Research Article

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Risk taking with variable resources: a field and a laboratory experiment

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Abstract: Background: Theoretical predictions and experimental findings concerning the relationship between risk taking and accumulated resources are contradictory. In contrast to laboratory experiments, studies conducted in an ecologically valid environment allow for the evaluation of available resources and the motivational impact of potentially serious consequences for risk taking. Objective: Our aim was to (i) examine the influence of available resources on risk taking in an ecologically valid field experiment; and (ii) to compare "real life" and laboratory experiments assessing risk taking. Method: To reproduce real decisions involving real stakes, the students were asked to choose between exam questions representing different levels of difficulty. Available resources of the students were defined as the amount of points accumulated during the semester. In parallel, the laboratory experiments were conducted to assess risk taking in a laboratory setting. Results: The two experimental setups yielded different results. In the field experiment, risk taking decreased with the available resources, whereas the laboratory experiments suggested an inverse tendency. The influence of contextual effects was only prominent in the field experiment.Conclusion: The results of the field experiment support the variable risk preference model, whereas the risk-sensitivity theory could only be validated in the laboratory setting.

Keywords: risk taking; available resources; field experiment; risk-sensitivity theory; variable risk preference model

Introduction

There are different, even contradictory theoretical predictions and empirical observations about the effect of resources on risk taking. According to Kahneman and Tversky's prospect theory, when people evaluate a risky prospect, their asset position serves as a reference point (Kahneman and Tversky 1979). The prospect theory predicts that people tend to be risk averse in the domain of gains (i.e., people with abundant resources will protect their assets), whereas risk seeking prevails in the domain of losses (i.e., people with scarce resources will take risks). Contrary to this notion, Dutton and Jackson (1987), Osborn and Jackson (1988) and Thaler (1994) argue that people with abundant resources will take risks because they can afford it. Burns and Stalker (1994), Czarniawska-Joerges (1988) and Wehrung, Lee, Tse and Vertinsky (1989) found out that when slack is small, low risk taking and tight control are preferred. Furthermore, the subject literature is also inconsistent regarding risk taking attitudes in extreme situations characterized by depleted resources and endangered survival (survival point).

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According to Bromiley (1991) risk taking increases with the degree of threat as a strategy to avoid death whereas Staw, Sandelands and Dutton (1981) claim that a threat to survival leads to rigidity and extreme risk aversion.

March and Shapira (1992) investigated different random walk models to explain the changing nature of risk taking. The "shifting focus model" incorporates three important components that influence risk taking: previous experiences of the risk taker; his/her aspiration level, which is constantly adjusted to the accumulated resources; and the survival point where the resources are depleted. When resources are abundant, the three determining factors unequivocally favour risk taking. On the other hand, the survival point represents a dilemma. According to March and Saphira (1992), in the case of an abundance of resources, inclination toward risk taking increases, while in times when resources are scarce, risk taking decreases. As the focus of attention shifts from the aspiration level to the dangers of risk taking, people at the survival point will fluctuate between risk taking and risk avoidance, which results in unstable risk taking behaviour.

The shift of attention in the survival situation is influenced by contextual effects such as framing and emotions which play an important role in decision making and risk assessment. According to Kahneman and Tversky (1979), choices can be influenced by framing (i.e. wording) of logically equivalent decision alternatives, affecting the perceptions of outcomes as either gains or losses. A positive frame (gain) evokes positive affect promoting risk taking, whereas a negative frame (loss) evokes negative affect which leads to risk avoidance (Slovic, Finucane, Peters, & MacGregor, 2004). Manipulation of the presentation order influences subsequent processing and evaluations: attributes at the beginning of the presentation (the prime) have more impact on ratings than those presented later (Calvillo & Penaloza, 2009; Klauer, & Musch, 2003; Lassiter, Lindberg, González-Vallejo, Bellezza, & Phillips, 2009; Newell, Wong, Cheung, & Rakow, 2009).

Evolutionary biologists argue that risk taking follows the adaptive behavioural pattern. For example, it has been proved that well-fed animals avoid risks by choosing constant rewards over variable ones, while starving animals switch to a risk-prone behaviour to maximize the probability of survival (Caraco, 1981; Rubenstein, 1987). It is believed that these evolutionary traits also shape human responses in risky situations (McNamara & Houston, 1996; Stephens & Krebs, 1988). According to the risk sensitivity theory, risky behaviour is adaptive in situations of high need ("energy budget" rule, Caraco, 1981; Rubenstein, 1987). However, the energy budget rule has been little investigated in humans because it is difficult to manipulate energy needs (Mishra & Lalumière, 2010). The laboratory experiments in which investigators used analogues for motivation (money, social status, survival decisions), and explicit description of alternatives to create situations of low and high needs, support risk sensitive decision making (Ermer, Cosmides, & Tooby, 2008; Island, Szalda-Petree, & Kucera, 2007; Pietras & Hackenberc, 2001; Wang, 2002). In the laboratory experiment assessing an ecological decision task, Mishra and Lalumiere (2010) showed that the participants shift from risk-aversion to risk-proneness in situations of high need. However, we argue that laboratory conditions and hypothetical situations based on the description of probability and variations are not ecologically relevant decision scenarios. The "foraging situation" (trees bearing apples on a computer screen) used by Mishra and Lalumiere remains highly artificial and the subjects' motivation remains just as trivial as in the general laboratory setting and has no serious consequences for risk taking. To compare the results of laboratory experiments and real-life situations, Kühberger, Schulte-Mecklenbeck and Perner (2002) contrasted real and hypothetical choices, real-life decisions and imagined decisions, and the amount of incentives. They stress the fact that high-stake risk taking involves irreversible and significant consequences where loss might endanger the person's well-being and self-esteem. In the "cold state" of laboratory experiments people have difficulty to picture themselves in "hot states", neglecting the relevance of the motivational strength of visceral impulses (hot-cold empathy gap, Loewenstein, 2000). Therefore, artificial situations manipulated in the laboratory are not able to recreate the characteristics of risk taking.

Risk taking has been studied mostly in laboratory situations evaluating choices between certain and risky alternatives. However, the predictive power of laboratory measures of risk taking to behaviour across domains is limited (Dohmen, Falk, Huffman, Sunde, & Wagner, 2011; Anderson & Mellor, 2009). We propose

that valid predictions about the relation of risk taking and the availability of resources should be confirmed by experiments conducted in a natural setting reproducing real life situations.

Our experiments addressed several questions. First, a field experiment was designed to evaluate the role of accumulated resources in risk-taking in an ecologically valid setting. Secondly, a laboratory experiment was conducted to compare the results obtained in the field experiment with those obtained in the analogous experiment performed in the artificial environment of the laboratory. Finally, an additional laboratory experiment was performed to assess the generality of the representation of risk taking in different resource situations. As far as we know, our study represents the first attempt to compare the effect of resources on risk taking in field and laboratory experiments.

