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SYMPOSIUM ARTICLE

The "vanishing" of the disjunction effect by sensible procrastination

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Abstract The disjunction effect (Tversky and Shafir in Psychol Sci 3:305–309, 1992) occurs when decision makers prefer option x (versus y) when knowing that event A occurs and also when knowing that event A does not occur, but they refuse x (or prefer y) when not knowing whether or not A occurs. This form of incoherence violates Savage's (Cognition 57:31–95, 1954) sure-thing principle, one of the basic axioms of the rational theory of decision-making. The phenomenon was attributed to a lack of clear reasons for accepting an option (x) when the subjects are under uncertainty. Through a pragmatic analysis of the task and a consequent reformulation of it, we show that the effect does not depend on the presence of uncertainty, but on the introduction into the text-problem of a non-relevant goal.

Keywords Pragmatics · Disjunction effect · Decision making under uncertainty

1 Introduction

Tversky and Shafir (1992) studied the decision processes in choice under uncertainty. When thinking under uncertainty, people often do not consider appropriately each of the relevant branches of a decision tree, as required by

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consequentialism. In a more formal way, we could say that decision makers prefer option A (versus B) when they are in a certain condition and they also prefer A when they are not in that condition, but they refuse A (or prefer B) when they don't know in which condition they are. This pattern of preference clearly violates Savage's (1954) sure-thing principle, and Tversky and Shafir called it the disjunction effect. According to sure-thing principle: if x is preferred to y knowing that event A occurred, and if x is preferred to y knowing that A did not occurr, then x should be preferred to y even when it is not known whether A occurred.

The sure-thing principle (Expected Utility Theory) is not able to explain this phenomenon, given that it treats the choices as dependent on their anticipated consequences. According to the theory, each alternative is associated with an expected value and chosen according to the principle of value maximization.

An alternative explanation to formal modeling is the reason-based analysis of Tversky and Shafir. The authors attribute this pattern of preference to a lack of clear reasons for accepting an option (A) when the subjects are in the disjunctive condition. The authors speak about a sort of ''loss of acuity induced by the presence of the uncertainty. Once the outcome of the exam is known the student has good reasons for taking the trip: if the student has passed the exam, the vacation is presumably seen as a reward; if the student has failed the exam, the vacation becomes a consolation'' (Tversky and Shafir 1992, p. 306).

The phenomenon of the disjunction effect was studied using several scenario problems (Bastardi and Shafir 1998, 2000; Croson 1999; Kühberger et al. 2001; Shafir and Tversky 1992; Tversky and Shafir 1992; Shafir et al. 1993; Shafir 1994).

In the present research we consider the well-known Hawaii problem (while the gamble problem was treated in Bagassi and Macchi 2006a).

1.1 Disjunctive version

Imagine that you have just taken a tough qualifying examination. It is the end of the fall quarter, you feel tired and run-down, and you are not sure that you passed the exam. In case you failed you have to take the exam again in a couple of months—after the Christmas holidays. You now have an opportunity to buy a very attractive 5-day Christmas vacation package to Hawaii[1] at an exceptionally low price. The special offer expires tomorrow, while the exam grade will not be available until the following day. Would you:

x. buy the vacation package;
y. not buy the vacation package;
z. pay a $5 non-refundable fee in order to retain the rights to buy the vacation package at the same exceptional price the day after tomorrow—after you find out whether or not you passed the exam.

[1] For obvious geographical reasons, Hawaii (which cannot be a reasonable destination for a 5-day holiday from Europe) have been changed with ''a nice destination''.

1.2 Pass/fail version

Imagine that you have just taken a tough qualifying examination. It is the end of the fall quarter, you feel tired and run-down, and you find out that you passed the exam (failed the exam. You will have to take it again in a couple of month—after the Christmas holidays). You now have an opportunity to buy a very attractive 5-day Christmas vacation package to Hawaii at an exceptionally low price. The special offer expires tomorrow. Would you:

x. buy the vacation package;
y. not buy the vacation package;
z. pay a $5 non-refundable fee in order to retain the rights to buy the vacation package at the same exceptional price the day after tomorrow.

