.

### 2.3 Kahneman's comments in *Thinking*

However, Kahneman displays a rather subtle position on the normative dimension of framings of outcomes in the chapter of *Thinking, fast and slow* dedicated to it (Kahneman, 2011, chap.34). In this chapter, he discusses both the framing of outcomes under certainty and under risk, but does not say the same thing about both. Concerning the framing of outcomes under certainty, Kahneman talks about "good frames" (371). He comments on the previous examples of the €10 bill lost *versus* the €10 theater ticket lost as follows:

The version in which cash was lost leads to more reasonable decisions. It is a better frame because the loss, even if tickets were lost, is "sunk," and sunk costs should be ignored. History is irrelevant and the only issue that matters is the set of options the theater patron [i.e., the decision maker] has now, and their likely consequences. Whatever she lost, the relevant fact is that she is less wealthy than she was before she opened her wallet. If the person who lost tickets were to ask for my advice, this is what I would say: "Would you have bought tickets if you had lost the equivalent amount of cash? If yes, go ahead and buy new ones." Broader frames and inclusive accounts generally lead to more rational decisions. (ibid)

The implicit consequentialism of economic theory is explicitly used in Kahneman's position to determine which are the "good frames" that "lead to more rational decisions". This can be seen as an explicit

development of KT’s early position (esp. in Tversky and Kahneman, 1981), whereby economic theory provides guidance in “the adoption of a decision frame [which] is an ethically significant act” (Tversky and Kahneman, 1981, 458).

But Kahneman’s position is different on the underlying normative dimension of the framing of outcomes under risk. Regarding the latter, Kahneman employs the expression “emotional framing” (364), and refers to what’s going on in the Asian Disease as “empty intuition” (368; both are section titles). Kahneman’s position on the normative dimension of the Asian Disease is especially clear in the following passage:

Your moral feelings are attached to frames, to descriptions of reality rather than to reality itself. The message about the nature of framing is stark: framing should not be viewed as an intervention that masks or distorts an underlying preference. At least in [...] the problems of the Asian disease [and others] there is no underlying preference that is masked or distorted by the frame. Our preferences are about framed problems, and our moral intuitions are about descriptions, not about substance. (Kahneman, 2011, 370)

Thus in cases of strict framing, that economic theory provides no specific ways of establishing equivalence between frames seems to imply for Kahneman that there is no sound guidance in the adoption of a good frame, or even that there is no such thing a good frame.

## **Conclusion: So what?**

The first section highlighted several ways by which economic theory allowed the establishment of equivalence between decision problems constructed by KT, while the second section depicted the evolution in KT’s positions on whether having preferences that are invariant to such equivalence relations was a normative demand of rationality. So what are the implications for contemporary economics? To conclude by some thoughts on this question, the following retrospective comment from Kahneman is especially worth commenting:

we eventually adopted a less theory-bound view of what makes two problems the same. It is the decision maker who should determine, after due consideration of both problems, whether the differences between them are sufficiently consequential to justify different choice. Violations of this lenient form of invariance demonstrate incoherence without a need for any judgment from on high about what is truly equivalent. The ubiquity of framing effects demonstrates that the human mind is not designed to achieve coherence.[...] Violations of invariance provide a compelling reason to separate descriptive from normative models of choice. It is surely rational to treat identical problems identically, but often people do not. (Kahneman 2000, xv)