1. Studying risk taking in an ecologically valid setting: the field experiment

To investigate the effect of accumulated resources on risk taking in an ecologically valid environment, we conducted a field experiment involving a "hot" decision making situation with real stakes and real motivations. The setting was a university course for which the final grade was based on test scores obtained during the semester (see detailed description in the Methods section). Three groups were formed on the basis of the prior test performance; one representing abundant resources (high scores), one with "just enough" resources (intermediate scores) and one at the survival point (low scores). Towards the end of the semester, the students were asked to choose between a standard question of average difficulty or a more difficult problem allowing a higher score. The choice of the more difficult problem over the standard test question was considered risk prone because of the reduced chance of a successful solution. Thus, the students had to choose between a less risky "default" option and its riskier alternative. To examine the stability of choices of the different resource groups, framing and presentation order were manipulated.

The field experiments addressed the following questions and hypotheses:

I. How do accumulated resources influence risk taking?

H1a In the case of abundant resources (AR) attention is focused on possibilities therefore willingness to take risks will increase (as predicted by March and Shapira, 1992).

H1b In the case of AR, the individuals will benefit from avoiding risk, so willingness to take risks will decrease (as predicted by the risk sensitivity or energy budget theory proposed by Mishra & Lalumiere, 2010).

H2 In the case of "just enough" resources (JE), willingness to take risks will decrease (as predicted by March and Shapira, 1992).

H3a At the SP, the individuals will behave in a risk-prone manner and choose the riskier alternative maximizing the possibility of survival (Bromiley, 1991; Mishra & Lalumière, 2010).

H3b The threat to survival leads to rigidity and extreme risk aversion in the survival group (SP) (Staw et al., 1981).

II. Are contextual effects more important to the survival point (SP) group?

Risk taking is influenced by contextual factors such as priming and framing. March and Saphira (1992) maintain that people at the survival point fluctuate between risk taking and risk avoidance, which results in unstable risk taking behaviour.

H4 The effect of contextual factors such as framing and presentation order will be more important to the SP group causing the instability of risk taking at the survival point.

III. Does the amount of accumulated resources influence the level of aspiration (the goal set by an individual in the situation)?

H5 Higher accumulated resources lead to the higher aspiration level (March & Shapira, 1992).

1.1. Methods

1.1.1. Participants

106 undergraduate students (65 females) from two business schools, between the ages of 18 and 25 (M=20.80, SD=2.00) participated in the field experiment. The experiment lasted for one semester. No specific recruitment was needed - the students who took the semester participated in the experiment.

The study design was approved by the Institutional Review Board of ELTE University (2017/307). Field studies offer the possibility to characterize risk taking influenced by real motivations free from the inevitable constraints of laboratory studies in which subjects are aware of being part of the experiment. Recommendations concerning the ethics of field experiments call for the minimization of harm and the augmentation of the benefit of the participants (Humphreys, 2015). Our study involved students of regular classes and required no changes in routine curricular activities. The participants were offered the possibility of gaining extra benefits. Retrospective consent, which could be withdrawn at the end of the experiment, was obtained after the completion of the field study (see deferred/retrospective, ex post consent by Humphreys, 2015) Anonymity and privacy rights were ensured during the data processing and analysis. At the end of the study, the students evaluated the fairness of the experimental procedure on a post-experimental questionnaire (see Appendix C), indicating the average of 3.2 (4: very much, 1: not at all). No objections were raised against the procedure.

1.1.2. Materials

An answer sheet was given to each student showing the cumulative exam score up till the experiment. The students had to tick either the “I choose the standard question” or “I choose the more difficult question” box. Two sets of tests were prepared, each containing one standard and one more difficult question. After completing the tests the students were debriefed and asked to complete a questionnaire (see Appendix C) to evaluate the riskiness of the choice situation (4 point scale), their aspiration level for the grade (5 point scale), their emotions concerning the choice situation (7 point scale) and the fairness of the experimental situation (4 point scale).

1.1.3. Procedure

Background: The students participating in the course were required to take nine tests during the semester. Each test consisted of two short-answer questions, and each correct answer was worth ½ point. Thus, the students could collect a maximum of 9 points throughout the semester. The final grade was calculated from the cumulative test points as shown in Table 1.

Table 1. Required points for the final grade

final grade	required points for grade
5	8
4	7
3	6
2	4.5
failure	0-4

Note. The grading system has five grades, with mark 5 being the top one

The students failing to score 4.5 points had to take a difficult oral exam.

At the start of the experiment, the participants had already taken six tests. Thus, some students had already met the minimal criterion of 4.5, while others were worried about a potential failure.

The experiment:

The field experiment started at the time of the seventh test. To create a risk-taking situation, the students (who were unaware of the experiment) were reminded of their cumulative points and offered a choice between two possibilities. The first option was to take the usual short-answer test worth ½ point; the second option was to take a more difficult short-answer test worth 1½ points (see "Instructions to Decision 1"). The students were asked to submit their choices by ticking either the "I choose the standard question" or "I choose the more difficult question" box. After completing the first test, the students were offered the same choice for the second test. Thus, instead of the usual maximum of 1 point, the students opting for the more challenging questions could collect a maximum of 3 points. The negative framing was generated by changing the reference point, giving the students 1½ points in advance, from which they could keep the points awarded for the successfully solved problems (see "Instructions to Decision 2").

Instructions for Decision 1 (positive frame):

Decision 1: "As the end of the semester approaches, it was decided that you would be given an opportunity to collect as many as 3 points today. As usual, you will have to solve two problems, but on this particular occasion you can choose between problems of varying difficulty. You have to submit your decision before the actual test questions are revealed, which entails a certain risk because you might be able to solve the easier problem more successfully.

For the first decision situation, you can choose between the following options:

A. A question of the usual difficulty level, worth ½ point

B. A more challenging question, worth 1½ points

In the case of an incorrect answer, you will get 0 points. Think about your choice and tick the appropriate box in the enclosed sheet which will be collected before you can start working on the task of your choice."

After these instructions, the first choice was made, the sheets were collected, and the students were given the test problems of their choice. After taking the first test, the students were asked to make a second decision concerning the second test problem.

Instructions for Decision 2 (negative frame):

"Now we turn to the second decision. It is also possible to obtain 1½ points, and to encourage you to earn more points, you are given 1½ points in advance. Add these 1½ points to your existing score and write the new score on your sheet. You can choose again.

C. A question of the usual difficulty, worth ½ point. If you choose this problem and solve it correctly, you can keep ½ point from the extra points you have just received, and 1 point will be taken away. In the case of an incorrect answer, you cannot keep any of the points you received in advance.

D. A more challenging question, worth 1½ points. If you choose this option, and solve the problem correctly, you can keep the 1½ points you have just received. In the case of an incorrect answer, you cannot keep any of the points you received in advance.

Think about your choice and tick the appropriate box representing your choice."

After these instructions, the second choice was made, the sheets were collected, and the students were given the test problems of their choice.

