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Influence of the Probability Level on the Framing Effect

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Abstract

Research of the framing effect of risky choice mostly applies to the tasks where the effect of only one probability or risk level on the choice of non-risky or risky options was examined. The conducted research was aimed to examine the framing effect in the function of probability level in the outcome of a risk option in three decision-making domains: health, money and human lives. It has been confirmed that the decision-making domain moderates the framing effect. In the monetary domain, the general risk aversion has been confirmed as registered in earlier research. At high probability levels, the framing effect is registered in both frames, while no framing effect is registered at lower probability levels. In the domain of decision-making about human lives, the framing effect is registered at medium high and medium low probability levels. In the domain of decision-making about health, the framing effect is registered almost in the entire probability range while this domain differs from the former two. The results show that the attitude to risk is not identical at different probability levels, that the dynamics of the attitude to risk influences the framing effect, and that the framing effect pattern is different in different decision-making domains. In other words, linguistic manipulation representing the frame in the tasks affects the change in the preference order only when the possibility of gain (expressed in probability) is estimated as sufficiently high.

Keywords: framing effect, risky decision-making, outcome probability, decision-making domain

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Introduction

The framing effect exists when different descriptions of formally identical decision outcomes lead to different choices – the change in the framing effect also leads to the change in the decision maker's preference order (Tversky & Kahneman, 1981). Whether we will describe option outcomes to the decision maker (DM) by emphasising positive aspects ("a half-full glass") or negative aspects ("a half-empty glass") can affect not only the final decision but also the DM's attitude to risk. Decision-making in risk conditions refers to decision-making problems, where the subject has the task to choose between two above-mentioned options of the same (expected) values which are distinguished by riskiness: the first option is non-risky (safe) while the second is risky. Each option can be framed: when we emphasise positive outcome aspects in the description of a situation, we use the positive frame (e.g. *90% people survive*), and when we emphasise unfavourable aspects of the same outcomes (*10% people die*), we use a negative frame. Such language manipulations in descriptions of possible outcomes are called *the frame* whereas the empirical phenomenon which is the consequence of these different descriptions is *the framing effect*. It is important to point out that in the task of risky decision-making there is no single normatively correct choice. In other words, in the decision-making theory it is not relevant whether the DM prefers a safe or risky option of the same expected values, but that he remains consistent in his/her own choice regardless of the way in which we presented the options.

The risky option contains information about net values and probabilities of favourable and unfavourable outcomes. In these tasks, the frame is placed on both options so that in a typical experiment there are four different possibilities: two positive and two negative safe and risky options. This includes the problem of the Asian disease, as well as variations and similar tasks used in a series of research (e.g. Frisch, 1993; Jou, Shanteau, & Harris, 1996; Kühberger, 1995; Reyna & Brainerd, 1991; Takemura, 1994; Tversky & Kahneman, 1981). Most research was aimed at measuring the change in risk aversion through comparing choices of risky options.

Frame experimental nation is varying descriptions of formally identical problems with the aim of emphasising different aspects of the presented situation: gains and losses. Swept by the wave of the huge success of Tversky and Kahneman, the results of the first and often replicated research confirmed the robustness of the framing effect (see Kühberger, 1998; Levin, Schneider, & Gaeth, 1998 for the overview of earlier research). The change in the examination procedure, complexity and deviation of the task from a classic problem of the Asian disease changed the picture. That is why in the last decade of the past century there was a large number of research reporting the inexistence of the framing effect (Ganzach & Schul, 1995; Li & Adams, 1995; Schneider, 1992; Shafir, 1993; Sniezek, Pease, & Switzer, 1990; Urbany & Dickson, 1990; Wang, 1996a; Wedell, 1997).

Structure of the Risky Decision-Making Task

The tasks mentioned in the studies differed by the frame type, domains which were decided about, measures used (from ranging to choice) as well as by whether those measures were group or individual, and the general finding was that the framing effect weakens as the task deviates from the format of the Asian disease problem without saying precisely which parametres are responsible for such changes (Kühberger, 1998). Decision-making tasks in risk conditions have a surface (soft) and deep (hard) structure. Under deep structure, we refer to the formal features of the risky decision-making task, i.e. necessary and sufficient elements and the way in which the task is constructed. Tasks usually have the following elements: a prologue, a safe and risky option with the lottery syntax. The surface structure refers to the content which is decided about and all other variations in tasks which do not change the task form, such as outcome probabilities, to whom exactly a decision refers to and similar aspects.

A special aspect of the surface task structure is the domain which is decided about. Framing effects were examined in different domains (contexts), i.e. the tasks used in experiments referred to different domains of human life: health, money, survival/death, ownership, time as a resource, shopping, morals and gambling (Kühberger, 1998). The findings suggest that the framing effect is connected with the "unit of measurement" of gain/loss. For example, when the classic task of the Asian disease was presented to a group of subjects as a statistical problem (by simply changing the task name into a "Statistical problem"), no framing effect was recorded, while the group which was presented the same task under the title "Medical problem" was prone to the framing effect (Bless, Betsch, & Franzen, 1998). The difference between framing effects in different domains is the topic of numerous studies (e.g., see Fagley & Miller, 1997; Haward, Murphy, & Lorenz, 2008; Huang & Wang, 2010; Wang, 1996b; Wang & Johnston, 1995). Different aspects of decision-making are of particular importance in different decision-making domains. For example, in certain decision-making domains, such as insurance and money investments, the precise determination of the point of change from underestimation to overestimation of probabilities is more important, whereas it is less important in some other decision-making domains (Huang & Wang, 2010). Moreover, subjects make riskier decisions about lives than about money (Damnjanović, 2013; Fagley & Miller, 1997; Kashima & Maher, 1995; Schneider, 1992; Tversky & Kahneman, 1981; Wang, 1996b) and ownership (Jou et al., 1996).

Therefore, framing effects vary in the function of the decision-making domain and those variations in consistency, intensity, and direction of the frame reveal different mechanisms occurring in the decision-making (Wang, 1996a). In decision-making about health, the framing effect, just as other cognitive biases, was mainly considered from the aspect of expert decision-making (Bornstein & Emler, 2001; Christensen, Heckerling, Mackesy, Bernstein, & Elstein, 1991). In medical practice, introducing the mandatory procedure of acquiring the patient's consent for conducting a medical intervention, called *informed consent*, directed research to decisions of patients (Chapman, 2004; Edwards, Elwyn, Covey, Mathews & Pill, 2001; Schwarz & Hasnain, 2002). Providing more information in the manner comprehensible to the patient is connected with the increased willingness to participate in medical treatments (Edwards et al., 2001). Patients are also susceptible to the framing effect in classically presented tasks of medical decision-making (Chapman, 2004; O'Connor, 1989), but they are less susceptible to the framing effect after more comprehensive consideration of both advantages and disadvantages of a certain treatment (Almashat, Ayotte, Edelstein, & Margrett, 2008; Garcia-Retamero & Galesic, 2010). In short, the aim of these studies was directed at mapping certain errors in the patient's decision-making and the manners of precise presentation of information (Covey, 2007; Moxey, O'Connel, McGettigan, & Henry, 2003).

Subjects are more prone to risk and their decisions are more prone to the framing effect when it comes to the choice of a medical treatment than a task from the domain of morals (Levin et al., 1988). When the survival rate is emphasised in relation to a medical treatment, subjects tend to accept the procedure more than when the emphasis is on the mortality rate (Levin et al., 1998). Risk-taking was observed in other health-related domains such as a number of pain hours (Eraker & Sox, 1981).