In the Hawaii problem, more than half of the subjects who know the outcome of the exam (54% in the passed condition and 57% in the fail condition) choose option x—buy the vacation package, but only 32% do it in the uncertain condition of not knowing the outcome of the exam. This is a crucial demonstration that Tversky and Shafir produced to show the disjunction effect. Here, as well as in the gamble problem, decision makers prefer option x (to buy the vacation package) when they are in a certain condition (passed exam) and they also prefer x when they are not in that condition (failed exam), but they refuse x (or prefer z) when they don't know which condition they are in (they don't know the outcome of the exam).

2 An alternative hypotheses based on an analyses of the relevance of the texts

Through a pragmatic analysis of the task—with reference to Relevance Theory (Sperber and Wilson 1986) and to the Psychorhetorical analysis of discourse (Mosconi 1990)—and a consequent reformulation of it, we will show that the disjunction effect is less general than has been supposed. We consider communication and thinking as two sides of the same cognitive process, which realizes in the discourse, as well as the ancient Greeks intended ''logos''. In Greek, in fact, the same word, ''logos'', means at the same time ''language'', but also ''calculation'', ''reasoning''.

Accordingly, analysis of the discourse is the proper methodology for studying reasoning. Numerous recent studies (Bagassi and Macchi 2006a, b; Dulany and Hilton 1991; Sperber et al. 1995; Politzer and Macchi 2000; Macchi 2000; Mosconi and Macchi 2001; Van der Henst et al. 2002) have shown the importance of the pragmatic approach to the study of thinking and reasoning, from problem solving, conditional reasoning and deductive reasoning to probabilistic reasoning.

However, according to our analysis, in the Hawaii problem the choice is affected by a misleading goal—''paying to know''—which is independent of the uncertainty condition, and that renders the choice z relevant in the control disjunctive version. Accordingly we propose that the choice of option z does

not occur as a consequence of the uncertainty condition, but as the result of the construction of the discourse-problem itself. Eliminating the ''paying to know'' aim, we expect that it will be possible to study the behaviour of people in the disjunctive condition in a ''cleaner'' way. We predict that in the Hawaii problem, as with the gamble problem after eliminating the added aim, the three conditions will not differ. We explored this hypothesis in two ways: first (Experiment 1), we eliminated from the text and from option z the spurious connection between the ''knowledge of the outcome'' and the ''decision'', which is not constitutive of the uncertainty condition. We expect a decrease of choices z in the experimental disjunctive version that we call ''Pure and Simple'' Disjunctive version.

Secondly (Experiment 2), we eliminated from the ''Pure and Simple'' Disjunctive version option z, limiting the decision to x (''buy'') or y (''not buy''). If the violation of the sure-thing principle was actually the result of the uncertainty in the disjunctive condition, we would expect that most of the subjects in the disjunctive condition prefer y, in (incoherent) contrast with the subjects in the certainty conditions (Pass/fail) that prefer x. According to our hypothesis we expect no difference in buy/not buy decisions across the three conditions of Pass/fail and disjunctive.

2.1 Experiment 1: ''Pure and Simple'' Disjunctive version

According to us, option z is sensible only for people who are in the disjunction condition, because the possibility to postpone the decision is strictly connected to the knowledge of the outcome of the exam. Actually it says that:

The special offer expires tomorrow, *while the exam grade will not be available until the following day*.

[...]

z. Pay a $5 non-refundable fee in order to retain the rights to buy the vacation package at the same exceptional price the day after tomorrow—*after you find out whether or not you passed the exam*.

By contrast, to those subjects who are in the Pass/fail conditions this opportunity is not relevant (to pay just to postpone the decision by one day).

With this in mind, we reformulated the disjunctive version eliminating the connection of the decision with the knowledge of the outcome of the exam (underlined text), which is an element introduced by the text. Accordingly in this regard the revised text is now very similar in form to the Pass/fail conditions:

Imagine that you have just taken a tough qualifying examination. It is the end of the fall quarter, you feel tired and run-down, and you are not sure that you passed the exam. In case you failed you have to take the exam again in a couple of months—after the Christmas holidays. You now have an opportunity to buy a very attractive 5-day Christmas vacation package to Hawaii at an exceptionally low price. The special offer expires tomorrow. Would you:

x. buy the vacation package;
y. not buy the vacation package;
z. pay a $5 non-refundable fee in order to retain the rights to buy the vacation package at the same exceptional price the day after tomorrow.