The order of the decisions was reversed in the loss/gain order group.

After the tests were completed, the students filled the post-experimental questionnaire (Appendix C.). They were debriefed and the ethical aspects of the experiment discussed. Because of the nature of the field experiment, informed consent was obtained after the debriefing.

1.1.4. Research design and statistical analysis

In a 3x2 design, three resource groups (see the categorical variable in Table 2) were offered a positively and negatively framed choice situation with two alternatives (standard and more difficult questions), presented either in a gain/loss, or a loss/gain order. 41 students received the two decision situations in the gain/loss order, and 65 in the loss/gain order. The dependent variable was risk taking. The choice of the less difficult question (no risk taking) was coded as 0, the choice of the more difficult question (risk taking) was coded as 1. Thus, with two questions, risk taking was either 0 or 1 or 2. As risk taking was not normally distributed, we performed non-parametric tests to compare risk taking between groups (Kruskal-Wallis, Mann-Whitney U) and within groups (Friedman test, Paired Wilcoxon).

1.2. The results of the field experiment

1.2.1. Categorizing the students by accumulated resources

The number of points accumulated before the experiment provided the basis for the categorisation.

We created three groups (Table 2):

- The Abundant resource (AR) group had accumulated at least 5 points during the first 6 tests. During the three remaining tests, these students could obtain the best grade without taking any extra risk. Taking advantage of the more challenging option offered the possibility for these students to reach the top grade already after the 7th test. In the case of an incorrect answer, the students did not receive any points, but still had two-test-days to reach best grade (see Table 1).
- The ”just enough”resource (JE) group had accumulated between 3 and 4.5 points.
- The group at the survival point (SP) had accumulated 2.5 points or fewer.

Table 2. Number of students in the three resource groups

Resource groups	Accumulated points	N
Abundant resource (AR) group	at least 5	34
“Just enough” (JE) resource group	3-4.5	38
Survival point (SP) group	0-2.5	34
Sum		106

1.2.2. Influence of accumulated resources on risk taking in the field experiment

The available resources had a significant effect on risk taking (Figure 1) (Kruskal-Wallis: $\chi^2(2)=8.93$, $p= .011$; $r= .09$). The highest risk was taken by the AR group, and the smallest risk by the SP group. In the case of the JE group, willingness to take risks was lower compared to the AR group, but the difference was insignificant, and the JE group took bigger risks than the SP group (Table 3). Thus, H1a and H3a were confirmed, and H1b and H3b were rejected.

Table 3. Post hoc tests comparing different resource groups

RG A	RG B	Mann-Whitney U
AR	JE	$U(72)=543.0$, $Z=-1.26$, $p= .209$, $r= .15$
	SP	$U(68)=351.5$, $Z=-2.96$, $p= .003$, $r= .36$
SP	JE	$U(72)=495.5$, $Z=-1.82$, $p= .071$, $r= .21$

Notes. RG= *resource group*, AR=*abundant resource*, JE= “*just enough”* SP=*survival point*

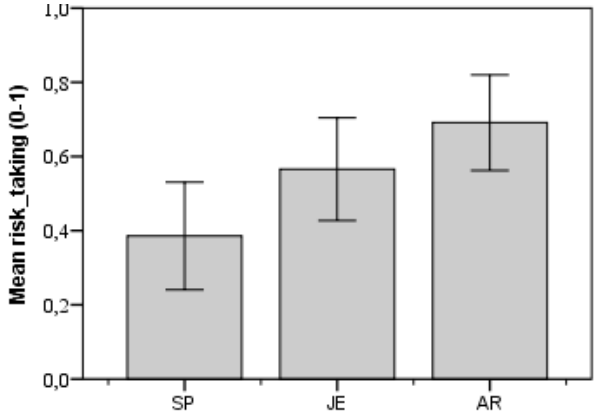

Figure 1. Risk taking in the different resource groups. *Notes.* 0=*no risk taking* and 1= *risk taking*; AR=*abundant,* JE=*"just enough"*, SP=*survival point*; 95% confidence intervals are represented by the error bars

1.2.3. Perception of risk

There were no significant differences between the three resource groups in the perception of risk taking ("How risky was it to choose the more difficult question?"; Kruskal-Wallis: $\chi 2(2)=2.11$, $p= .347$, $r= .02$), and the attributed influence of riskiness on the choice ("How much did the riskiness of the choice alternatives influence your choice?" Kruskal-Wallis: $\chi 2(2)=0.57$, $p= .752$, $r= .01$).

1.2.4. Framing

Only the students at the survival point took bigger risks in the negative frame (Figure 2). There was no evidence of the classical framing effect in the JE and the AR groups (Table 4).

Table 4. Summary of Wilcoxon matched pair tests comparing risk taking in gain and loss frame

RG	N	Paired Wilcoxon
AR	34	Z=-0.302, $p= .763$, $r= .05$
JE	38	Z=-0.302, $p= .763$, $r= .05$
SP	34	Z=-2.12, $p= .034$, $r= .36$

Notes. RG= *resource group*, AR=*abundant resource*, JE=*"just enough"*, SP=*survival point*

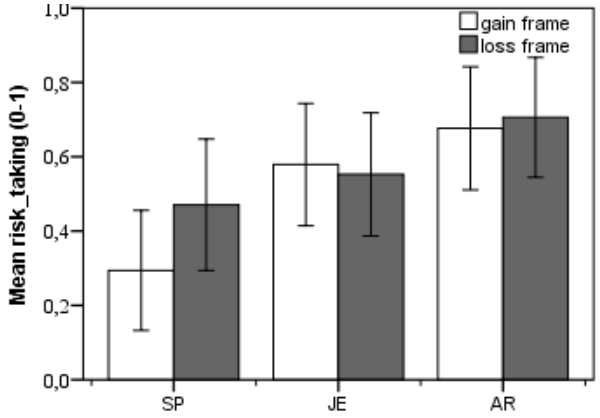

Figure 2. Risk taking in the gain and loss frame in the different resource groups. *Notes.* 0=*no risk taking* and 1= *risk taking*; AR=*abundant*, JE=*"just enough"*, SP=*survival point*; 95% confidence intervals are represented by the error bars

1.2.5. The effect of the order of presentation

Due to the priming effect, when the loss frame was presented first, the risk taking was reduced in both the gain and the loss frames (Figure 3). The students took significantly smaller risks in the loss/gain order in both positively and negatively framed decisions (Mann-Whitney: $U(106)=678.0$, $Z=-4.53$, $p< .001$, $r= .44$).