The Framing Effect and the Prospect Theory

The Prospect Theory (Kahneman & Tversky, 1979) represents a dominant behavioural decision-making model in conditions of risk. Framing effects indicate that the preference order is not invariant in relation to the different descriptions of the same situation. Tversky and Kahneman (1981) define "a decision frame" in order to describe the "decision maker's concepts in relation to acts, outcomes, and contingencies related to a certain choice. The frame adopted by the DM is partly determined by the problem formulation and partly by personal characteristics and partialities of the decision-maker himself – which form a reference point from which a problem is approached" (p. 455).

So, what happens in the decision-making process when the DM faces an enforced choice between the safe and risky option? Based on the conceptualization of the framing effect and empirical phenomena of deviation from the axiom of normatively rational decision-making, Kahneman and Tversky (1979) established the Prospect Theory (PT) whose key concepts are related to two functions – the value function and the probability weighting function.

The value function reflects the attitude of the DM to action outcomes. The value is defined in terms of gains and losses, i.e. by deviation from the reference point). Tversky and Kahneman start from the fact that in assessing values there is a value representing the norm (the above-mentioned reference point) in relation to which the outcome is valued as a gain or loss – thus forming the value function as the basis for decision-making.

The value function has the following characteristics: *referential dependence* (value carriers [y] are gains and losses determined in relation to the reference point, e.g. starting position, cross-section x and y); *loss aversion* – the slope of the function is bigger in the negative than in the positive domain, i.e. losses are assessed as higher than equally valuable gaines (loss of 1000 RSD has a larger weight than the gain of 1000 RSD); and *diminishing sensitivity* – marginal values of both gains and losses decline with their distance from the reference point, or the differential threshold increases with the distance from the starting position (Kahneman & Tversky, 1979).

The Prospect Theory introduces a concept of the reference point as a boundary between the zone of gains and the zone of losses. The implication of distinguishing these two zones is the assumption about a different psychological treatment of gains and losses: risk-taking and risk aversion. The Prospect Theory stipulates that the change of the frame in which outcomes are presented leads to the change of the reference point as well. Since our preferences are in the function of the reference point, our preferences will also change. If we present an outcome as positive, we place it into the zone of gains ("a half-full glass"), the function is convex upwards and the DM will tend to avoid risk, i.e. refuse the risky option if the safe option has also been offered. On the other hand, when we use the negative frame – we place it into the zone of losses ("a half-empty glass"), the value function is convex downwards and the DM will be prone to risk-taking. The value function is not a function of the decision maker's overall wealth but the function of the change in that wealth.

The probability weighting function of a decision reflects the DM's attitude to event probabilities. The shape of the function reveals that our attitude to probabilities is subjective, i.e. that the same differences in probabilities along the continuum from 0 to 1 are not experienced in the same manner. Earlier (normative) models, prior to the Prospect Theory, assumed that the DM will evaluate the probability 0.5 for winning as "probability 0.5 for winning". Contrary to that, the Prospect Theory treats preferences in the function of weight coefficients of a decision and assumes that these ponders do not linearly correspond to probabilities. Mathematically speaking, the value of probability is always between (inclusive of) 0 and 1, and values of probability are always added to 1. What is particularly psychologically intriguing is that people, however, observe probabilities differently. When judging and deciding about an uncertain event, even when they know the probabilities, decision makers do not observe the values of real (given) probabilities as such, but rather they use probability ponders (i.e. underestimate or overestimate them). Namely, there are objective probabilities and subjective, estimated probabilities which are treated by the DM as objective, i.e. which are considered by the DM and used as a basis for judging and deciding (maximising the value on the basis of subjective probabilities), while the relation between subjective and objective probabilities is not linear. A typical ponder function lies above the diagonal for low probabilities and below the diagonal for medium and high probability. The probability weighting functions are elaborated by Kahneman and Tversky in the Cumulative Prospect Theory (1992).

Probabilities 0 and 1 are observed as they really are, as impossible and as certain. However, low probabilities are overestimated or neglected. The probability of a rare event which is saturated in our mind will be overestimated; similarly, the probability of a rare event which is not saturated in our mind will be ignored. Besides that, medium and high probabilities are underestimated (for example, objective probability 0.9 is subjectively observed as 0.7). Subjective observation of probabilities is also illustrated by the fact that we observe the change of objective probability from 0.6 to 0.7 as a less important change from the leap from 0.9 to 1. These phenomenological aspects of observing probabilities are called the certainty effect and the pseudocertainty effect (Kahneman & Tversky, 1979; Tversky & Kahneman, 1981).

The questions of the critical point representing the boundary between high and low subjective probabilities, as well as shapes of this function, are still open. In the first version of the Prospect Theory (Kahneman & Tversky, 1979) the authors state 0.1 as the critical value of probability, while in the Cumulative Prospect Theory (Tversky & Kahneman, 1992) the probability weighting function is redefined and 0.3 is stated as the critical point of probability, while Kahneman (2011) states that even 0.2 probabilities are overestimated.

Fuzzy-Trace Theory

The Prospect Theory is described in the literature as a formal model of decision making, since it does not explain the nature of cognitive mechanisms in the basis of deciding (Kühberger, 2002). On the other hand, cognitive models assume that the level of cognitive processing is determined by the content and importance of a problem and that the opinion depends on the domain of the problem. Accordingly, the Fuzzy-Trace Theory (FTT) explains the framing effect as a result of strategies of information processing which operate at the surface, simplified level in judgment and deciding (Reyna & Brainerd, 1991, 1995; Reyna, Lloyd, & Brainerd, 2003). The thinking is fluid and operates at the level of essential gist information and not at the level of detailed, comprehensive, precise and numerical i.e. verbatim information. Processing is parallel and not linear like in logics, and the thinking is fuzzy and qualitative in processing, and not precise in the estimate. Framing effects are the result of processing at the qualitative level, i.e. of drawing the gist of the presented information. According to this approach, people prefer "fuzzy" processing or processing at the lowest possible level (Fischer & Hawkins, 1993; Reyna & Brainerd, 1995). The gist information and the detailed information are stored, coded and taken over by different mechanisms. In a situation when numerical information about probability is presented, the DM draws representations of the gist qualitative information. For example, a fifty-year-old woman is trying to find out the risk of her getting breast cancer and receives the information that her risk of breast cancer is

22%. The verbatim information is therefore 22% of the risk. However, the gist of this value can be interpreted in the range from "low" to "high" in relation to 50%, but, on the other hand, it is high in relation to the average risk for women of her age (11.3%). The gist depends on contextual factors (e.g. in her environment there may be someone suffering from breast cancer) and individual factors, including the level of numeracy (Reyna & Brainerd, 2007). The representation of gist information is the answer to the question: "What does 22% of the risk mean?" For example, a classic framing effect was registered in a study aimed at measuring various forms of avoiding risk, although the information about probability is not presented to subjects and they did not even ask for them, even though it was possible (Huber, Huber, & Bär, 2014). Similarly, the findings suggest that, while people are deciding in risk conditions, they are actually not even interested in the information about probability, rather they focus on the information about outcome and value it more (Huber, Wider, & Huber, 1997; Tyszka & Zaleśkiewicz, 2006). Using the technique of recording eye movements, a higher percentage of fixation on the information about the outcome was registered than on the information about the probability of that outcome (Su et al., 2013).