2.1.1 Method

Participants and procedure In this and the following experiments, participants were undergraduate students of Humanity Faculties from the University of Milano-Bicocca. All groups were tested in Italian. Participants were tested at the beginning of a lecture. Each of them was randomly allocated to one of the four conditions. The three control versions were submitted to 114 students and the experimental version to 39 students.

Stimulus materials and manipulations Each participant received a form that contained one problem.

Four kinds of forms were prepared, defining four versions (three controls and one experimental version). The four versions were as follows:

- control 1, the disjunctive version, presented a translation of Tversky and Shafir' original problem;
- control 2, the Pass version;
- control 3, the Fail version;
- the ''Pure and Simple'' Disjunctive version, where the choice to postpone the decision to the day after tomorrow was not subordinated to the knowledge of the outcome of the exam. In this way it was consistent with the Pass/fail control versions.

Part in common for the two disjunctive versions Imagine that you have just taken a tough qualifying examination. It is the end of the fall quarter, you feel tired and run-down, and you are not sure that you passed the exam. In case you failed you have to take the exam again in a couple of months—after the Christmas holidays. You now have an opportunity to buy a very attractive 5-day Christmas vacation package to Hawaii at an exceptionally low price.

Control Disjunctive version

[...]

The special offer expires tomorrow, *while the exam grade will not be available until the following day*. Would you:

x. buy the vacation package;
y. not buy the vacation package;
z. pay a $5 non-refundable fee in order to retain the rights to buy the vacation package at the same exceptional price the day after tomorrow—*after you find out whether or not you passed the exam*.

''Pure and Simple'' Disjunctive version

[...]

The special offer expires tomorrow. Would you:

x. buy the vacation package;
y. not buy the vacation package;
z. pay a $5 non-refundable fee in order to retain the rights to buy the vacation package at the same exceptional price the day after tomorrow.

2.1.2 Results

The results in Table 1 show that, with the ''Pure and Simple'' Disjunctive version the percentages of subjects who choose to postpone the decision is substantially identical (18%) to the percentages of people who were not in an uncertain condition (22% in the pass condition and 15% in the fail one). Actually, most of the people in all the three versions decided to buy the vacation package (around 60%) (no significant difference). By contrast, with the original disjunctive version almost 50% of people choose to postpone the decision. The difference between the two Disjunctive versions—Control versus Pure and Simple—is significant [Chi square (1 *df*) = 6,61, $p < 0.05$]. It appears then that what determines the tendency to postpone the decision in the Control Disjunctive version is the connection between the ''knowledge of the outcome'' and the ''decision'', and not the presence of uncertainty. When the connection between the ''knowledge of the outcome'' and the ''decision'' is eliminated in the ''Pure and Simple'' version, the pattern of subjects decisions is coherent Table 2.

Table 1 Results obtained with Experiment 1 (the Hawaii problem—''Pure and Simple'' Disjunctive version)

	Pass ($N = 40$) (%)	Fail ($N = 39$) (%)	Disjunctive ($N = 35$) (%)	''Pure and Simple'' Disjunctive ($N = 39$) (%)
x. buy	60	62	40	59
y. not buy	18	23	14	23
z. pay a fee	22	15	46	18

Table 2 Results obtained with Experiment 2 (the Hawaii problem—Two-choices versions)

	Pass ($N = 34$) (%)	Fail ($N = 34$) (%)	Disjunctive ($N = 35$) (%)
x. buy	91	82	94
y. not buy	9	18	6

2.2 Experiment 2: the Hawaii problem (Two-choices versions)

To check our hypothesis, we submitted to three different groups of subjects the Disjunctive version and the Pass/fail versions offering just *two options*, limiting the decision to:

x. ''buy''

or

y. ''not buy the vacation package''.

If the uncertainty itself was the reason of the disjunction effect, we would expect incongruent choices, that is the choice of y in the disjunctive condition versus the choice of x in the certain condition (Pass/fail).

By contrast, according to our hypothesis, we expect that the choices of the three groups are not significantly different.

2.2.1 Method

Participants and procedure One hundred and three subjects were randomly allocated to one of the three conditions: the Pass version ($N = 34$), the Fail version ($N = 34$) and the Disjunctive one ($N = 35$).

Stimulus materials and manipulations Each participant received a form that contained one problem.