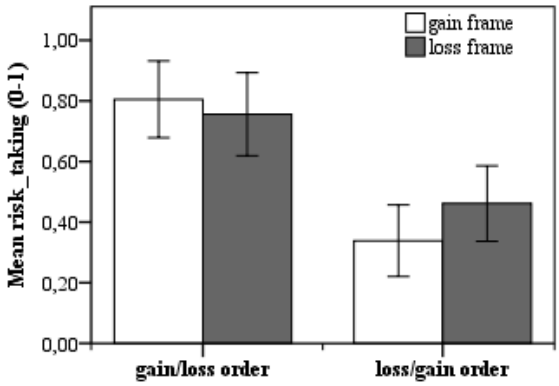

Figure 3. Risk taking in the two problems presented in the gain/loss and loss/gain order. *Notes.* 0=*no risk taking* and 1= *risk taking*; 95% confidence intervals are represented by the error bars

It has to be stressed that the two groups received exactly the same decision situations in the gain and loss frame, and only the order of presentation was changed. We compared the answers on the post-experimental questionnaire (Appendix C) to account for the large difference between the risk taking in the two groups (Table 5).

Table 5. Results of the post experimental questionnaire

	Instruction order		Mann-Whitney *p*
	gain/loss *M*	loss/gain *M*	
joy	4.66	3.84	0.007
excitement	4.17	4.90	0.046
influence of riskiness	1.98	2.56	0.001
danger to worsen the grade	2.00	2.67	0.004
opportunity to improve the grade	3.08	2.43	0.001

The students in the loss/gain situation reported significantly less positive feelings, less enjoyment and less quiescence during the test. They also admitted in the post-experimental questionnaire that they felt a greater danger of worsening their grade, and a limited opportunity to improve the grade with the riskier choice (Table 5). The perceived riskiness of the choice had a higher impact on their decisions and they would have taken more risks if they had had more points.

We expected that the contextual effects would be more pronounced in the survival point (SP) group. Therefore we compared the effect of the ordering manipulation between the different resource groups (Figure 4).

The difference in risk taking between the gain/loss and loss/gain orders was significant for the SP group and for the JE group. In the abundant resource group (AR) there was no significant difference in risk taking (Table 6).

These results confirm our hypothesis (H4) showing the pronounced influence of contextual effects on risk taking in the SP group.

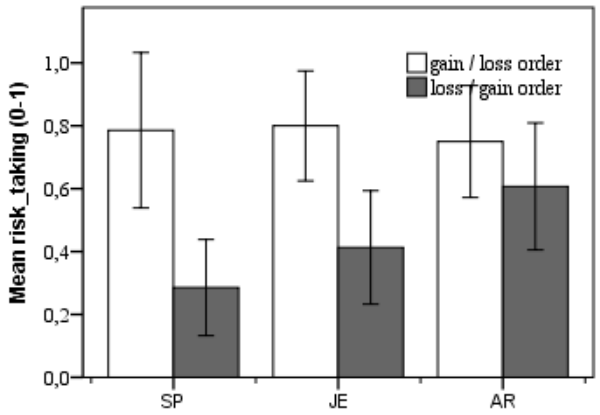

Figure 4. Risk taking in the three resource groups in the gain/loss and loss/gain orders. *Notes.* 0=*no risk taking* and 1= *risk taking*; AR=*abundant*, JE=*"just enough"*, SP=*survival point*; 95% confidence intervals are represented by the error bars

Table 6. Summary of Mann-Whitney U tests comparing risk taking in presentation order (gain/loss)

RG	N	Mann-Whitney U
AR	34	$U(34)=105.5$, $Z=-1.34$, $p=0.231$, $r=.23$
JE	38	$U(38)=86.0$, $Z=-2.76$, $p=.009$, $r=.45$
SP	34	$U(34)=26.0$, $Z=-2.85$, $p=.007$, $r=.49$

Notes. RG= *resource group*, AR=*abundant resource*, JE=*"just enough"*, SP=*survival point*

1.2.6. The effect of the aspiration level on risk taking

The question "Which grade would you be satisfied with in this subject?" served as a measure of the aspiration level on a 5-point scale (Figure 5).

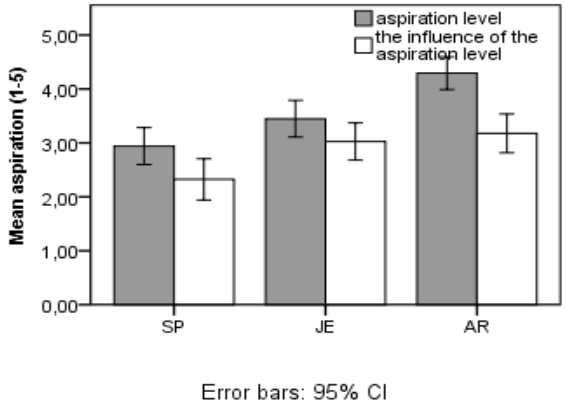

Figure 5. The aspiration level and the assumed influence of aspiration level on choice. *Notes.* 1=*low aspiration/influence* and 5=*high aspiration/influence*; AR=*abundant*, JE=*"just enough"*, SP=*survival point*; 95% confidence intervals are represented by the error bars

In agreement with our hypothesis (H5), the level of aspiration decreased with the decrease in the amount of resources (Kruskal-Wallis: $\chi^2(2)=26.61$, $p< .001$; r= .25). The students with more resources were more motivated to achieve higher grades (Table 7).

Table 7. Post hoc tests comparing different resource groups

RG A	RG B	Mann-Whitney U
AR	JE	U(72)=347.5, Z=-3.53, p< .001, r= .42
	SP	U(68)=193.0, Z=-4.90, p< .001, r= .59
SP	JE	U(72)=470.5, Z=-2.07, p= .039, r= .24

Notes. RG= *resource group*, AR=*abundant resource*, JE= *"just enough"* SP=*survival point*

1.3. Discussion of the results obtained in the field experiment

Theoretical predictions and experimental findings concerning the relationship between risk taking and accumulated resources are contradictory. The relevance of the motivational impact of potentially serious consequences provides a strong argument in favour of field experiments. Our aim was to examine the influence of available resources on risk taking in an ecologically valid field experiment. We wanted to examine whether in a real situation people with different resources would follow the adaptive strategy proposed by the evolutionists, or rather, a risk avoiding, erratic strategy, proposed by March and Shapira (1992).

In our real life experiment we found that the abundance of resources motivates risk taking and the scantiness of resources does not. The students with abundant resources had a higher aspiration level and took the biggest risks (H5), the students with "just enough" resources took smaller risks, and the students at the survival point took the smallest risks. We did not find a significant difference between the risk perceptions or the attributed influence of the riskiness of the choice in the three resource groups, so we can assume that all the groups perceived the magnitude and impact of the risks in a similar way. Consequently, the manifested behaviour of all the resource groups can be considered as risk taking, where differences are explained by the amount of accumulated resources (H1a, H2, H3a). Our results do not confirm the risk-sensitivity theory. We note that the laboratory experiment conducted by Mishra and Lalumiere (2010) included trivial motivations and a symbolic "survival", while in our field experiment the motivation and the resources were real.