In typical tasks of risky choice, the gist information is frequently the basic categorical distinction between "no risk" and "with risk". In the example of Asian disease tasks, it means that the DM translates (reduces) quantitative information (number) presented in options into category information (*some* and *no one*), and therefore the safe option that *200 people will survive* turns into *some people will survive,* whereas the risk option that the *probability of 1/3 that all 600 people will survive and the probability of 2/3 that no one will survive* becomes *some people will survive or no one will survive*, which also happens in the negative frame. It is on this that FTT bases the explanation of the framing effect since the DM prefers to operate with the most simple possible gist information enabling deciding. Therefore, in the positive frame the DM actually prefers the option in which some people will survive to the option in which it is possible that some people will survive, but it is also possible that no one will survive. In the negative frame he prefers the option in which there is a possibility of no one dying as opposed to the option in which some people will definitely die. As a matter of fact, when redundant numerical information is eliminated from the options in the Asian disease task, by which the DM loses the possibility of deciding on the basis of the categorical gist information, the framing effect is eliminated (Kühberger & Tanner, 2010; Reyna & Brainerd, 1991). In other words, FTT claims that the DM, whenever it is possible, ignores the presented numerical information, or more precisely, that he translates "quantifiers" into "qualifiers", and then connects them in order to draw the conclusion what is the gist information. The empirical findings which are in line FTT show that intuitions based on gist extraction decrease risky behaviour in the health domain (Reyna & Farley, 2006) and that relying on gist information can contribute to better reasoning (Reyna & Brainerd, 1995).

Problem and Aim of Research

Size and direction, as well as the existence of the framing effect, having in mind numerous findings and models, are not unambiguous, but depend on a larger number of parameters of the task of deciding in risk conditions (Kühberger & Tanner, 2010; Levin et al., 1998; Wang, 1996a). Empirically speaking, the framing effect is registered in studies through many types of tasks and measuring techniques are also different so, although the results report about the existence of the effect, such results are not commensurable. The surface structure of the task also includes the expected utility of safe and risky options, where one aspect of expected utility refers to outcome probabilities presented in the task. Apart from the fact that the subject observes riskiness and probability presented in the decision-making tasks subjectively (PT), or reduces them to qualitative information (FTT), it is justified to assume that the decision maker observes such numerical information differently in different decision-making domains, which leads the DM to assume about different mechanisms in the basis of the framing effect. This is the basis for comparing two presented models of the framing effect. When it comes to the relation between probability and risky deciding, the findings indicate the possibility of the framing effect depending on the presented probability level (Gvozdenović & Damnjanović, in press). In the study referring to this conclusion, however, no effect of the domain of deciding was controlled, i.e. the registered framing effects were examined in several domains and analysed collectively (Milićević, Pavličić, & Kostić, 2007). In an earlier study, which examined the effect of the changed net value on the framing effect, the framing effect was examined in different domains (Wang, 1996b). This approach is complementary to the examination of the influence of the probability levels, because the expected value is a product of probability and net value. The decision-making domain is an inseparable feature of the surface structure of the risk deciding task. In our study, we examined the framing effect by comparing the size of the effect in three domains of deciding: about money, health and human lives.

Our study was aimed at offering a detailed empirical description of the phenomenon through introducing systematic variations of the parameters of the surface structure of the risky choice task (probability and domain), and at determining conditions in which the frame had an effect and those in which it did not. The objective also included theoretical aspect - to compare the predictive power of the two dominant descriptive models of deciding – the Prospect Theory and the Fuzzy-Trace Theory. Namely, possible sensitivity of the attitude towards risk in the function of probability cannot be explained by the Fuzzy-Trace Theory, since this model assumes that in presented tasks the DM will extract the gist information at categorical level (by translating numerical data into a relation of more or less). It can be concluded that the framing effect will remain equally consistent when subjects are presented with different levels of probability, as long as tasks keep the syntax of a classical task of the Asian disease (S1-R1R2, in both frames). The objective of the experiment was to examine the framing effect in the function of probability level of realisation of the risky option outcome. By varying probability in three domains of deciding (human lives, health, money) through six levels (0.05, 0.25, 0.40, 0.60, 0.75, and 0.90), risk tendency and risk aversion were examined in the function of probability. Since observing riskiness is correlated to the framing effect in risky deciding, the pattern of dependence of the framing effect on risk tendency mediated by probability was studied.

Method

Participants and the Procedure

Each of the total of 1800 subjects (of the average 22.7 years of age; 57% female) answered only one task of risky choice. The subjects had the task to choose one of two offered options by marking the preferred option. Answering was preceded by written and oral instructions. The study was conducted in groups of about 50 subjects during years 2012 and 2013 in 31 sessions. The subjects were students of the University of Belgrade (the Faculty of Law, the Faculty of Natural Sciences and Mathematics, the Faculty of Special Education and Rehabilitation), Singidunum University and the University in Banja Luka. Psychology students did not participate in the study.

Stimuli

Stimuli had the form of the risky-choice deciding task, which had lottery syntax, with two versions of the task at each level of the frame (positive and negative frames). In the tasks, the subjects made a forced (and imaginary) choice between the non-risky (sure, S) and risky (R) options, whereas the value of the safe option outcome was equal to the expected value of the risky option outcome. As the expected value of the risky option is equal to the sum of products of the outcome value and belonging probabilities, the outcome values of the safe option and probability in the risky option are in a direct linear relation - the low probability of the favourable risky option outcome also implied the low value of the safe option outcome (Appendix 1). All tasks consisted of the prologue (description of the situation) and two offered options (S and R). For the decision-making domain about human lives, the classic task of the Asian disease was used as the starting task (Kahneman & Tversky, 1979). The starting task of deciding about money shows the situation of a prize game which, ever since the Allais paradox, has been the usual choice of the situation for examining risky decision-making about money (see, for example, problem 11 in Kahneman & Tversky, 1979). The starting task for the third domain, i.e. deciding about health, had the form of a choice between two types of medical treatment - invasive (operation) and non-invasive (radiation), i.e. the options taken from the study about deciding about exclusive medical therapies (McNeil, Pauker, Sox, & Tversky, 1982). The total of 36 stimuli was constructed. The stimuli are shown in Appendix 1.

Design

The study design is 2 x 6 x 3. The first factor, the frame, had two levels - a positive and a negative description of the same options. The second factor, the probability level (of the favourable outcome of the risky option), had 6 levels (0.05, 0.25, 0.40, 0.60, 0.75, and 0.90). The third factor, or the decision-making domain, had three levels - deciding about money, human lives, and health. By crossing the factors of the probability level with two frames and three decision-making domains, 36 tasks of risky choice or 18 experimental situations were formed [probability (6) x domain (3)]. It was of particular importance to avoid the possibility of failing to detect the existing effect. In other words, in the preparation of the study special attention was paid to the minimization of type II error, so that the results of the analysis of the test strength show that the probability of detecting a statistically significant framing effect by bivariate test (at level $p<.01$) of the size reported by Tversky and Kahneman (1981) for the sample of 20 subjects per experimental group amounts to only 75.3%. When 30 subjects participate at each level, the test strength amounts to 93.4%. Finally, by increasing the number of subjects to 50 per experimental group, the test strength at the same level reaches as high as 99.8%.

