Risk Seeking Preferences: An Investigation of Framing Effects across Decisional Domains

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Abstract

The framing effect refers to the fact that presenting the descriptions of equivalent decisional alternatives in different terms results in the preference for one alternative over the other, depending on the description format. Changing one's preference for a decisional outcome, depending on the wording of those outcomes, represents a violation of the principle of invariance, one of the cornerstones of the decision maker's rationality. Since previous framing-related empirical work highlighted some contradicting results regarding the existence or magnitude of risky choice framing effects, our research objective was to investigate whether framing effects are consistent between and within decision-making domains. Participants were presented with nine hypothetical decisional situations related to health, financial or nature and objects domains. The equivalent decisional alternatives were framed in either gain or loss terms. We analyzed the impact of framing on participants' level of risk seeking in the decisional situations. Our results add to the existing literature by indicating that framing effects are not consistent between decisional domains. Framing effects were present for health and nature and objects domains, but not for the financial domain. More importantly, we also found that within the same decisional domains, different problems elicit varying levels of framing effects. One possible explanation for the differences found between decisional domains might involve the emotional reaction triggered by the decisional problems. Implications of framing effects for different real-life decisions are discussed.

KEYWORDS: framing effects, risk taking, decisional domains, decision

For several centuries, scholars in economics used the standards of the normative models in decision to evaluate the level of the decision maker's rationality. Although the definition of rationality has long been debated, there is some consensus that rational decisions should, among other criteria, satisfy the requirement of invariance (Tversky & Kahneman, 1981). According to the principle of invariance, a preference for a particular decisional option should be independent of the terms in which it is described (Tversky & Kahneman, 1986). In other words, when the options of a decisional situation are presented in different forms (i.e., frames), these different wordings should not influence the decision maker's preference for a particular alternative. However, people lack the knowledge, skills or computational resources to make decisions consistent with the notion of economic rationality (Heilman, 2006, 2014; Simon, 1955). Therefore, there are many compelling empirical evidence that contradict the decision maker's absolute rationality and indicate that certain people are prone to various sources of distortion, which can be consistent and predictable in certain circumstances (Kahneman, 2011).

One of the most prolific lines of research that provided empirical evidence to undermine the rationality of decision makers is related to the effect of formulating alternatives, also known as framing effects. This effect refers to the fact that presenting the descriptions of equivalent decisional alternatives in different terms reflects the preference for one alternative over the other, depending on the description format. Changing one's preference for a decisional outcome depending on the wording of those outcomes represents a violation of the principle of invariance (Kahneman, 2003a, 2003b). This framing effect was first demonstrated using a well-documented experimental task, namely the *Asian Disease Problem* (Tversky & Kahneman, 1981). The Asian Disease Problem presents the decision-maker with a hypothetical situation in which a disease is expected to affect 600 people. The decision-maker has to choose which one of two possible intervention programs should be applied. The two intervention programs are described either in gain terms (how many people will be saved) or in loss terms (how many people will die). For each frame, the decision-maker is presented with a sure alternative, specifying the number of people who will surely survive/die, and a probabilistic alternative, stating the probabilities that all people should survive/die. From a mathematical point of view, the outcomes of the sure and probabilistic alternatives are equal. Using this decisional task, the authors have shown a risk seeking preference among participants who received the problem described in terms of loss and a

risk aversion tendency if the same situation was described in terms of gain (Tversky & Kahneman, 1981). Basically, the wording of the decisional alternatives in terms of loss resulted in 78% of the participants choosing the probabilistic alternative, while formulating the same decisional situation in terms of gain led to the choosing of the probabilistic alternative by only 28% of the participants (Tversky & Kahneman, 1981). The violation of the principle of invariance refers to this specific reversal of one's preferences induced by the wording of the decisional alternatives. Once this line of research was opened, dozens of studies were published to further provide empirical support for this decision-making bias. Moreover, the existence of the framing effect was documented in medical or clinical decisions, consumer preferences, social dilemmas, or negotiation situations (Cacciatore, Scheufele, & Iyengar, 2016; Levin, Schneider, & Gaeth, 1998).