Kahneman here seems not to distinguish identity from equivalence as was done in this paper. And in the view of identity adopted here (from Dilworth, 1988), the decision problems he is talking about are not identical, either in terms of consequences (viz. loose framings) or in terms of their descriptions (viz. strict framings). Furthermore, a set of experimental results that KT never discussed challenge the claim that decision makers usually see the pairs of problems in framing experiments as equivalent. The paper in which Frisch (1993) made the strict/loose distinction showed that this was especially the case in loose framings, and less strikingly so for strict framings. Recent findings on the role of language uses in framing experiments are increasingly making the case that decision makers are rationally inferring implicit information, and thus arguing against the view that description invariance is a normative demand of rationality (see the contributions in Keren 2011a). Some of these findings have even motivated some formal theoretical contributions in economics (see, e.g., Giraud, 2004; 2005; Giraud and Bourgeois-Gironde, 2009; Gold and List, 2004; Ahn and Ergin, 2010; Blume et al. 2013). From these contributions, it appears that formally fleshing out the implicit axiom of description invariance is not an easy task, on the one hand, and, on the other, that economists are at best agnostic on the rationality of the behaviors underlying framing effects or that they follow KT's late position that they are not rational. The methodological framework used to analyze external frames in this paper might be relevant for both the task of formally fleshing out an axiomatic structure to capture framing phenomena in economics, and to provide some arguments against the widespread beliefs that behaviors displaying framing effects are not rational because the two problems involved are 'obviously' the same.

One may speculate that the interaction between external and internal frames could be formalized to derive the conditions under which preference reversals are rational or irrational conditional on the speech act constitutive of the external frames (i.e., not only the words but who is the speaker, what are his or her intentions etc.). These conditions are likely to include the capacity of the decision maker to take a third-person perspective on the decision problem by imagining himself in the shoes of the one who constructed the external frame, and *vice-versa*, i.e., the capacity of the latter to imagine himself in the shoes of the decision maker (see van Buiten and Keren 2009). Such intersubjective process makes the normative dimension of models of individual behaviors less fixed than traditionally assumed. That is, it would not be associated with standard economics models in all cases; in some cases behavioral economics models could be interpreted as describing normatively justifiable behaviors (as with models of social preferences for fairness). The reason-based approach of Franz Dietrich and Christian List (e.g., 2013; forthcoming) along with the normative justification of choices by 'being able to convince or

not being able to be convinced' of Itzhak Gilboa et al. (2010) seem to provide appropriate frameworks for such a formal project (the latter could benefit from contemporary advances in the epistemological theory of justification through reflective equilibrium, see esp. Brun 2014a;b).

## References

- Ahn, David S. and Haluk Ergin. 2010. Framing Contingencies. *Econometrica*, 78(2): 655–695.
- Anscombe, Gertrude Elizabeth Margaret. 1969. Causality and Extensionality. *The Journal of Philosophy*, 66(6): 152–153.
- Arrow, Kenneth J. 1982. Risk Perception in Psychology and Economics. *Economic Inquiry*, XX: 1–9.
- Bacharach, Michael Owen. 1994. The Epistemic Structure of a Theory of a Game. *Theory and Decision*, 37(1): 7–48.
- Bernheim, Douglas B. and Antonio Rangel. 2007. Behavioral Public Economics : Welfare and Policy Analysis with Non-standard Decision-Makers. In Peter Diamond and Hannu Vartianinen (eds.), *Behavioral Economics and its Applications*, Princeton and Oxford: Princeton University Press. 7–77.
- Blume, Lawrence, David Easley, and Joseph Y. Halpern. 2013. Constructive Decision Theory. URL <http://arxiv.org/pdf/0906.4316v1.pdf>.
- Boumans, Marcel. 2005. *How Economists Model the World into Numbers*. London and New-york: Routledge.
- Boumans, Marcel. 2007. Invariance and Calibration. In Marcel Boumans (ed.), *Measurement in Economics. A Handbook*, London: Elsevier Inc., chapter 9. 231–247.
- Bourgeois-Gironde, Sacha and Raphaël Giraud. 2009. Framing Effects as Violations of Extensionality. *Theory and Decision*, 67(4): 385–404.
- Brun, Georg. 2014a. Reconstructing Arguments: Formalization and Reflective Equilibrium. *Logical Analysis and History of Philosophy*, 17: 94–129.
- Brun, Georg. 2014b. Reflective Equilibrium Without Intuitions? *Ethical Theory and Moral Practice*, 17: 237–252.