Results

Factors of Risky-Choice

The risky choice percentages, confidence intervals, and chi-square statistics for framing effects obtained from the 32 experimental groups receiving the risky choice tasks in three examined domains are presented in Table 1 and Figure 1. Statistically significant percentage of the risky-choices in both frames was registered on 12 out of 36 tasks, 6 of them being in the health domain and 6 in the domain of human lives. A significant percentage of sure choices was registered on 8 tasks, of which 7 were in the monetary domain. In other words, risk-seeking is different considering three different domains. Percentage of subjects which choose risky option on all tasks (on all level of probability) in domain of human lives is 60.5% (95% CI [56.53, 64.33], in monetary domain 31.33% (95% CI [27.75, 35.15]), and in health domain 62.5% (95% CI [58.56, 66.20]). The second percentage is significantly different from the first and the last one – $\chi^2_{(2, N=1800)}=146.21$, $p<.001$. On the other hand, percentages of risky choices in domains of health and human lives do not differ, $\chi^2_{(1, N=1200)}=0.51$, $p=.48$. In short, subjects were more prone to risky options when outcomes were framed in terms of dying and surviving rates.

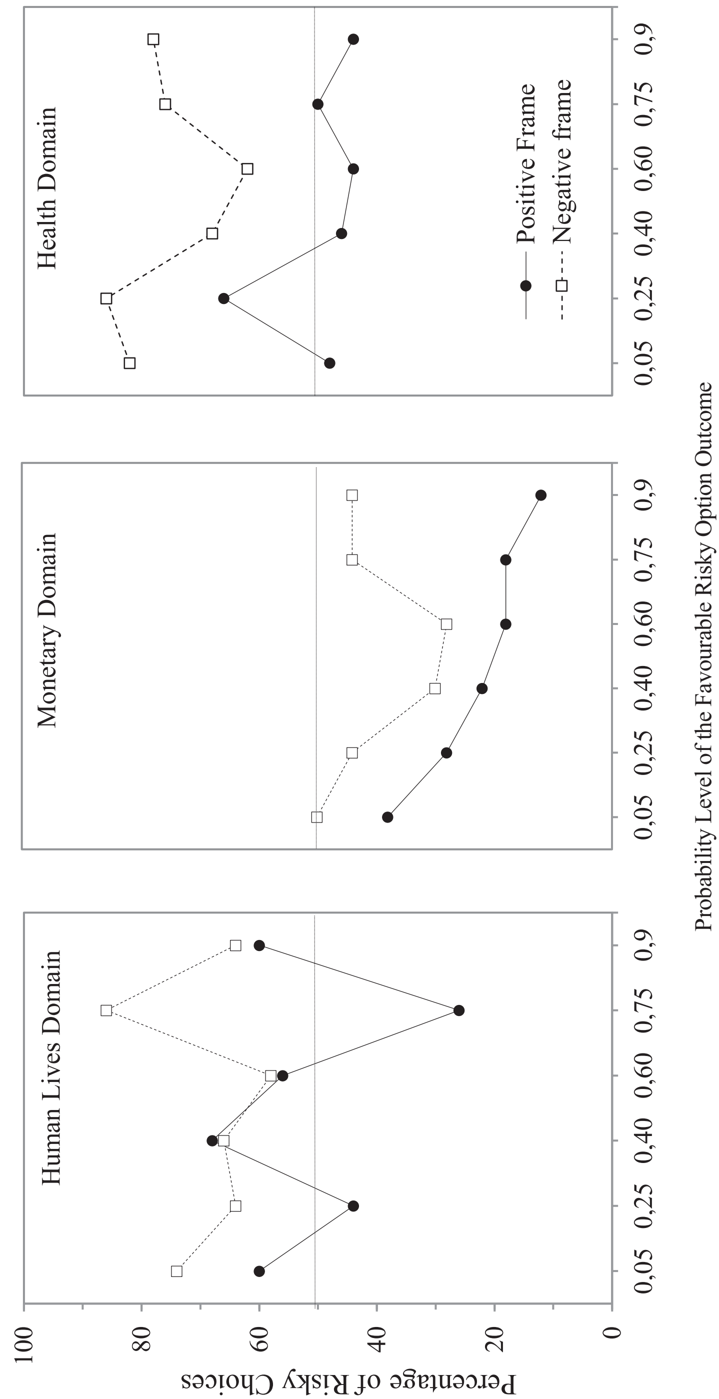
Table 1. *Group Differences in Risk Preference for Positively and Negatively Framed Outcomes of Decision Problems in Three Domains (Money, Health and Human Lives)*

Domain	Probability Level	Framing of the Outcome	Risky Choice			Framing Effect			
			P(%)	95%CI-	95%CI+	χ^2	r_φ	p	CONCLUSION
Lives	5%	Survive	60%	46.18	72.39	2.22	.15	.137	Non-significant
		Die	74%	60.45	84.13				
	25%	Survive	44%	31.16	57.69	4.03	.20	.045	Two-way
		Die	64%	50.14	75.86				
	40%	Survive	68%	54.19	79.24	0.05	-.02	.832	Non-significant
		Die	66%	52.15	77.56				
	60%	Survive	56%	42.31	68.84	0.04	.02	.840	Non-significant
		Die	58%	44.23	70.26				
	75%	Survive	26%	15.87	39.55	36.52	.60	<.001	Two-way
		Die	86%	73.91	93.05				
	90%	Survive	60%	46.18	72.39	0.17	.04	.680	Non-significant
		Die	64%	50.14	75.86				
Money	5%	Win	38%	25.86	51.85	1.46	.12	.227	Non-significant
		Lose	50%	36.64	63.36				
	25%	Win	28%	17.47	41.67	2.78	.17	.096	Non-significant
		Lose	44%	31.16	57.69				
	40%	Win	22%	12.75	35.24	0.83	.09	.362	Non-significant
		Lose	30%	19.10	43.75				
	60%	Win	18%	9.77	30.80	1.41	.12	.234	Non-significant
		Lose	28%	17.47	41.68				
	75%	Win	18%	9.77	30.80	7.90	.28	.005	One-way
		Lose	44%	31.16	57.69				
	90%	Win	12%	5.62	23.80	12.69	.36	<.001	One-way
		Lose	44%	31.16	57.69				
Health	5%	Survive	48%	34.80	61.49	12.70	.36	<.001	Two-way
		Die	82%	69.20	90.23				
	25%	Survive	66%	52.15	77.56	5.48	.23	.019	One-way
		Die	86%	73.91	93.05				
	40%	Survive	46%	32.97	59.60	4.94	.22	.026	Two-way
		Die	68%	54.19	79.24				
	60%	Survive	44%	31.16	57.69	3.25	.18	.071	Non-significant
		Die	62%	48.15	74.14				
	75%	Survive	50%	36.64	63.36	7.25	.27	.007	One-way
		Die	76%	62.59	85.70				
	90%	Survive	44%	31.16	57.69	12.14	.35	<.001	Two-way
		Die	78%	64.76	87.25				

Note. Each experimental group had 50 subjects. P - percentage; 95% CI- i 95% CI+ denote lower and upper boundaries of the 95% confidence interval estimated with Wilson's procedure (Wilson, 1927); χ^2 – Chi-square statistic; r_φ – mean square contingency coefficient; p – α level

A statistically significant tendency to choose the risky option was observed only in those tasks where the outcome probability contained in the risk option was 5% (P=58.67%, 95% CI [53.02, 64.10]). At remaining probability levels no significant preference for either option was established (trust intervals encompassed 50% of the risky option choice).