Although most studies support the robustness of this framing effect (Levin & Gaeth, 1988; Levin, Gaeth, & Schreiber, 2002; Tversky & Kahneman, 1981), there were also empirical studies that did not replicate the phenomenon (Fagley & Miller, 1987; Mandel, 2001; Takemura, 1992, 1993). In addition, some of the studies that have identified a framing effect did not obtain an effect size as large as that presented by Tversky and Kahneman (Bloomfield, 2006; Kühberger, 1998; Tversky & Kahneman, 1981).

A possible reason for these conflicting results is considering framing effect as a homogeneous effect. All decision-making situations presented in the literature as representative of the distortion associated with the formulation of the alternatives are based on emotional valence: the critical information for the decision is formulated either in positive or negative terms. In order to explain the contradictory results, Levin and coworkers (1998) proposed a taxonomy that can differentiate between three types of framing effects. Moreover, Levin and colleagues argue that each type of framing effect has specific consequences and underlying mechanisms (Levin et al., 1998).

The *risky choice framing* represents the most studied category of framing effects. This form of decision-making bias was introduced by Tversky and Kahneman (1981) through the Asian Disease Problem. The risky choice framing is considered the prototypical form of framing effects (Levin et al., 1998). In this type of framing, different formulations are applied to the results of the decisional alternatives involving varying levels of risk. In this particular decisional

context, Kahneman and Tversky (1981) showed a reversal of participants' preferences: the majority of participants who received the positive version selected the sure outcome alternative, while participants who received the negative version of the problem mostly opted for the probabilistic alternative. Kahneman and Tversky turned to their Prospect Theory (Kahneman & Tversky, 1979; Tversky & Kahneman, 1992) to explain this framing effect. The Prospect Theory assumes that the different formulations of the alternatives determine the evaluation of the decisional outcomes in terms of gains or losses relative to the current baseline. The concept of loss aversion, also predicted and explained by the prospect theory, refers to the fact that losses loom larger than gains, meaning that people are more sensitive to losses than to comparable gains. Considering loss aversion as being characteristic to most people, one can understand why negatively framed information has more impact than positive information. It is easier for a person to prefer a probabilistic option when it is framed in loss terms, because accepting a sure loss is more difficult to conceive than an uncertain outcome. The reverse seems to be the case for gain contexts (Kahneman, 2011).

The second form of framing effects is represented by the *attributes framing*. In this situation the characteristics of an object or event are the ones being differently formulated. This type of framing is considered the simplest form of framing and is relevant to understand how descriptive valence influences information processing (Levin et al., 1998). The different frames are applied to the attributes describing a single characteristic of an object or event, and the dependent variable is how one evaluates that specific object or event. To illustrate this type of framing, we refer to the study conducted by Levin and Gaeth (1988), in which the authors manipulated the presentation of a product ("75% lean meat" or "25% fat meat") and assessed consumers' preference for the product in each of the two formulations. The study results indicated that participants rated as tastier the meat package labelled as "75% lean meat" than the one marked "25% fat meat" (Levin & Gaeth, 1988). Similar results were seen in other areas as well. For instance, in medical-related decisions, people are more willing to accept a certain treatment procedure if it is described in terms related to survival rates than described referring to mortality rates (Marteau, 1989; Wilson, Kaplan, & Schneiderman, 1987). Also risky decisions, such as financial gambles, are preferred if presented in terms of probability of winning than if negatively formulated by highlighting the chances of losing (Levin et al., 1986; Levin, Snyder, &

Chapman, 1989). One plausible explanation for this type of framing effect is linked to the way information is encoded depending on its descriptive valence. Levin and Gaeth (1988) argue that labelling a positive characteristic of the evaluated object leads to encoding the information by evoking positive associations from the long-term memory. Similarly, a negative label associated with an evaluated object or event would evoke unpleasant associations. This explanation has already received empirical support from multiple independent research groups and is continuously adapted to include various methodological variations (Isaac & Poor, 2016; Shafir, 1993; Shafir, Simonson, & Tversky, 1993; van Schie & van der Pligt, 1995).