- van Buiten, Marc and Gideon Keren. 2009. Speaker-listener Incompatibility: Joint and Separate Processing in Risky Choice Framing. *Organizational Behavior and Human Decision Processes*, 108(1): 106–115.
- Chao, Hsiang-Ke. 2007. Structure. In Marcel Boumans (ed.), *Measurement in Economics. A Handbook*, London: Elsevier Inc., chapter 11. 271–294.
- Chisholm, Roderick M. 1941. Sextus Empiricus and Modern Empiricism. *Philosophy of Science* 1, 8(3): 371–384.
- Cohen, Jonathan L. 1981. Can Human Rationality be Experimentally Demonstrated? *The Behavioral and brain sciences*, 3(4): 317–370.
- Cubitt, Robin P. and Robert Sugden. 2003. Common Knowledge, Salience and Convention: a Reconstruction of David Lewis' Game Theory. *Economics and Philosophy*, (2): 175–210.
- DellaVigna, Stefano. 2009. Psychology and Economics: Evidence from the Field. *Journal of Economic Literature*, 47(2): 315–372.
- Dietrich, Franz and Christian List. 2013. A Reason-based Theory of Rational Choice. *Nous*, 47(1): 104–134.
- Dietrich, Franz and Christian List. 2016. Reason-based Choice and Context-dependence: An Explanatory Framework. *Economics and Philosophy*.
- KEY: Dietrich
- ANNOTATION: forthcoming
- Dilworth, Craig. 1988. Identity, Equality and Equivalence. *Dialectica*, 42(2): 83–92.
- Fennema, Hein and Peter P. Wakker. 1997. Original and Cumulative Prospect Theory: A Discussion of Empirical Differences. *Journal of Behavioral Decision Making*, 10(1): 53–64.
- Frisch, Deborah. 1993. Reasons for Framing Effects. *Organizational Behavior and Human Decision Processes*, 54: 399–429.
- Gilboa, Itzhak, Fabio Maccheroni, Massimo Marinacci, and David Schmeidler. 2010. Objective and Subjective Rationality in a Multiple Prior Model. *Econometrica*, 78(2): 755–770.
- Giraud, Raphaël. 2004. *Une théorie de la décision pour les préférences imparfaites*. Ph.D. thesis.

- Giraud, Raphaël. 2005. Anomalies de la théorie des préférence. Une interprétation et une proposition de formalisation. *Revue Economique*, 56(4): 829–854.
- Gold, Natalie and Christian List. 2004. Framing as Path Dependence. *Economics and Philosophy*, 20(2): 253–277.
- Hammond, Peter J. 1988. Consequentialist Foundations for Expected Utility Theory. *Theory and Decision*, 25: 25–78.
- Heukelom, Floris. 2014. *Behavioral Economics: A history*. New York: Oxford University Press.
- Hogarth, Robin M. and Melvin W. Reder. 1987. *Rational Choice. The Contrast between Economics and Psychology*. Chicago and London: The University of Chicago Press.
- Kahneman, Daniel. 2000. Preface. In Amos Tversky and Daniel Kahneman (eds.), *Choices, Values and Frames*, New York: Cambridge University Press.
- Kahneman, Daniel. 2011. *Thinking, Fast and Slow*. New York: Farrar, Straus and Giroux.
- Kahneman, Daniel, Jack L. Knetsch, and Richard Thaler. 1986. Fairness as a Constraint on Profit Seeking: Entitlements in the Market. *American Economic Review*, 76(4): 728–741.
- Kahneman, Daniel and Richard H Thaler. 2006. Anomalies: Utility Maximization and Experienced Utility. *Journal of Economic Perspectives*, 20(1): 221–234.
- Kahneman, Daniel and Amos Tversky. 1979. Prospect Theory: An Analysis of Decision under Risk. *Econometrica*, 47(2): 263–291.
- Kahneman, Daniel and Amos Tversky. 1984. Choices, Values, and Frames. *American Psychologist*, 39(4): 341–350.
- Keren, Gideon. 2011a. On the Definition and Possible Underpinnings of Framing Effects: A Brief Review and a Critical Evaluation. In Gideon Keren (ed.), *Perspectives on Framing*, New York: Psychology Press, chapter 1. 3–34.
- Keren, Gideon. 2011b. *Perspectives on Framing*. New York: Psychology Press.
- Kühberger, Anton, Michael Schulte-Mecklenbeck, and Josef Perner. 2002. Framing Decisions: Hypothetical and Real. *Organizational Behavior and Human Decision Processes*, 89(2): 1162–1175.