Figure 1. *Choice of the Risky Option as the Function of the Probability Level of the Favourable Risky Option Outcome in Deciding Tasks in Three Domains*



On the whole, subjects choose the risk option in the positive frame in 41.56% cases (95% CI [38.38, 44.81]), while they opt for this option in the negative frame in 61.33% cases (95% CI [58.11, 61.33]). These two percents significantly differ statistically ($\chi^2(1, N=1800)=70.47, p<.001$), which is the result suggesting existence of a two-way framing effect. Table 1 also contains results of chi-square tests for the corresponding pairs of experimental situations, different only in relation to the deciding frame, whereas the sizes of the framing effects are also expressed by phi-coefficient. These results show that out of the total of 18 pairs of deciding tasks, the two-way framing effect was registered in five cases and one-way in four cases. The framing effect was not recorded in nine cases. In other words, the main framing effect is not representative for all levels of the factors of the decision-making domain and probability level.

Factors of the Framing Effect

The probability level of 75% is the only one where the framing effect was registered in all three domains (ps<.01). It is only at the probability level of 60% that the framing effect was not statistically significant in any of three deciding domains (ps>.05). At the remaining probability levels, significance of the framing effect depended on the deciding domain.

In the domain of human lives, the percentage of subjects choosing the risky option in the positive frame amounts to 52.33% (95% CI [46.68, 57.92]), while the risk option in the negative frame is chosen by 68.67% of the subjects (95% CI [63.21, 73.65]). The difference in choices between two frames is statistically significant ($\chi^2(1, N=600)=16.75, p<.001$), and points to the existence of one-way framing effect in this domain. However, the significant framing effect in this domain was registered only at probability levels of 25% and 75%, while both effects were two-way and with a clear preference for choosing the safe option in the positive frame and the risky option in the negative frame (see Table 1). On the other hand, at probability levels of 40%, 60% and 90%, the percentage of choosing the risky option was almost identical in both frames. Results of three binary logistic regressions confirm that probability in the domain of human lives is not correlated to the framing effect ($B=0.26$, $\chi^2(1)=0.86, p=.35$) or, with the choice of the risky option, either in the positive ($B=-0.48$, $\chi^2(1)=1.46, p=.23$) or in the negative frame ($B=0.04$, $\chi^2(1)=0.01, p=.93$).

It is stated that most of the subjects choose the safe option in the monetary domain. So, the percentage of choosing the risky option in the positive frame is only 22.67% (95% CI [18.30, 27.74]), and 40% (95% CI [34.62, 45.64]) in the negative frame. The difference between two frames is statistically significant ($\chi^2(1, N=600)=20.95, p<.001$). However, one-way framing effects were registered only at probability levels of 75% and 90%. Moreover, results of binary logistic regression show that the interaction of factors frame and probability level in their influence on the choice of the risky option is statistically significant in this domain ($B=1.37$,

$\chi^2(1)=4.56$, $p=.033$). When the effect of probability level on the choice of the risky option is analysed in the positive frame, results reveal a linear dependence of the choice on the probability level ($B=-1.62$, exp(B)=0.20, $\chi^2(1)=10.74$, $p=.001$). If probability level is increased by one level, the chance for the risky choice is reduced by 80%. In the negative frame the correlation of probability level and percentage of the choice of the risky option is not linear ($B=-0.26$, $\chi^2(1)=0.40$, $p=.53$). The lines of the probability level factor shown in Figure 1 suggest that it would be more appropriate to show this correlation in the negative frame by square *U*-function. Just as in the domain of human lives, probability in the monetary domain was not in linear correlation with model behaviour nor the framing effect ($B=0.45$, $\chi^2(1)=2.44$, $p=.12$).

Finally, in the health domain, the subjects chose the risk option in 49.67% cases (95% CI [44.05, 55.30]) in the positive frame, while in the negative frame they made this choice in 75.33% situations (95% CI [70.15, 79.97]). The difference between these two percentages is statistically significant ($\chi^2(1, N=600)=42.16$, $p<.001$). Besides the probability level of 60%, the framing effect was registered in each pair of tasks in the health domain, while three effects were two-way and two effects were one-way. Results of binary logistic regression show that probability factor does not affect the size of the framing effect ($B=0.03$, $\chi^2(1)=0.01$, $p=.92$). Moreover, no linear dependence of the percentage of choosing the risky option on probability level was registered either in the positive ($B= -0.45$, $\chi^2(1)=1.29$, $p=.26$) nor in the negative frame ($B=-0.54$, $\chi^2(1)=1.34$, $p=.25$).

Discussion

Results of this series of experiments suggest that the size and direction of the framing effect are also determined by the risk level shown in the decision-making tasks, whereas the domain moderates the correlation of probability and choice. Earlier studies suggest that the presented probability level is not a necessary element of the decision-making task, since the framing effect is registered in those tasks where probability of realization of the favourable risky option outcome was omitted (e.g. Huber et al., 2014; Reyna & Brainerd, 1991; Su et al., 2013). However, on the basis of those findings, the assumption about the dependence of the size of the framing effect on this factor (probability level) cannot be rejected. In our study, probability level of 75% is the only one where the framing effect was registered in all three domains, while only at probability level of 60% the framing effect was not statistically significant in any of the three decision-making domains. At remaining probability levels, significance of the framing effect depended on the decision-making domain.

In the domain of human lives, the probability is not in linear correlation with risk tendency, which results in a specific pattern of choices and presence of framing effects. In the medium range of riskiness (shown by two points: 40% and 60%), as well as the highest and lowest levels, no framing effect was registered. Furthermore, when the probability of the favourable risky option outcome is 40% and 60%, risk tendency is identical in both frames, and the similar situation is for the highest and lowest levels. Since the expected value in the tasks was under control, i.e. the change in the outcome probability the net value of outcome was also changed, from this aspect the net value of safe outcome and probability of the favourable risky option outcome are exceptionally low or high for the last two levels (30 people – 5%; 540 people – 90%). In such situations, since the expected value is determined in equal measure to both values which are very close, it is possible to assume that the difference between, for example, the certain number of only 30 (out of 600) surviving people and probability of only 5% of all of them surviving is not sufficiently convincing. The assumption is that in such a situation the subject is focused to an exceptionally small percentage of survivors in the safe outcome, so that the risky option tends to be chosen more at this probability level in both frames. The probability weighting function of the Cumulative Prospect Theory predicts this risk tendency for probabilities in the zone of gains. By the same principle, on the opposite end of probability continuum, the safe net value is 540 human lives, while risky probability in which everybody will survive is 90%, so the tendency to the risky choice is the same again in both frames. The classic two-way framing effect is registered on two complementary levels (25% and 75%), where expected probability values (probability x net-value) are 150 and 450, which leads to a conclusion that there is a range of values for which the subjects have no strong preference, and in such decisions they tend to rely on the framing effect. That is a range of medium low and medium high probabilities, while in other, exceptionally low and exceptionally high and medium range, they have the same risk tendencies in both frames. In the original Asian disease task, probability level was 33% (the expected value of 200 [out of 600] lives), which is close to our second level. This probability belongs to the range of medium low ones or, descriptively, it is neither too high nor too low, and it is not close to 50% either.