The third form of framing effects refers to *goal framing*, more specifically, the manipulation is applied to the formulation of the goals of a certain behavior or an action. This type of framing is mostly investigated in communication and persuasion studies. Empirical research shows that the impact of a persuasive message depends on the way the consequences of an action are described. The description can either highlight the benefits of performing the action in question or the risks if the target action is not performed. Therefore, in the positive wording of the action, the aim is to get some positive consequences (i.e., gains), whereas in the negative formulation the purpose is to avoid a negative consequence (i.e., losses). One classic study illustrating the goal framing was conducted by Meyerowitz and Chaiken (1987). The two authors have shown that women are more willing to do breast self-examination if they are given information that reveals the negative consequences of not doing this compared to the gains of self-palpation (Meyerowitz & Chaiken, 1987). The same effect has been achieved in other research areas, thereby fostering the idea that messages showing possible losses from failure of doing a certain behavior are more persuasive than messages that provide information regarding the benefits of realizing that behavior.

In an attempt to explain the divergent results found by previous studies, numerous factors that could influence decision-making were investigated. Methodological variations could explain some of the discrepancies found between studies. Some empirical research addressed framing effects in different areas or domains (e.g., human life, finance, animals or even aliens), other studies looked into different characteristics of participants (e.g., teens vs. adults; experts vs. novices) (Best & Charness, 2015), the size of the group being affected by the decision-making

situation (i.e., small groups vs. large groups). Also, there are studies aimed at investigating individual differences of the participants, such as personality traits, emotional states or the effects of emotion regulation strategies.

The domain on which decisions are made seems to be a crucial factor for the emergence of the framing effect. People are more prone to framing effects in their decisions related to human life, than in situations where decisions referred to animals (Bloomfield, 2006; Peters & Levin, 2008; Schneider, 1992), money or properties (Fagley & Miller, 1997; Kühberger, Schulte-Mecklenbeck, & Perner, 1999), precious metal or artwork (Jou, Shanteau & Harris, 1996; Wang, 1996a, 1996b) or even aliens (Wang, Simons, & Brédart, 2001). A meta-analysis (Kühberger, 1998) showed that scenarios involving human life and health lead to an increased size of the framing effect compared to scenarios relevant for business decisions, social decisions, animals or objects. Other studies confirm that people's preference for risky decisions is dependents on the domain on which decisions are made (Kusev, Schaik, Ayton, Dent, & Chater, 2009; Mandel & Vartanian, 2010). However, differences remain between framing effects related to decisional domains, and even within the same domain there are framing inconsistencies.

Current Study

Previous framing related empirical work highlighted some contradicting results regarding the existence or magnitude of risky choice framing effects. The decision-making domain might be responsible for some of the conflicting results. More studies are needed to directly address this issue. Therefore, our research objective was to further investigate whether framing effects are consistent between decision-making domains. The ecological validity of the decision-making situation was a high priority in this study, in order to permit the extrapolation of the study results to real life decisions. To increase the study's ecological validity, we chose to use decisional problems that are similar to the Asian Disease Problem in the way they depict situations that might be encountered in real life. Based on previous studies, we expected our results to indicate the existence of framing effects for all three decisional domains under investigation. However, considering previous contradicting results, we did not expect all problems from within a decisional domain to elicit significant behavioral change due to the formulation of alternatives.

Method

Participants

The study sample included 82 healthy students (69 women, mean age = 27.13±7.52), who were randomly selected from a larger sample of students attending undergraduate studies in Psychology. All participants signed an informed consent before taking part in the study, in accord with the Declaration of Helsinki (1964/2013) and the Deontological Code of the American Psychological Association (2010).

Study materials

All participants were presented with nine vignettes that involved decision-making scenarios similar to the one described by the Asian Disease Problem. Therefore, for each vignette, one decisional option was sure, presenting certain consequences of choosing that option, whereas the second option was risky in the sense that it presented probabilities associated with possible outcomes. Framing of alternatives was manipulated so that half of the participants were presented with the decision-making problems described in gain terms, whereas the other half of the participants saw the same decisional situations described in loss terms. The nine vignettes were classified in three broad decision-making domains: health and human life (two problems), financial situations (three problems) and nature and objects (four problems). The vignettes were originally presented in other studies and some of them were slightly modified to refer to the national geographic or social context. Samples of vignettes pertaining to each decisional domain are presented in **Table 1**. The vignettes were randomly presented and all participants were instructed to select which option they prefer, namely the sure or the probabilistic option.

Design and procedure

A between participants design was used to test for the effects of framing of decisional alternatives on risk preferences in financial situations, health related situations and nature and objects related decisional problems.