Our results support March and Shapira's theory predicting higher and more stable risk taking with abundant resources, and erratic risk-averse behaviour at the survival point. By exploring the consistency and stability of the choices through contextual changes, we found that only the SP group was affected by the different framing and in particular the order of the problems. We can conclude that risk taking of the students with abundant resources was generally stable, while risk taking of the students with scarce resources was unstable, and subject to the context effect (H4).

When studying the influence of accumulated resources on risk taking through the test-writing situation, we must face several dilemmas. Does the same risk-taking behaviour represent significantly different risk for people with different resources? It is possible that a person with abundant resources does not even perceive an action with a smaller probability of success as risk? Instead of risky and riskless alternatives, we offered the students a less risky "default" option and a riskier alternative. This concept is in line with Kühlberger's meta-analysis of decision framing which includes not only choices between riskless and risky, but also risky and riskier situations (Kühberger, 1998). Does choosing a more or less difficult task really represent different risk taking initiatives, or is it simply the result of a different ability or motivation of more or less intelligent and ambitious people? To control if the behaviour of people with different resources can be unvaryingly judged as risk taking, we examined our respondents' perception of the riskiness of the choice situation in a post-experimental questionnaire administered after the experiment. All resource groups judged the more difficult alternative to be risky, but the motivations were different. They depend on the available resource, and higher aspiration levels lead people with abundant resource to take risks.

Our claim that an intense emotional reaction was evoked by the presentation order is supported by the answers to the questionnaire. The loss/gain situation provoked significantly more negative feelings and more excitement. It increased the perceived riskiness and lowered the perceived gain of the choices

compared to the gain/loss situation. The effect of the presentation order was especially evident on the risk taking propensity of the survival group. Our result supports March and Shapira's expectation predicting that advantageous possibilities are to the fore under positive emotional influence, and the downside danger of risk taking is highlighted under negative emotional influence (March and Shapira, 1992).

2. Differences between risk taking in real and hypothetical situations: the laboratory experiments.

In the field experiment we studied risk taking in a real life setting where high-stake risk taking involved irreversible and significant consequences. To compare risk taking of people in the ecologically valid field experiment to risk taking in the laboratory, we designed two laboratory experiments. In the first experiment we manipulated the amount of resources and the contextual effects; in the second experiment we kept the framework of the experimental situation, but changed the subject of the decision to gain information about the generality of the influence of resources on risk taking.

The laboratory experiments addressed the following questions and hypotheses:

H6 The results of the laboratory and field experiments will be different. In the "cold" situation of the laboratory, people behave according to their mentally represented, generalized behavioural responses to situations (Bargh, Chen, & Burrows, 1996). It corresponds to an evolutionarily adaptive solution: taking smaller risks when resources are extensive and taking bigger risks when survival is endangered.

H7 Contextual impacts, such as framing or the presentation order are stronger in "hot" decision situations than in the laboratory setting, especially for people who struggle for survival (March and Shapira, 1992). Therefore, contextual effects will be smaller and bias will be weaker in the laboratory experiments.

H8 The object of risk taking will not influence the effect of resources on risk taking because the mentally represented generalized behavioral responses to situations will dictate a similar response in a similarly structured situation (4 very much, 1 not at all).

2.1. Laboratory experiment 1: Hypothetical risk taking

In the first laboratory experiment we recreated the field experiment in a typical laboratory setting to compare the student's risk taking attitudes in the two settings. Contrary to the field experiment (where the subjects were grouped based on their previous academic achievements and their choice had real consequences), in this laboratory setting the students were asked in a questionnaire to imagine that they had to choose between a usual and a more difficult test in a particular resource situation. Task-related capabilities (intelligence, interest in the task) were represented by the students' average annual grades.

2.1.1. Methods of the first laboratory experiment

2.1.1.1. Participants

271 undergraduate business school students took part in the first laboratory experiment (109 females); 143 received two problems in the gain/loss order (78 females), 128 in the loss/gain order (78 females). The students were between the ages of 18 and 45 (M=21,9, SD=3,89). The annual grade average was recorded for a subset of students (86), 41 receiving the two problems in the gain/loss order (25 females), 45 in the loss/gain order (22 females).

2.1.1.2. Materials

The students recruited on a voluntary basis were asked to complete a questionnaire describing the decision making situation created in the field experiment (see the questionnaire in Appendix A). First, he respondents

had to imagine that they had already collected a maximum of 2.5; between 3 and 4.5; or a minimum of 5 points during the semester. Then, they indicated their two choices between the standard and risky options in all three different resource positions and in the two presentation orders. All subjects gave 3 answers in the loss frame and 3 answers in the gain frame. The presentation order was changed for half of the students.

2.1.1.3. Procedures

The students received the questionnaire in a classroom situation before a lecture. After obtaining informed consent and instructing the students about the objective of the experiment, they were asked to complete the questionnaire.

2.1.2. Results of the first laboratory experiment

2.1.2.1. Risk taking in the different resource groups

Figure 6 shows the results obtained in the real and hypothetical situations. In the laboratory experiment risk taking in the three resource groups was significantly different (Table 8). A non-parametric Friedman test of differences among repeated measures was conducted: N=271, $\chi 2$(2)=74.85, p< .001, Kendall W=0.138.

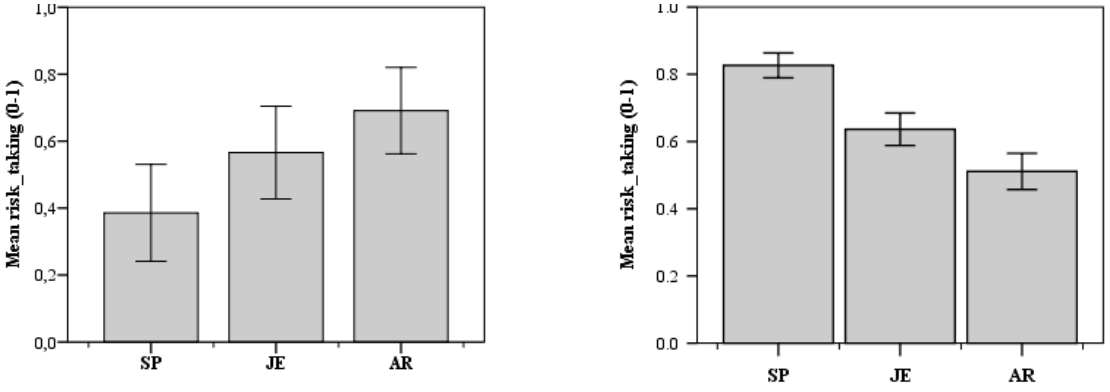

Figure 6. Risk taking in the different resource groups (field experiment on the left, laboratory experiment on the right). *Notes.* 0=*no risk taking* and 1= *risk taking*; AR=*abundant*, JE="*just enough"* SP=*survival point*; 95% confidence intervals are represented by the error bars

Strikingly, the order of risk taking of the three resource groups proved to be different: in the hypothetical situation the students at the survival point took the biggest risks and students with abundant resources took the smallest risks (Kendall's Tau-b: Laboratory I.: r_τ=-0.275, p< .001, N=813), whereas in the field experiment the students at the survival point were risk-averse and students with abundant resources were risk-prone (Kendall's Tau-b: Field: r_τ=0.329, p< .001, N=107).