In the monetary domain, the tendency to the risky choice is generally lower than in other two domains. Results show that risk tendency in the positive frame decreases with the increase of probability level (80% per level). Looking from a different aspect of the expected value, the tendency towards the safe choice in the zone of gains increases with the increase in the net value of the safe option outcome, which may also be the consequence of the certainty effect (Kahneman & Tversky, 1979). In the negative frame, risk tendency is higher than in the positive frame and decreases with the increase in probability level at first four levels, and then grows at the two highest levels (75% and 90%). Therefore, as long as probabilities for the favourable risky option outcome are seen as low (which is close to the pseudocertainty effect, Tversky & Kahneman, 1981), the high net value of the safe option (the lowest being 300 euros and amounting up to 3600 euros) is sufficiently attractive for subject to choose the safe option. Furthermore, when the possibility of not losing any gained money increases so that it is estimated as sufficiently high, while the safe sum is significantly lower that the initial one (1500 euros and 300 euros), the subjects become more willing to risk. This is in line with the probability weighting function in the Cumulative Prospect Theory, according to which risk tendency is expected in the loss at high probability levels, while the critical point for transferring from overestimating to underestimating given probabilities is between 0.2 and 0.3. Due to different attitudes to risk in the probability function in two frames, the effect was registered at two highest probability levels. This framing effect is one-way, since at both levels (as well as in all tasks in this domain) the subjects made more safe choices than risky ones, but at levels of 75% and 90% the tendency to the risky choice in the negative frame was significantly higher than in the positive frame.

In the health domain the subjects tended more towards risk in the negative than in the positive frame, but in neither frame the choice of the risky option was in linear correlation with the presented probability level. Framing effects were registered at five probability levels except for level of 40%. Just like in the case of risk tendency in this domain, results of binary logistic regression suggest that the size of the framing effect is not the consequence of the change in probability level either. However, the lines of simple effects shown in Figure 1 indicate non-linear dependence of the direction of framing effects and risk level. Namely, at the highest (90%) and lowest (5%) probability levels the effects are two-way, i.e. the safe option (radiation) is preferred in the positive frame, and the risky option (operation) is preferred in the negative frame. At the medium low (25%) and medium high (75%) levels, framing effects are one-way: the subjects in both frames chose the risky option on a large scale but much more significantly in the negative frame. Such an arrangement of directions of the framing effects suggest that (imaginary) decisions in the health domain will be more prone to the framing effects at both ends of probability continuum, while the framing effect will be weaker in the medium range of probabilities.

Having in mind the extremely high level of involvement of subjects in deciding in this domain and in line with the earlier findings (e.g. Huang & Wang, 1996; Reyna & Brainerd, 1995), framing effects are one-way (and more consistent) at high levels of involvement, which was recorded at levels 25% and 75% in our study. Once again, presented net values of the safe outcome (number of years to live) in tasks grow with the increase in probability level of the favourable risky option outcome. That is why at the lowest probability level the safe outcome is only 6 months to live, as opposed to the risky 5% (for 10 more years), and as many as 95% of not surviving the intervention. From that it can be concluded that the subjects demonstrate aversion to "gain", or the unattractive safe option, whereas that aversion is even (significantly) higher when the outcome is described negatively, which results in the framing effect. Such risk tendency in the zone of gains for low probabilities is in line with the probability weighting function of the Cumulative Prospect Theory. According to predictions of the same function, the subjects in our study show risk tendency in the health domain at the highest probability levels (75% and 95%). At these levels, net values of safe outcomes are relatively high (7.5 and 9 years), but the presented probabilities of even more favourable risky outcomes (10 years) are also high and the subjects treat them like close certainties and are more prone to risk. In the medium range of probabilities, there is a lower tendency to the risky choice than at lower and higher levels and, according to CPT, the subjects underestimate these values of probabilities. In other words, the subjects do not find these risky outcomes "sufficiently likely" and, in comparison to other probabilities, they tend to choose safe options to a larger extent. Risk tendency at these levels is higher in the negative than in the positive frame. While at level of 40% the difference in choosing risky option between two frames is significant and the framing effect is registered, at level of 60% it is not significant.

In short, linear dependence of risk tendency on the presented probability level is registered only in the positive frame of the monetary domain while in other two domains there are specific categorical patterns both of the attitude to risk and of the framing effects. The findings are also in line with the earlier studies in the aspect of higher risk tendency, when a pair of terms survival-dying was used as the frame (Wang, 1996b; Wang & Johnston, 1995). In these studies, the expected value was varied through variations in net values of the outcome and not through varying probability, which was constant. Results of our study show that the violation of the principle of normatively rational deciding was affected, apart from the frames, by one of the factors of expected value – the outcome probability of the risky option. The findings are not in line with the predictions of the normative Expected Utility Theory or the cognitive Fuzzy-trace Theory, but they do, in general, confirm predictions of the Cumulative Prospect Theory. Our findings replicate results of earlier, although rare, studies investigating the correlation of the framing effects and presented probability level (Gvozdenović & Damnjanović, 2016; Milićević et al., 2007; Wang, 1996b). The Fuzzy-trace Theory does not predict the change of the framing effect in the probability function and on the basis of our findings we can conclude that this model neglects the empirically significant aspect of the framing effect.

As for limitations of these findings, they stem both from the nature of the phenomenon of the framing effect and theoretical model within which it was examined, as well as from methodological aspects of our study. Although the psychological approach to investigating decision-making, just as other descriptive approaches, is founded on the prospect theory, in the literature the theory of Kahneman and Tversky is categorised in the group of formal, and not in the group of cognitive models (Kühberger, 2002). The model of the Prospect Theory also implies cognitive elements in deciding, but those elements are not elaborated either in the original version of the theory or in the Cumulative Prospect Theory; they are only implied as different psycho-physical functions on the basis of attitude to losses and gains between which there is a reference point (Kahneman & Tversky, 1982; Tversky & Kahneman, 1992). The question of how the cognitive system operates with elements of the task of risky deciding marked by the frame and probability is definitely still open. The prospect theory was aimed at offering a model which should describe how the deciding process really progresses and in that sense it has a limited range because this methodological approach does not directly investigate cognitive mechanisms in the basis of deciding.

Results of our study show that, despite the experimenter's invested efforts to record them in the context within which the outcome is presented, there are probability levels where subjects copy the preference order from the positive to the negative frame. However, in this study, the outcome probability of the risky option (which is one of the two mathematical factors of expected value, next to the net value) was operationalised by the factor with six levels, whereas the continuum was only assumed. In order to give a precise description of dependence of the framing effect on the presented probability level, further studies should include the whole probability range (from 0 to1). In addition, the initial net value our subjects had to opt for (6000 €) is another mathematical factor of expected value and it can be assumed that expanding the value range can influence the framing effect, which makes our findings limited in that aspect as well.

Results of this study are in line with former findings leading to the conclusion that risk aversion is not unambiguous and that it depends on whether the DM sees costs as reduced income or as a loss, as well as on the amount of "saved" money. The risk tendency recorded in the negative frame and different behaviours in the zones of gains and losses are generally in line with the decision-making model of the Cumulative Prospect Theory.

References

Almashat, S., Ayotte, B., Edelstein, B., & Margrett, J. (2008). Framing effect debiasing in medical decision making. *Patient Education and Counseling*, *71*(1), 102-107.

Bless, H., Betsch, T., & Franzen, A. (1998). Framing the framing effect: The impact of context cues on solutions to the 'Asian disease' problem. *European Journal of Social Psychology, 28,* 287-291.

Bornstein, B., & Elmer, A. (2001). Rationality in medical decision making: A review of the literature on doctors' decision-making biases. *Journal of Evaluation in Clinical Practice*, *7*(2), 97-107.

Chapman, G. (2004). The psychology of medical decision making. In D. Koehler, & N. Harvey (Eds.), *Handbook of judgment and decision making* (pp. 585-603). Oxford, UK: Blackwell.

Christensen, C., Heckerling, P., Mackesy, M., Bernstein, L., & Elstein, A. (1991). Framing bias among expert and novice physicians. *Academic Medicine, 66*, 76-78

Covey, J. (2007). A meta-analysis of the effects of presenting treatment benefits in different formats. *Medical Decision Making*, *27*(5), 638-654.