A female experimenter tested all participants individually and the procedure lasted approximately 50-60 minutes. After each participant signed the informed consent, he/she was seated at a table, in front of a computer. Participants were presented with the instructions for the decisional problems. Half of the participants were presented either with the gain frame or the loss frame of the problems. All nine decision-making situations were randomly presented through a computer program. After the participant answered each of the hypothetical decisional situations, he/she was instructed to assess the arousal and valence levels associated with the vignette. Arousal was measured on a 5 point Likert scale, where 1 signified no arousal and 5 was associated with high level of arousal. Valence was also measured on a 5 point Likert scale, where 1 was associated with negative emotional valence and 5 indicated positive emotional valence.

Results

Valence and arousal effects of decision-making situations

To see whether the different formulations of the decisional situations create a significant emotional impact, we measured the level of arousal and emotional valence for each decisional problem and we made comparisons on these measurements depending on the experimental condition (gain vs. loss). The emotional valence was significantly different between conditions (gain vs. loss) only for financial problems, indicating that problems that were framed in loss terms were perceived as more negative than those framed as gains ($t(81) = 3.53$, $p < 0.001$). For the other two categories of problems, there were no significant differences regarding emotional valence depending on the terms that the problems were framed in (see **Table 2**). No frame related differences were found in arousal levels for the three decisional domains.

Moreover, we tested whether the decisional domain would be associated with different arousal and valence levels. To this end, we compared mean arousal and valence levels between the three decisional domains. Our results indicate that, for the loss condition, health related problems induced higher arousal levels than financial problems ($t(40) = 3.31$, $p < 0.01$) and nature and objects related problems ($t(40) = 2.792$, $p < 0.01$). In the gain framing condition, health related problems were significantly more arousing than nature and objects decisional situations ($t(40) = 2.477$, $p < 0.05$). When looking at the decisional problems' emotional valence,

our results show that, for both framing conditions (i.e., gain vs. loss), health related problems are considered to be less pleasant than both nature and objects problems ($t(40) = -3.89$, $p < 0.001$, respectively $t(40) = -3.58$, $p < 0.001$) as well as financial problems ($t(40) = -9.11$, $p < 0.001$, respectively $t(40) = 6.71$, $p < 0.001$). In addition, nature and objects problems were evaluated as less pleasant than financial problems, for both gain and loss framing conditions ($t(40) = -6.75$, $p < 0.001$, respectively $t(41) = -4.69$, $p < 0.001$). The main results related to valence and arousal levels are illustrated in **Figure 1 A** and **B**.

Behavioral performance

We analyzed the impact of framing on participants' level of risk seeking in the decisional situations. We considered the proportion of risk seeking preference as the dependent variable. The proportion of risk seeking options was quantified by dividing the total number of responses favoring the probabilistic option to the total number of decisional situations. Therefore, the dependent variable took values in the [0; 1] interval. The independent variable was the framing of decisional options, either in terms of gain or loss. Additionally, for in depth analyses, we grouped the decisional situations according to the decision-making domain: health, financial or human and nature domains.

A one-way ANOVA highlighted a significant overall effect of framing, with participants selecting the risky option more frequently in the loss frame compared to the gain frame, $F[1, 80] = 38.62$, $p < 0.001$ ($\eta^2 = 0.32$) (see **Figure 2**). Similar analyses evidenced the existence of framing effects for problems that concerned health issues, $F[1,80] = 39.81$, $p < 0.001$($\eta^2 = 0.32$), and objects and nature issues $F[1,80] = 31.33$, $p < 0.001$ ($\eta^2 = 0.28$). For problems related to financial issues, participants did not exhibit a framing effect, but we observed a general tendency towards preferring the probabilistic option more in the loss frame compared to the gain frame ($F[1,80] = 3.02$, $p = 0.08$, $\eta^2 = 0.036$) (**Figure 2**). No significant differences were found between risk taking preferences for men compared to women.

One-sample *t* tests were used to further analyze whether participants' risk taking preference in both gain and loss frames significantly differed than the 0.5 cut-off point. This cut-off point indicates no specific preference towards either risk seeking or risk averse decisional outcomes. The results show that participants presented with the gain frame of the decisional situations displayed significant risk aversion for all decision-making domains (see **Table 3**). For the loss frame participants displayed significant risk seeking behavior only for the health and nature and objects decision-making domains. Additionally, for the financial problems, we found that participant also exhibit risk aversion in the loss frame (**Table 3**).