Three kinds of forms were prepared, defining three versions, as follow:

- the Disjunctive version, with two-choices;
- the Pass version, with two-choices;
- the Fail version, with two-choices.

Disjunctive ''Two-choices'' version

Imagine that you have just taken a tough qualifying examination. It is the end of the fall quarter, you feel tired and run-down, and you are not sure that you passed the exam. In case you failed you have to take the exam again in a couple of months—after the Christmas holidays. You now have an opportunity to buy a very attractive 5-day Christmas vacation package to a nice destination at an exceptionally low price. The special offer expires tomorrow. Would you:

x. buy the vacation package;
y. not buy the vacation package.

Pass/fail ''Two-choices'' version

Imagine that you have just taken a tough qualifying examination. It is the end of the fall quarter, you feel tired and run-down, and you find out that you passed the exam (failed the exam. You will have to take it again in a couple of month—after the Christmas holidays). You now have an oppor-

tunity to buy a very attractive 5-day Christmas vacation package to a nice destination at an exceptionally low price. The special offer expires tomorrow. Would you:

x. buy the vacation package;
y. not buy the vacation package.

2.2.2 Results

In all the three conditions, around 90% of subjects chose the vacation package (no significant difference). This is a further disconfirmation of the disjunction effect, since we obtained coherent choices. Furthermore, notice that in the experiment by Tversky and Shafir (and also in our Control version, Experiment 1), in addition to around 55% of the subjects who made the same choice (x) (in the Pass/fail versions), one third of the subjects also chose option z, indicating that almost all of the subjects (90%) potentially were favourably disposed to buy the offered package. The same happened in the disjunction condition, where 32% chose option x (to buy), and 61% chose option z. Again around 90% were potentially buyers of the holiday package (see Tversky and Shafir 1992, p. 305).

2.3 Experiment 3: the Hawaii problem (sensible procrastination)

If, as we have shown, procrastination of a decision is not a consequence of uncertainty, but of the structure of the text, it should be possible to induce procrastination of the decision even when the result of the exam is known. When one considers that around one third of the subjects in the original Pass/fail condition preferred to postpone the decision—presumably because of a sort of subjective uncertainty rather than any objective uncertainty—we would expect to be able to increase the proportion of people who choose (z) in the Pass/fail condition when it becomes more attractive. To test this hypothesis we changed option (z) of the Pass/fail original versions which was not sensible for people who already knew the outcome of the exam, into a new option (z1), as follows:

z1. pay a \$5 non-refundable fee in order to retain the rights to buy the vacation package at the same exceptional price **for some time**.

2.3.1 Method

Participants and procedure Ninety-eight subjects were presented with the Pass version z1 ($N = 58$) and the Fail version z1 ($N = 40$). Each subject was randomly allocated to one of the two conditions.

Stimulus materials and manipulations Each participant received a form that contained one problem.

Two kinds of forms were prepared, defining two versions, as follows:

- the Pass version (Z1),
- the Fail version (Z1).

Pass/fail version (Z1)

Imagine that you have just taken a tough qualifying examination. It is the end of the fall quarter, you feel tired and run-down, and you find out you passed the exam (failed the exam. You will have to take it again in a couple of month—after the Christmas holidays). You now have an opportunity to buy a very attractive 5-day Christmas vacation package to a nice destination at an exceptionally low price. The special offer expires tomorrow. Would you:

x. buy the vacation package;
y. not buy the vacation package;
z1. pay a $5 non-refundable fee in order to retain the rights to buy the vacation package at the same exceptional price **for some time**.

2.3.2 Results

Table 3 shows that most of the subjects in the certainty condition (52% in the Pass Z1 version and 57.5% in the Fail Z1 version) preferred to postpone the decision when the option (z1) is sensible for those who already know the outcome of the exam, because it offers the advantage of more time to think about the decision, while the option (z) was not.

The statistical analyses shows that there is not a significant difference with the Control Disjunctive version.

2.4 Experiment 4: the Hawaii problem (onerous procrastination)

By the same reasoning, if we render the procrastination option more onerous (z2) we should decrease the choice of this option in all the three conditions. To achieve this aim, we used the word ''deposit''[2] instead of ''fee'', in order to transmit the idea of paying a more substantial amount of money:

z2. Pay a non-refundable **deposit** in order to retain the rights to buy the vacation package at the same exceptional price the day after tomorrow.