Damnjanović, K. (2013). *Efekat okvira: Domen odlučivanja.* In *The IV Conference Current Trends in Psychology, Book of abstracts* (pp. 113-115). Novi Sad, Serbia: Faculty of Philosophy

Edwards, A., Elwyn, G., Covey, J., Matthews, E., & Pill, R. (2001). Presenting risk information - A review of the effects of 'framing' and other manipulations on patient outcomes. *Journal of Health Communication*, *6*(1), 61-82.

Eraker S., & Sox, H. (1981). Assessment of patients' preferences for therapeutic outcomes. *Medical Decision Making, 1*(1), 29-39.

Fagley, N., & Miller, M. (1997). Framing effects and arenas of choice. *Organizational Behavior and Human Decision Processes, 71*, 355-373.

Fischer, G., & Hawkins, S. (1993). Scale compatibility, strategy compatibility and the prominence effect. *Journal of Experimental Psychology: Human Perception and Performance*, *19*, 580-597.

Frisch, D. (1993). Reasons for framing effects. *Organizational Behavior and Human Decision Processes, 54,* 399-429.

Ganzach, Y., & Schul, Y. (1995). The influence of quantity of information and valence framing on decision. *Acta Psychologica*, *89,* 23-36

Garcia-Retamero, R., & Galesic, M. (2010). How to reduce the effect of framing on messages about health? *Journal of General Internal Medicine*, *25*(12), 1323-1329.

Gvozdenović, V., & Damnjanović, K. (in press). Influence of the probabilty level on the framing effect in the reference point of loss. *Primenjena psihologija.*

Haward, M., Murphy, R., & Lorenz, J. (2008). Message framing and perinatal decisions. *Pediatrics*, *122*(1), 109-118.

Huang. Y., & Wang. L. (2010). Sex differences in framing effects across task domain. *Personality and Individual Differences, 48*, 649-653.

Huber, O., Huber, O.W., & Bär, A. (2014), Framing of decisions: Effect on active and passive risk avoidance. *Journal of Behavioral Decision Making*, *27*(5), 444-453.

Huber, O., Wider, R., & Huber, O.W. (1997). Active information search and complete information presentation in naturalistic risky decision tasks. *Acta Psychologica*, *95*(1), 15-29.

Jou, J., Shanteau, J., & Harris, R. (1996). An information processing view of framing effects: The role of causual-schemas in decision-making. *Memory & Cognition, 24,* 1-15.

Kahneman, D. (2011). *Thinking, fast and slow*. New York, USA: Farrar, Straus and Giroux.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, *47*, 263-291.

Kashima, Y., & Maher, P. (1995). Framing of decisions under ambiguity. *Journal Behavioral Decision Making, 4*, 249-262.

Kühberger, A. (1995). The framing of decisions: A new look at old problems. *Organizational Behavior and Human Decision Processes, 62,* 230-240.

Kühberger, A. (1998). The influence of framing on risky decisions: A meta-analysis. *Organizational Behavior and Human Decision Processes*, *75*(1), 23-55.

Kühberger, A. (2002). Theoretical conceptions of framing effects in risky decisions. In R. Ranyard, W. Crozier, & O. Svenson (Eds.), *Decision making: Cognitive models and explanations* (pp. 128-144). London, UK: Routledge.

Kühberger, A., & Tanner, C. (2010). Risky choice framing: Task versions and a comparison of prospect theory and fuzzy-trace theory. *Journal of Behavioral Decision Making, 23*, 314-329.

Levin, P., Schneider, S., & Gaeth, G. (1998). All frames are not created equal: A typology and critical analysis of framing effects. *Organizational Behavior and Human Decision Processes*, *76*, 149-188.

Li, S., & Adams, A. (1995). Is there something more important behind framing? *Organizational Behavior and Human Decision Processes*, *62*(2), 216-219.

McNeil, B.J., Pauker, S.G., Sox Jr, H.C., & Tversky, A. (1982). On the elicitation of preferences for alternative therapies. *New England Journal of Medicine, 306*(21), 1259-1262.

Milićević, A., Pavličić, D., & Kostić, A. (2007). The dynamics of change in decision making under risk. *Psihologija*, *40*(1), 147-164.

Moxey, A., O'Connell, D., McGettigan, P., & Henry, D. (2003). Describing treatment effects to patients. *Journal of General Internal Medicine*, *18*(11), 948-959.

O'Connor, A. (1989). Effects of framing and level of probability on patients' preferences for cancer chemotherapy. *Journal of Clinical Epidemiology*, *42*(2), 119-126.

Reyna, V., & Brainerd, C. (1991). Fuzzy-trace theory and framing effects in choice: Gist extraction, truncation, and conversion. *Journal Behavioral Decision Making, 4*, 249-262.

Reyna, V., & Brainerd, C. (1995). Fuzzy-trace theory: Some foundational issues. *Learning and Individual Differences*, *7*, 145-162.

Reyna, V., & Brainerd, C. (2007). The importance of mathematics in health and human judgment: Numeracy, risk communication, and medical decision making. *Learning and Individual Differences*, *17*, 147-159.

Reyna, V., & Farley, F. (2006). Risk and rationality in adolescent decision-making: Implications for theory, practice, and public policy. *Psychological Science in the Public Interest*, *7*, 1-44.

Reyna, V., Lloyd, F., & Brainerd, C. (2003). Memory, development, and rationality: An integrative theory of judgment and decision-making. In S. Schneider, & J. Shanteau

(Eds.). *Emerging perspectives on judgment and decision research* (pp. 201-245). New York, USA: Cambridge University Press.

Schneider, S. (1992). Framing and conflict: Aspiration level contingency, the status quo, and current theories of risky choice. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 18*(5), 1040-1057.

Schwartz, A., & Hasnain, M. (2002). Risk perception and risk attitude in informed consent. *Risk, Decision and Policy*, *7*(2), 121-130.

Shafir, E. (1993). Choosing versus rejecting: Why some options are both better and worse than others. *Memory & Cognition*, *21*(4), 546-556.

Sniezek, J., Paese, P., & Switzer, F. (1990). The effect of choosing on confidence in choice. *Organizational Behavior and Human Decision Processes*, *46*(2), 264-282.

Su, Y., Rao, L., Sun, H., Du, X., Li, X., & Li, S. (2013). Is making a risky choice based on a weighting and adding process? An eye-tracking investigation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *39*(6), 1765-1780.

Takemura, K. (1994). Influence of elaboration on the framing of decision. *Journal of Psychology*, *128,* 33-39.

Tversky, A., & Kahneman, D. (1981). The framing of decisions and psychology of choice. *Science*, *211*, 453-458.

Tversky, A., & Kahneman, D. (1992). Advances in prospect theory: Cumulative representation of uncertainty. *Journal of Risk and Uncertainty, 5,* 297-323.

Tyszka, T., & Zaleskiewicz, T. (2006). When does information about probability count in choices under risk? *Risk Analysis*, *26*(6), 1623-1636.

Urbany, J., & Dickson, P. (1990). Prospect theory and pricing decisions. *Journal of Behavioral Economics*, *19*(1), 69-80.

Wang, X. (1996a). Domain-specific rationality in human choices: Violations of utility axioms and social contexts. *Cognition, 60,* 31-63.

Wang, X. (1996b). Framing effects: Dynamics and task domains. *Organizational Behavior and Human Decision Processes, 68,* 145-157.