Table 8. Summary of Wilcoxon matched pair tests comparing risk taking in differed resource groups

RG A	RG B	Paired Wilcoxon (N=185)
AR	JE	Z=-3.74, p< .001, r=0.16
	SP	Z=-7.92, p< .001, r=0.34
SP	JE	Z=-5.78, p< .001, r=0.25

Notes. RG= *resource group*, AR=*abundant resource*, JE=*"just enough"*, SP=*survival point*

To inspect the effect of intellectual skills and motivation, we included a control group of students for whom the cumulative annual grade average was available. They were divided into the following three groups:

students with poor grades (*N*=25, average less than 3), students with mediocre grades (*N*=29, average between 3 and 4) and students with good grades (*N*=32, average between 4 and 5). First, we looked only at the answers which corresponded to the situation in the field experiment: the risk taking of the students with good grades in the AR situation, students with mediocre grades in the JE situation, and students with poor grades in the SP situation. The difference was insignificant between the three groups (weak students (SP): 0,76 mediocre students (JE): 0,71, good students (AR): 0,78). Considering all answers in this subset of students, we found that each group, regardless of their academic record, claimed that they would take the biggest risks at the survival point and the smallest risks when having abundant resources (the means of risk taking of weak students (N= 25) in the three situations: (SP) 0.76>(JE) 0.66>(AR) 0.44, the means of risk taking of mediocre students (N= 29) in the three situations (SP) 0.88>(JE) 0.71>(AR) 0.50 and the means of risk taking of good students (N= 32) in the three situations (SP) 0.89>(JE) 0.78>(AR) 0.72).

2.1.2.2. Framing effect

In the laboratory situation the framing affect was not reproduced as the students' risk taking was not significantly different under the two frames (Figure 7, Table 9).

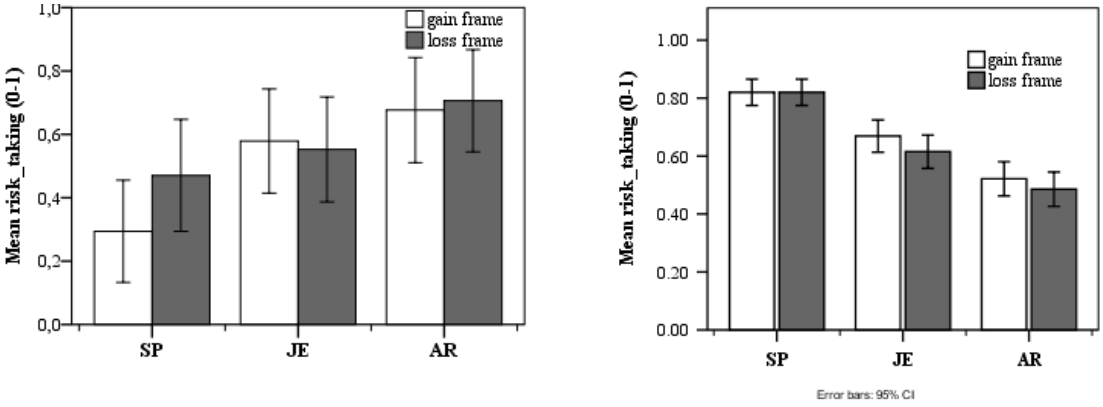

Figure 7. Risk taking in gain and loss frames among the different resource groups (field experiment on the left, laboratory experiment on the right). *Notes.* 0=*no risk taking* and 1= *risk taking*; AR=*abundant*, JE=*"just enough"* SP=*survival point*; 95% confidence intervals are represented by the error bars

Table 9. Summary of Wilcoxon matched pair tests comparing risk taking in gain and loss frame

RG	N	Paired Wilcoxon
AR	271	*Z*=-1.24, *p*= .216, *r*=0.05
JE	271	*Z*=-1.73, *p*= .083, *r*=0.07
SP	271	*Z*=0, *p*= 1, *r*=0

Notes. RG= *resource group*, AR=*abundant resource*, JE=*"just enough",* SP=*survival point*

2.1.2.3. The effect of the order of presentation

While the order effect was significant in the field experiment, in the laboratory experiment the students did not make a riskier choice in the gain/loss order than in the loss/gain order (Mann-Whitney: *U*(271)=8981.5, *Z*=-0.212, *p*= .832, *r*= 01). (Figure 8)

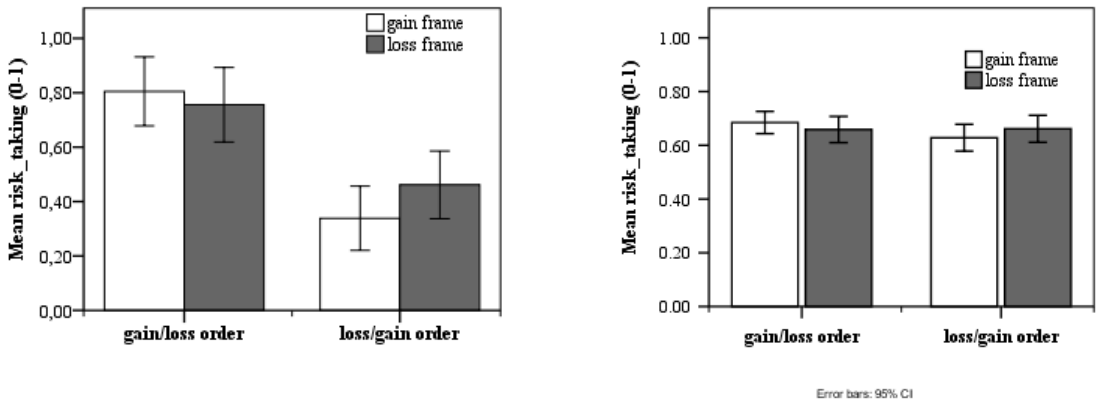

Figure 8. Effect of the order of presentation (gain/loss or loss/gain) on risk taking (field experiment on the left, laboratory experiment on the right). *Notes.* 0=*no risk taking* and 1= *risk taking*; 95% confidence intervals are represented by the error bars

Grade average did not influence the effect of framing (Wilcoxon matched pair tests comparing risk taking in gain and loss frame AR:N=32, Z=-2.12, p= .034, r=0.37; JE:N=29, Z=-0.302, p= .763, r=0.06; SP:N=25, Z=-0.302, p= .763, r=0.06) or order (Mann-Whitney U comparing risk taking in different order AR: U(32)=124.5, Z=-0,12, p= .905, r=0.02; JE: U(29)=85, Z=-0,87, p= .385, r=0.07; SP:U(25)=72.5, Z=-0,314, p= .753, r=0.06).