Next we investigated whether framing effects are consistent within the problems pertaining to each domain. To this purpose, we analyzed participants' behavioral performance for each decisional situation. We therefore compared the frequencies with which participants chose the risky option in both framing conditions (i.e., gain vs. loss). Our results show that the framing effect does not appear in each decisional situation. Participants displayed significant framing effects, thus choosing more frequently the risky choice in the loss frame and the sure option in the gain frame, in both health related problems ($\chi^2 = 5.89$, $p < 0.05$, respectively $\chi^2 = 11.3$, $p < 0.001$), in one of the financial problems ($\chi^2 = 10.12$, $p < 0.01$) and in two of the nature and objects problems ($\chi^2 = 6.25$, $p < 0.05$, respectively $\chi^2 = 9.25$, $p < 0.01$) (see **Figure 3**). No significant gender differences were found in any of the nine decisional situations.

Discussions

In the present study we set out to investigate the consistency of framing effects across three decisional domains, namely, health, finance and nature and objects. Framing effects refer to the situations in which the different formulations of decisional alternatives result in different decisional preferences. More specifically, it was shown that people generally prefer a sure outcome when the options are described in gain terms, but an equivalent risky outcome is favored when alternatives are presented in loss terms (Tversky & Kahneman, 1981). Previous empirical studies provide inconsistent results concerning the existence or magnitude of the framing effects. Our results add to the existing literature by indicating that framing effects are not consistent between decisional domains. More importantly, we also found that within the

same decisional domains, different problems elicit varying levels of framing effects. One possible explanation for the differences found between decisional domains might involve the emotional reaction triggered by the decisional problems.

Selecting the risky alternative in both experimental conditions was taken to indicate participants' behavioral performance. Our results confirmed the presence of the framing effect for health problems and problems related to nature and objects, thus partially confirming the first research hypothesis. In these two decisional domains participants mostly preferred the sure outcome in the gain frame, and the risky or probabilistic outcome for the loss framing of the alternatives. Additionally, in the health domain, participants displayed the more pronounced framing effect. This result is consistent with other studies in the literature (Bloomfield, 2006; Peters & Levin, 2008; Schneider, 1992) that showed the same pattern of selections. Regarding financial issues, the participants of our study showed no effect of framing, due to the fact that in both framing conditions prevailed the selection of the sure alternative. Therefore, the participants in our study sample expressed aversion towards financial risk, regardless of the wording of the decision alternatives. This result pertaining to the financial sector could be associated with gender differences identified in this area of decision-making. Although there are many controversies regarding the stability of a gender effect on decisions in various domains, Huang and Wang (2010) show that men are more prone to the effect of framing in the financial domain, while women exhibit this tendency in decisional situations targeting areas related to life and death. Considering that our group of participants included a small number of men, we cannot exclude the possibility that the lack of the framing effect in the financial domain might be a consequence of gender differences in this regard. In general, our study confirms the findings of other previous studies (Kusev et al., 2009; Kühberger, 1998; Mandel & Vartanian, 2010) drawing attention to the fact that the domain on which decisions are made is a major factor influencing the presence and even the magnitude of the framing effect.

Another significant result is related to participants' attitudes towards risk taking in different problems related to the same decisional domain. Most previous experimental studies have addressed the attitude towards risk taking in one decisional situation relevant to each domain. From this point of view, our study is innovative and adds further knowledge, since we

selected multiple decisional situations for each domain. Our results highlight behavioral differences in attitudes towards risk in problems pertaining to the same domain, thus confirming our expectations. In other words, it is possible that some of the previously reported diverging results in framing effects might be due to the use of different decisional situations. In our study we used two different problems related to health issues, three problems related to financial decisions and four problems regarding nature and objects. Our results indicate that the framing effect was not present in all problems related to the same domain, even though there was an overall framing effect for the decisional domain. For example, in two of the three financial problems and in two of the four decisional problems related to nature and objects we found no significant behavioral differences due to the different formulations of the decisional alternatives. This result highlights the fact that not all problems associated with the same decisional domain elicit similar behavioral responses. Future studies could investigate various aspects related to the content or the motivational value of the different decisional situations to eliminate possible confounding variables in this area of research.