Wang, X., & Johnston, V. (1995). Perceived social context and risk preference: A re-examination of framing effects in a life-death decision problem. *Journal of Behavioral Decision Making*, *8*(4), 279-293.

Wedell, D. (1997). Another look at reasons for choosing and rejecting. *Memory & Cognition, 25*(6), 873-887.

Wilson, E. (1927). Probable inference, the law of succession, and statistical inference. *Journal of the American Statistical Association*, *22*, 209-212.

Utjecaj razine vjerojatnosti na efekt okvira

Sažetak

U istraživanjima se djelovanja okvira rizičnog izbora uglavnom primjenjuju zadaci u kojima se ispituje utjecaj samo jedne razine vjerojatnosti, odnosno rizičnosti, na izbor nerizične ili rizične opcije. Cilj je provedenog istraživanja bio ispitivanje efekta okvira u funkciji razine vjerojatnosti realizacije ishoda rizične opcije u tri domene odlučivanja: zdravlje, novac i ljudski životi. Potvrđeno je da domena odlučivanja moderira djelovanje okvira. U monetarnoj je domeni odlučivanja potvrđena generalna averzija prema riziku, registrirana u ranijim istraživanjima. Na visokim se razinama vjerojatnosti u oba okvira registrira efekt okvira, a na nižim razinama vjerojatnosti nije registriran efekt okvira. U domeni je odlučivanja o ljudskim životima efekt okvira registriran na srednje visokim i srednje niskim razinama vjerojatnosti. U domeni odlučivanja o zdravlju efekt okvira registrira se na gotovo čitavom opsegu vjerojatnosti, po čemu se ova domena izdvaja od prethodnih dviju. Rezultati pokazuju da odnos prema riziku nije istovjetan na različitim razinama vjerojatnosti i da dinamika odnosa prema riziku utječe na efekt okvira te da je obrazac efekta okvira drugačiji u različitim domenama odlučivanja. Drugim riječima, lingvistička manipulacija koja predstavlja okvir u zadacima ima učinak na promjenu redoslijeda preferencija tek kada je mogućnost dobitka (iskazana vjerojatnošću) procijenjena kao dovoljno visoka.

Ključne reči: efekt okvira, rizično odlučivanje, vjerojatnost ishoda, domena odlučivanja

Influencia del nivel de probabilidad en el efecto de encuadre

Resumen

La investigación del efecto de encuadre de la elección arriesgada en su mayoría se aplica a las tareas en las que se examinó el efecto de una sola probabilidad o nivel de riesgo para la elección de opciones no arriesgadas o arriesgadas. El objetivo de esta investigación fue investigar el efecto de encuadre en la función del nivel de probabilidad para el resultado de la opción arriesgada en tres dominios de toma de decisiones: salud, dinero y vidas humanas. Se ha confirmado que el dominio de toma de decisiones modera el efecto de encuadre. En el dominio monetario la aversión general de riesgos se ha registrado igual que en las investigaciones previas. A niveles altos de probabilidad el efecto de encuadre se ha registrado en ambos marcos, mientras que no se ha registrado a niveles bajos de probabilidad. En el dominio de toma de decisiones para la vida humana, el efecto de encuadre se ha registrado a niveles medio altos y medio bajos de probabilidad. En el dominio de toma de decisiones para la salud, el efecto de encuadre se ha registrado casi a todos los niveles de probabilidad, y este dominio difiere de los dos anteriores. Los resultados muestran que la actitud hacia el riesgo no es idéntica a diferentes niveles de probabilidad, que la dinámica de la actitud hacia el riesgo influye en el efecto de encuadre y que el patrón de este efecto es diferente en diferentes dominios de toma de decisiones. Es decir, la manipulación lingüística que representa el marco en las tareas afecta el cambio en el orden de preferencia cuando la posibilidad de ganancia (expresada en probabilidad) se estima como suficientemente alta.

Palabras claves: efecto de encuadre, toma de decisiones arriesgada, probabilidad de resultados, dominio de toma de decisiones

Primljeno: 21.12.2015.

Appendix 1

Overview of Stimuli Production

The stimuli for the first (lowest) level of probability factor are shown – 5% (probability of favourable risky option outcome (p_{fav}). By increasing the shown probability level, the net value of the safe outcome (v_{sure}) and probability of unfavourable outcome (p_{unf}) of the risky option also changed in both options of each frame (in order to make expected values of the options uniform). Those values are shown in bold. All other task elements at different probability levels are the same, whereas this is a structure of a classic task.

DOMAIN OF HUMAN LIVES

Prologue: Imagine that Serbia is getting ready for the out-break of an epidemic of an unusual disease which is expected to take 600 human lives. Two alternative programs against this disease have been proposed and their outcomes have been carefully calculated by experts:

Positive frame

Safe option: If program A is applied, **30** (v_{sure}) people will survive.
Risky option: If program B is applied, there is probability of **5%** (p_{fav}) that all 600 people will survive and probability of **95%** (p_{unf}) that no one will survive.

Negative frame

Safe option: If program A is applied, **570** (v_{sure}) people will die.
Risky option: If program B, is applied, there is probability of **5%** (p_{fav}) that no one will die and probability of **95%** (p_{unf}) that all 600 people will die.

Which program will you choose?

MONETARY DOMAIN

Prologue: You are taking part in the prize game of the Lottery of Serbia which has two rounds. In the first round you won 6000 euros but now, in the second round, you must choose between two lottery tickets:

Positive frame

Safe option: If you choose ticket A, you will get the total of **300 euros** (v_{sure}).
Risky option: If you choose ticket B, there is probability of **5%** (p_{fav}) that you will get the total of 6000 euros and probability of **95%**(p_{unf}) that you will get nothing (from both rounds).

Negative frame

Safe option: If you choose ticket A, you will lose **5700 euros** (v_{sure}) from the sum in the first round.
Risky option: If you choose ticket B, there is probability of **5%** (p_{fav}) that you will lose nothing from the first round and probability of **95%** (p_{unf}) that you will lose everything from the first cycle.

Which lottery ticket will you choose?

MEDICAL DOMAIN

Prologue: The doctors have told you that you are seriously ill. You should choose between two possible interventions (an operation or radiation).

Positive frame

Safe option: Everybody survives radiation and lives on average for another **half a year** (v_{sure}).
Risky option: The operation is survived by **5%** (p_{fav}) of people and they live on average for another 10 years, while **95%** of people do not survive the operation (p_{unf}).

Negative frame

Safe option: During radiation no one dies and the average non-dying period after radiation is **half a year (**v_{sure}).
Risky option: During the operation 9**5%** (p_{unf}) people die, while the remaining **5%** (p_{fav}) does not die for another 10 years on average.

Which intervention will you choose?

Appendix 2

Table 2. *Changes for all Probability Levels*

		Human Lives 600 lives		Monetary 6000 €		Health max. 10 years	
P_{fav} (%)	P_{unf} (%)	V_{s*} survive	v_{s-} die	v_{s+} won €	v_{sig-} not won €	v_{sig+} life (years)	v_{sig-} not die
5	95	30	570	300	5700	0.6	0.6
25	75	150	450	1500	4500	2.5	2.5
40	60	240	360	2400	3600	4	4
60	40	360	240	3600	2400	6	6
75	25	450	150	4500	1500	7.5	7.5
90	10	540	60	5400	600	9	9

Note: $p_{fav} + p_{unf=}$100%; $v_{s=}p_{fav}$ x value in the prologue