2.4.1 Method

Participants and procedure One hundred and thirty-two subjects were presented with the Pass version Z2 ($N = 58$), the Fail version Z2 ($N = 29$), and

[2] We used the Italian word ''*caparra*'' (deposit) which indicates a percentage (usually around 20%) of the total amount of money that has to be paid for the holiday. In this sense, it is surely more onerous than a fee.

Table 3 Results with Experiment 3 (the Hawaii problem—sensible procrastination)

	Pass Z1 (N = 58) (%)	Fail Z1 (N = 40) (%)
x. buy	19	22.5
y. not buy	29	20
z1. pay a fee [...] for some time	52	57.5

the Disjunctive version Z2 (N = 45). Each of them was randomly allocated to one of the three conditions.

Stimulus materials and manipulations Each participant received a form that contained one problem.

Three kinds of forms were prepared, defining three versions, as follow:

- the Pass version (Z2);
- the Fail version (Z2);
- the Disjunctive version (Z2).

Pass/fail version (Z2)

[...] The special offer expires tomorrow. Would you:

x. buy the vacation package;
y. not buy the vacation package;
z2. pay a non-refundable **deposit** in order to retain the rights to buy the vacation package at the same exceptional price the day after tomorrow.

Disjunctive version (Z2)

[...] The special offer expires tomorrow, while the exam grade will not be available until the following day. Would you:

x. buy the vacation package;
y. not buy the vacation package;
z2. pay a non-refundable **deposit** in order to retain the rights to buy the vacation package at the same exceptional price the day after tomorrow—after you find out whether or not you passed the exam.

2.4.2 Results

As is shown in Table 4, with the onerous procrastination possibility very few subjects in all three conditions are prone to postpone the decision (10–20%). While option x is now chosen by around 70% in the Fail Z2 and the Dis-

Table 4 Results with Experiment 4 (the Hawaii problem—onerous procrastination)

	Pass Z2 (N = 58) (%)	Fail Z2 (N = 29) (%)	Disjunctive Z2 (N = 45) (%)
x. buy	45	73	70
y. not buy	40	17	11
z. pay a deposit	15	10	20

junctive Z2 (no significant difference), there is a moderate decrease of this kind of choices (45%) in the Pass Z2 condition (the difference between Pass and Fail versions is significant: Chi square (1 *df*) = 6,03, $p < 0.05$).

3 Discussion

The disjunction effect does not depend on the uncertainty condition, but on inserting in the text-problem the misleading goal ''paying to know'' (or ''waiting to know'' in several other scenarios used by Bastardi and Shafir 1998). This goal is not intrinsically connected to the uncertainty condition. By eliminating it, whilst still maintaining the uncertainty condition, we obtained a ''vanishing'' of the disjunction effect (see Experiments 1 and 2). On the other hand, when the ''z'' choice is sensible (see Experiment 3), most of the subjects choose it, while, on the contrary, when ''z'' is onerous (see Experiment 4), it is substantially ignored. Then, option ''z'' is not a ''real'' alternative to ''x'' and ''y'', but it becomes an additional premise that conveys information, so that the decisional context changes. Option ''z'' is a real alternative only when it is sensible, or pragmatically relevant, for the decisional context. It is therefore evident that the crucial factor is not the certainty versus uncertainty condition, but the relevance of the discourse-problem of which z is one element.

In sum, when people are in the uncertainty condition and they simply don't know (see, for instance, the ''Pure and Simple'' versions, where the link with misleading goals is not introduced) they do not make incoherent choices. Apparently then, the uncertainty itself does not induce ''loss of acuity'' nor ''a lack of clear reasons to decide'', nor an inability to consider each branch of the decision tree.

We obtained the same results with the problems studied by Bastardi and Shafir (1998). According to the authors, decision makers pursue information that appears relevant, but has no impact on choice. By a pragmatic analyses of the text-problems (Bagassi and Macchi 2006b), we showed again the misleading role of some certain elements of the text, independently on the uncertainty condition.

A further doubt about the reliability of the disjunction effect under experimentally controlled conditions comes also from Kühberger et al. (2001) who, with the Two step gambles problem, showed that people do not violate the sure-thing principle in repeated gambles.

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