As a possible explanation for this result, we may refer to the participants' self-assessed emotional valence and arousal levels associated with each decisional situation. In the present study we observed that regardless of how the decisional alternatives are formulated, health problems were evaluated as being more arousing than other decisional domains, and their emotional valence is more oriented towards the negative pole. This might partially explain the strongest framing effect found in health problems. Although both our study and other relevant studies (see Kühberger, 1998) show a clear effect of framing on health issues, our study may be the first to associate the presence of this effect with a higher motivational relevance of this domain, as measured by the greater activation and negative emotional valence of this area. Additionally, the lack of a framing effect identified for the financial domain in our sample might be due to the fact that the financial problems elicited the less arousal level and were also associated with more positive emotional reactions as self-assessed through the valence scale. Future studies could directly address the contributions of motivational relevance of a particular decisional domain, or even specific decisional problems, to the appearance of the framing effect.

Conclusions

The way decisional alternatives are formulated was shown to induce major differences in people's preference for one option or another. This result has major implications for many areas of human life. For example, medical decisions, for both professionals and laypeople, are influenced by the way treatment alternatives are presented, either in terms of their success or their failure. Health care professionals could be trained regarding this framing effect, since the way they frame treatment options could influence the direction of intervention chosen by patients (Almashat, Ayotte, Edelstein, & Margrett, 2008; McDermott, 2008). Another possible relevant implication of the framing effect might regard the managers' activity. Karevold and Teigen (2010) conducted three empirical studies, which have shown that different descriptions of the progress of a particular project determine managers' decision whether to continue financing the project. Therefore, major decisions about human life or allocation of additional financial resources are exposed to this distortion. Our study adds to the existing literature and further indicates new directions to explore the framing effects. If future studies confirm that the motivational relevance of a decisional situation is an important factor contributing to people's risk taking preference in different frames, then training programs could be initiated in order to reduce this biasing effect.

Even though this study has important contributions to scholars' understanding of the framing effect, it also has some limits. Future studies could address these limits and shed some more light on the topic. One limitation of the current study is the between-subjects design. This particular design does not allow us to directly compare changes in risk attitudes as a result of the different framing conditions. In follow up studies, researchers could employ a within-subjects design and directly test if and to what extent does risk taking preference change. Another limitation of our research refers to the study sample. The large majority of our sample consisted of women. Since there are studies that indicate gender differences in framing effects, especially in the financial domain, it is highly recommended that future studies use participants' samples that are balanced in respect to gender.

In conclusion, our study indicates that framing effects are not consistent between decisional domains and differences in risk taking preferences also appear within situations

pertaining to the same decisional domain. Our results suggest that different motivational values of the particular decisional situations might lead to a higher or lower framing effect. Scholars are already recognizing the need to reanalyze framing effects and to distinguish between different categories of framing types. Our study proves once again that framing effects are, indeed, in need of reconsideration. All the research areas that investigate framing effects, including psychology, communication, behavioral economics, political science or sociology, would greatly benefit should this line of theoretical and empirical investigation continue.

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Table 1.

A sample of the decisional vignettes used in the study. One vignette from each domain is illustrated.

Problem 1 – health and human life domain	
Imagine that an outburst of an unusual disease is expected in Romania and this disease is anticipated to cause 600 victims. Two programs were proposed in order to fight this disease outburst. Assuming the following scientific estimates of the two programs, which program would you prefer?	
Gain frame	*Loss frame*
Program A: 200 people will be surely saved.	**Program C**: 400 people will surely die.
Program B: There is a 1/3 probability that all 600 people will be saved and a 2/3 probability that no one will be saved.	**Program D**: There is a 1/3 probability that no one will die and a 2/3 probability that all 600 people will die.
Problem 2 – nature and objects domain	
Due to fires that have destroyed numerous hectares of forest in Cluj County and resulted already in the death of hundreds of forest animals. Cluj County Committee for Emergency Situations proposed two different programs aiming at protecting the rest of the forest animals. The forests in Cluj County accommodate 3600 living animals. Which program would you choose?	
Gain frame	*Loss frame*
Program A: 1200 animals will be surely saved.	**Program C**: 2400 animals will surely die.
Program B: There is a 1/3 probability that all 3600 animals will be saved and a 2/3 probability that no animal will be saved.	**Program D**: There is a 1/3 probability that no animal will die and a 2/3 probability that all 3600 animals will die.
Problem 6 – financial domain	
Imagine that you invested 60.000 RON in shares at a company that entered bankruptcy. The company's managers have proposed two programs to save some of the invested money. Which program would you chose?	
Gain frame	*Loss frame*
Program A: 20.000 RON will be surely recovered.	**Program C**: 40.000 RON will be surely lost.
Program B: There is a 1/3 probability that all 60.000 RON invested will be recovered and a 2/3 probability that no money will be recovered.	**Program D**: There is a 2/3 probability that all 60.000 RON invested will be lost and a 1/3 probability that no money will be lost.