2.2. Laboratory experiment 2: Risk taking in a hypothetical gambling situation

In the second laboratory experiment we challenged the robustness of our conclusions by constructing a different scenario. The overall concept and experimental design were unchanged. However, instead of the hypothetical choice between exams of a different level of difficulty, the participants were asked to imagine a gambling situation in which chance determined both the accumulated resources and the consequences of risk taking. By comparing the results of the two laboratory experiments we were able to evaluate the generality of behavioral responses of risk taking in different resource situations.

2.2.1. Methods of the second laboratory experiment

2.2.1.1. Participants

128 subjects took part in the study (57 females), 89 received the two decisions in the gain/loss order (32 females), and 39 in the loss/gain order (25 females). The participants were between the ages of 21 and 69 (M=37.54, SD=11.67).

2.2.1.2. Materials

The participants (recruited on a voluntary basis) were asked to imagine the following scenario. During their holiday stay, the hotel organises a 9-round-roulette gambling session with an entry cost. “Test writing” corresponded to betting, the standard situation was betting on black and red, the riskier alternative offered betting on 4 groups of winning numbers. “Final grade” was analogous to the final payment. The subjects made their hypothetical choices between the safer and riskier alternative at the 7th round. In the negative frame condition, they were given money in advance. The presentation order was altered for half of the participants (See instructions in Appendix B).

2.2.1.3. Procedure

The participants received the questionnaire together with an unrelated survey (measuring organizational satisfaction). A conference room was provided for the investigation. After obtaining informed consent, the subjects were asked to fill in the questionnaire (Appendix B). To ensure that they understood the task, the experimenter answered all their questions regarding the gambling situation.

2.2.2. The results of the second laboratory experiment

2.2.2.1. Risk taking in the different resource groups

The two laboratory experiments showed very similar tendencies: in the hypothetical situations, the participants with abundant resources took the smallest risks and those at the survival point took the biggest risks (Figure 9). A non-parametric Friedman test of differences among repeated measures was conducted N=128, $\chi 2(2)$=22.39, p< .001, Kendall W=0.087.

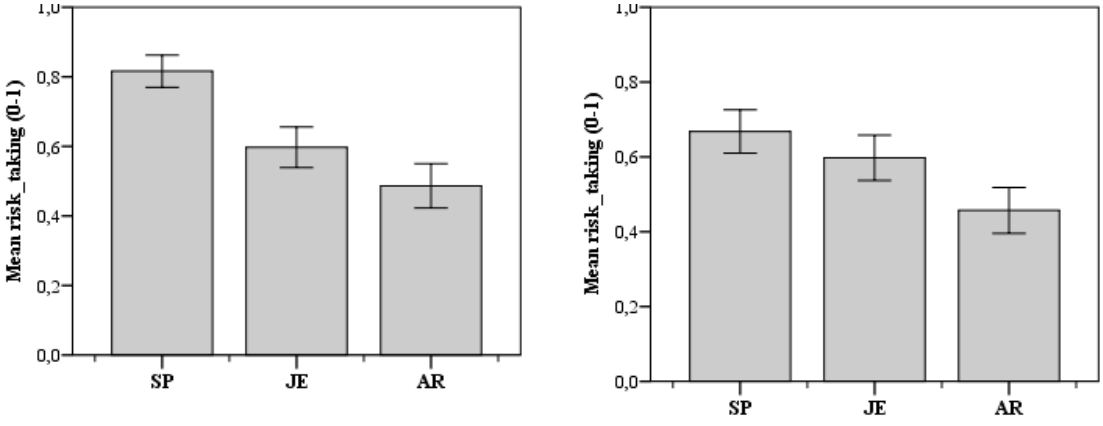

Figure 9. Risk taking in the different resource groups in the hypothetical situations (exam situation on the left and gambling decision on the right). *Notes.* 0=*no risk taking* and 1= *risk taking*; AR=*abundant*, JE=*'just enough'*, SP=*survival point*; 95% confidence intervals are represented by the error bars

2.2.2.2. Framing effect and the effect of the order of presentation

We found no evidence of a significant framing effect (Table 10) or the order effect in the gambling situation (Mann-Whitney: U(128)=1681.5, Z=-0.284, p=0.776).

Table 10. Summary of Wilcoxon matched pair tests comparing risk taking in gain and loss frame

RG	N	Paired Wilcoxon
AR	128	Z=-1.35, p= .178
JE	128	Z=-0.19, p= .847
SP	128	Z=-0.93, p= .353

Notes. RG= *resource group*, AR=*abundant resource*, JE="*just enough"*, SP=*survival point*

2.3 Discussion of the results obtained in the laboratory experiments

To verify our assumptions regarding the differences between real life and laboratory experiments, we designed analogous laboratory experiments where students had to indicate their choices in a structurally and thematically equivalent, but imaginary, hypothetical situation. Our hypothesis was verified: the

behaviour in the laboratory showed an opposite tendency as compared to the field experiment. In the laboratory, the students responded in a more adaptive, more rational way, taking smaller risks when equipped with rich resources, and bigger risks having depleted resources (H6). Risk taking was stable under different contextual influences (H7). To ascertain that risk taking in the field experiment was not merely due to a tendency of more skilled and motivated people to tackle the more difficult question, i.e. take a larger risk, we recorded the academic achievement of a subset of students, as an approximation of these individual characteristics (see Harris, 1940). We compared the field and laboratory risk taking on the same basis (good students responding to the abundant resource situation, the mediocre group to the "just enough" situation and week students to the "survival" situation). The similarity of risk taking occurred in the three groups allows us to conclude that risk taking in the field was influenced rather by the resource and not by the skills. The same order of risk taking in the respective resource situations indicated that academic records (and hence intelligence and/or motivation) do not influence the effect of the available resources on decision making in the laboratory. The second laboratory experiment involving a gambling situation yielded the same results. We have to note that in the gambling task sample the age range of the subjects was wider and the participants were not students. Despite the well-known age-dependence of the level of risk taking and the different attitudes of the students and employees, the relation of risk taking to resource situations and environmental influences showed the same pattern in the two laboratory experiments. Thus, the results obtained allow us to draw inferences on the general mental representation of the influence of available resources on risk taking behaviour in a hypothetical laboratory situation (H8).

3. General discussion and limitations

Our objective was to evaluate the role of available resources in risk taking in a valid environment characterized by real stakes in which people make natural decisions based on real motivations. To highlight the relevance of field experiments in the domain of risk taking, we designed equivalent laboratory tests, allowing for comparative study of these two experimental approaches.

Based on the *field study*, we conclude that people with large reserves are motivated to take more risks and that the context does not fundamentally influence their behaviour. In contrast, people in danger show an unstable risk taking pattern, which is sensitive to framing and priming effects. In these circumstances people tend to take risks when the environment suggests hope, but they become risk averse under the influence of the prospect of losing. Collectively, these results support March and Shapira's (1992) variable risk preference model. Thus, the field experiments do not support the evolution theory (McNamara & Houston, 1996; Mishra & Lalumière, 2010; Stephens & Krebs, 1986) which predicts increased risk taking at the survival point.