- Lanzi, Diego. 2011. Frames as Choice Superstructures. *The Journal of Socio-Economics*, 40(2): 115–123.
- Levin, Irwin P., Sandra L. Schneider, and Gary J. Gaeth. 1998. All Frames Are Not Created Equal: A Typology and Critical Analysis of Framing Effects. *Organizational behavior and human decision processes*, 76(2): 149–188.
- Luce, Robert Duncan, Patrick Suppes, David H. Krantz, and Amos Tversky. 1990. *Foundations of Measurement. Volume III: Representation, Axiomatization, and Invariance*. New York: Academic Press.
- Moscatti, Ivan. 2012. Intension, Extension and the Model of Belief and Knowledge in Economics. *Erasmus Journal for Philosophy and Economics*, 5(2): 1–26.
- Quine, Willem v. O. 1994. Promoting Extensionality. *Synthese*, 98: 143–151.
- Saez, Emmanuel. 2007. Comment. In Peter Diamond and Hannu Vartiainen (eds.), *Behavioral Economics and its Applications*, Princeton and Oxford: Princeton University Press. 81–84.
- Salant, Yuval and Ariel Rubinstein. 2008. (A,f): Choice with Frames. *Review of Economic Studies*, 75: 1287–1296.
- Thaler, Richard H. 1980. Toward a Positive Theory of Consumer Choice. *Journal of Economic Behavior & Organization*, 1(1): 7–59.
- Thaler, Richard H. 2015. *Misbehaving: the Making of Behavioral Economics*. New York: W. W. Norton & Company.
- Thiel, Christian. 2003. The Extension of the Concept Abolished? Reflexions on a Fregean Dilemma. In Jaakko Hintikka, Tadeusz Czarnecki, Katarzyna Kijania-Placek, Tomasz Placek, and Artur Rójczak (eds.), *Philosophy and Logic: In Search of the Polish Tradition*, Kluwer Academic Publishers. 269–274.
- Thiel, Christian. 2009. Gottlob Frege and the Interplay between Logic and Mathematics. In Leila Haaparanta (ed.), *The Development of Modern Logic*, New York: Oxford University Press. 196–202.
- Tversky, Amos and Daniel Kahneman. 1981. The Framing of Decisions and the Psychology of Choice. *Science*, 211(4481): 453–458.

- Tversky, Amos and Daniel Kahneman. 1986. Rational Choice and the Framing of Decisions. *The Journal of Business*, 59(4): S251–S278.
- Tversky, Amos and Daniel Kahneman. 1992. Advances in Prospect Theory: Cumulative Representation of Uncertainty. *Journal of Risk and Uncertainty*, 5(4): 297–323.
- Tversky, Amos and Derek J. Koehler. 1994. Support Theory: A Nonextensional Representation of Subjective Probability. *Psychological Review*, 101(4): 547–567.
- Vilks, Arnis. 1995. On Mathematics and Mathematical Economics. *Greek Economic Review*, 17(2): 177–204.
- Wakker, Peter P. 1999. Justifying Bayesianism by Dynamic Decision Principles. URL [people.few.eur.nl/wakker/pdf/alias.pdf](http://people.few.eur.nl/wakker/pdf/alias.pdf).
- Wakker, Peter P. 2010. *Prospect Theory for Risk and Ambiguity*. Cambridge, England: Cambridge University Press.

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