Table 2.

Arousal and valence levels associated with the decision-making problems, categorized by domain of decision (i.e., financial, health, nature and objects)

		Gain	**Loss**	**Overall**
Arousal	Financial	3.66 ± 0.56	3.38 ± 0.84	3.52 ± 0.72
	Health	3.75 ± 0.65	3.86 ± 0.74	3.81 ± 0.69
	Nature & objects	3.54 ± 0.60	3.55 ± 0.73	3.55 ± 0.66
Valence	Financial	2.83 ± 0.59	2.40 ± 0.50	2.62 ± 0.59
	Health	1.96 ± 0.69	1.72 ± 0.66	1.84 ± 0.68
	Nature & objects	2.27 ± 0.68	1.98 ± 0.68	2.12 ± 0.69

Note: Values in the table represent mean and standard deviations for arousal and valence levels.

Table 3.

Means and standard deviations for participants' risk seeking preference for gain and loss frames.

Frame		**Mean ± *SD***	***t* test value**
Gain	T_R	0.27 ± 0.18	***t*(40) = -7.62 (*p* < 0.001)**
	H_R	0.31 ± 0.33	***t*(40) = -3.54 (*p* < 0.001)**
	F_R	0.29 ± 0.31	***t*(40) = -4.27 (*p* < 0.001)**
	NO_R	0.24 ± 0.26	***t*(40) = -6.18 (*p* < 0.001)**
Loss	T_R	0.56 ± 0.23	***t*(40) = 1.87 (*p* < 0.06)**
	H_R	0.75 ± 0.29	***t*(40) = 5.49 (*p* < 0.001)**
	F_R	0.4 ± 0.27	***t*(40) = -2.19 (*p* < 0.05)**
	NO_R	0.59 ± 0.3	***t*(40) = 2.04 (*p* < 0.05)**

Note. One-sample t test values indicate participants' risk seeking preference compared to the 0.5 cut-off point. T_R = total risk taking; H_R = risk taking in health related problems; F_R =risk taking in financial problems; NO_R = risk taking in nature and objects related problems.

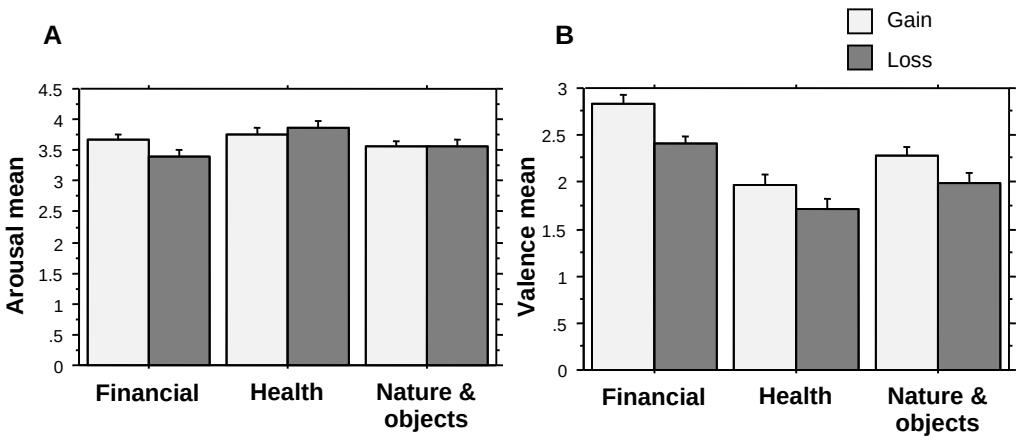

Figure 1. Mean levels of arousal and valence, depending the experimental condition (gain vs. loss frame). Error bars represent one standard error of the mean.

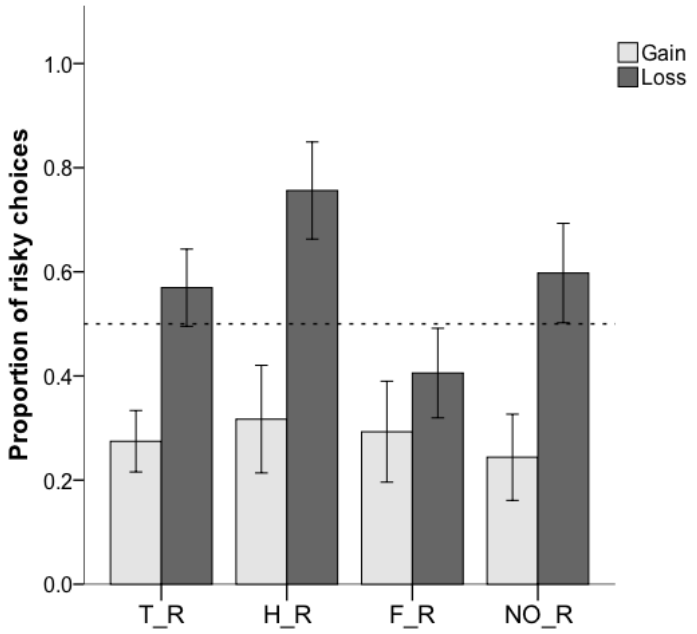

Figure 2. Proportion of risky choices depending on the problem domain and framing of alternatives (gain vs. loss). Error bars represent one standard error of the mean. The dashed horizontal line marks the 0.5 cut-off point, indicating either risk seeking preference (if the proportion of risky choices > 0.5) or risk averse preference (if the proportion of risky choices < 0.5). T_R = total risk taking; H_R = risk taking in health related problems; F_R =risk taking in financial problems; NO_R = risk taking in nature and objects related problems.

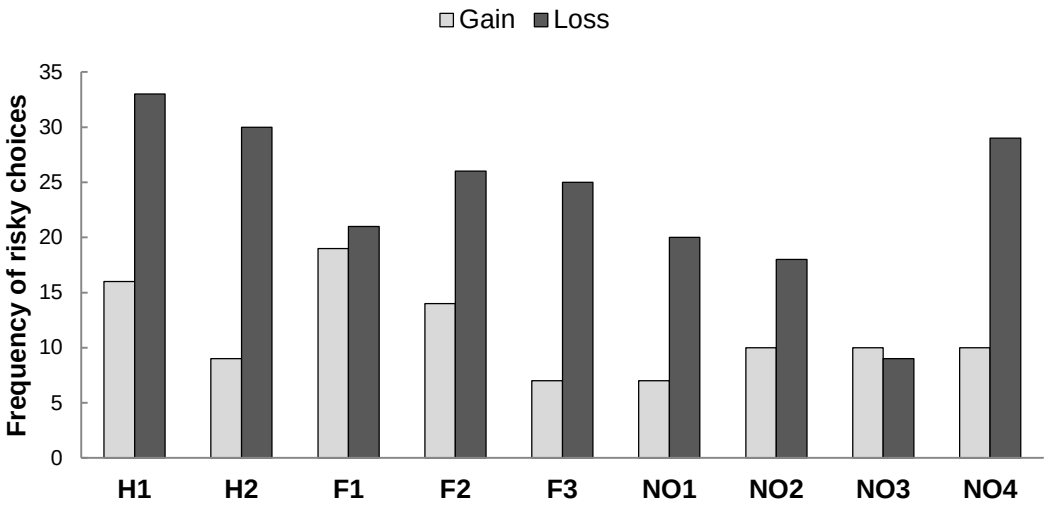

Figure 3. Frequency of risky choices for each decisional problem for gain and loss formulation of alternatives. H1 and H2 = health related problems; F1, F2 and F3 = financial problems; NO1, NO2, NO3 and NO4 = nature and objects related problems.