Interestingly, the parallel laboratory experiments gave an entirely different result, showing that in hypothetical situations the students do behave as predicted by the evolutionists' view. In the laboratory settings, the abundant resources led to decreased risk taking and the scarcity of resources induced a risk-prone behaviour. Importantly, the environmental influences determining risk taking in the field study did not have any effect in the laboratory conditions.

Our results call into question the relevance of laboratory results of risk taking on actual human behaviour, especially in "hot" situations, where strong motivations and serious consequences prevail. Several reports have expressed similar concerns (for example, (Kühberger et al., 2002; Levitt & List, 2007; Reyna & Farley, 2006; Slovic, 1969; Sun & May, 2013; Teigen, 1997) based on differences observed between judgments and choices, real and imaginary situations. Our results indicate that risk taking is driven by motivation and emotions which are obscured by cognitive inferences in the laboratory setting.

We used the framing manipulation to investigate the stability of choices in the laboratory and field experiments. Framing manipulation is realized generally using a between subject design because in a within subject design the two frames are presented simultaneously, and therefore the identical content of the two frames can be easily spotted. The within subject design allowed us to look at the framing as a contextual effect and not as a general bias. Framing only impacted the survival group in the field study, but

in the opposite direction as compared to the prediction of the framing effect theory. We attribute this result to the sensitivity of the survival group to contextual influences in which the negative frame seems to be more threatening, and risk taking is perceived more as a danger and less as a possibility.

Limitations

The use of natural decisions as dependent variables in field experiments cannot account for all the factors that may explain systematic differences in choices among individuals. Besides the "treatment" of interest, a number of other important factors have not been sufficiently controlled, therefore the estimation of the treatment's effect could be biased (Kerlinger, 1986). In our case, the number of available resources (and the level of individual abilities) could not be manipulated. We had to start with natural distributions of unevenly distributed attributes that are not independent from each other. As not all subgroups contained enough members to suit multivariate statistical analysis, the examination of our data is restricted to univariate comparisons. In the laboratory, the students reacted to all three hypothetical resource situations while in the field experiment, their situation was determined by their previous performance. This different presentation of the same material can change preferences (Hsee, Loewenstein, Blount, & Bazerman, 1999).

In our field experiment, the points collected in the tests were considered as accumulated resources. Resources and risk are not independent: abundant resources reduce and limited resources increase the risk of goal achievement. In our experiment the survival group may have been confronted with a bigger risk, as the probability of solving the problem can be smaller for students with less potential and less previous success. Conversely, students with better grades are likely to be more qualified, suggesting that the risk for the abundant resource group might have been smaller. Thus, our findings may have been primarily influenced by the willingness of the subjects with more resources to take more risk, or by the willingness of high-achieving students to tackle more difficult problems. However, high achieving students did not choose the more difficult question in the laboratory. In the field experiment, the abundant resource group faced some risk, as at the time of the experiment, the students have reached but a mediocre grade. In the case of a negative result the excellence of these students was at risk, so their behaviour can be judged as risk taking. To ensure that the students' attention was directed towards risk taking, the instructions explicitly mentioned the risk associated with the decisions. For the survival group, the probability of solving the problem was smaller and the motivation of the students was different (avoiding failure). In our opinion, March and Shapira captured the essence of the relation between risk taking and resources by discussing the role of the previous experience, aspiration level and survival point.

The strong influence of surface contextual effects on the survival group's decisions has clear societal implications. Future research in the field on the instability and reliability of opinions and decisions of people with severely limited resources should reveal the mechanism of manipulative influences.

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Conflict of Interest: The authors have no conflict of interest with respect to this publication.

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Appendix A

Instructions for the hypothetical test writing situation (gain/loss version)

Imagine that in your university course you have to write tests on 9 occasions. On each occasion you have to answer 2 questions, each worth ½ point, so that each time you can get 0, ½ or 1 point depending on the number of your correct answers. At the end of the semester, the final course grade depends on the cumulative points collected during the 9 tests. The grades are calculated as follows:

grade	minimum points to reach the grade at the end of the semester
5	8
4	7
3	6
2	4.5
failure	0-4

If you don't get at least 4 points by the end of the semester, you will have to take a difficult oral examination. Imagine that you have already taken 6 tests, and now you are before your 7th test. However, this test is different, since you are given the following instructions:

"As the end of the semester approaches, it was decided that you would be given an opportunity to collect as many as three points today. As usual, you will have to solve two problems, but on this particular occasion you can choose between problems of varying difficulty. You have to submit your decision before the actual test questions are revealed, which entails a certain risk, because you might be able to solve the easier problem more successfully.

For the first decision situation, you can choose between the following options:

A. A question with the usual difficulty level, worth ½ point

B. A more challenging question, worth 1½ points

In the case of an incorrect answer, you will get 0 points. Think about your choice and check the appropriate box in the enclosed sheet, which will be collected before you can start working on the task of your choice."

Which problem would you choose* if your points collected during the first six tests were

-between 0 and 2.5? The question worth ½ point OR The question worth 1½ points.

-between 3 and 4.5? The question worth ½ point OR The question worth 1½ points.

-over 5? The question worth ½ point OR The question worth 1½ points.

* Please underline the appropriate answer.

Now we turn to the second decision. Here, it is also possible to obtain 1½ points, and to encourage you to earn more points, you are given 1½ points in advance. Add 1½ points to your existing score and write this new score on your sheet. You can choose again.

C. A question with the usual difficulty, worth ½ point. If you choose this problem and solve it correctly, you can keep ½ point from the extra points you have just received, and 1 point will be taken away. In the case of an incorrect answer, you cannot keep any of the points you received in advance.

D. A more challenging question, worth 1½ points. If you choose this option, and solve the problem correctly, you can keep the 1½ points you have just received. In the case of an incorrect answer, you cannot keep any of the points you received in advance.

Think about your choice and tick the appropriate box representing your choice."

Which problem would you choose* if your points collected during the first six tests were
-between 0 and 2.5? The question worth ½ point OR The question worth 1½ points.
-between 3 and 4.5? The question worth ½ point OR The question worth 1½ points.
-over 5? The question worth ½ point OR The question worth 1½ points.
* Please underline the appropriate answer.

Appendix B

Instructions for the hypothetical gambling situation (gain/loss version)

Imagine that during your holiday the hotel managers organize a gambling event. The entry costs 1000 forints, which you have decided to pay. In the roulette game you have to bet on red or black to win points. There are 9 rounds, and at each round you can bet twice, and win 50 points at each bet (100 points in each round). In case of a wrong bet you get nothing.

If at the end of the 9th round you have
- less then **400** points, you **lose your 1000** forints
- at least **450** points, you **get back** your **1000** forints
- at least **600** points, you **get back** your **1000** forints **plus** you receive **2000** forints bonus
- at least **700** points, you **get back** your **1000** forints **plus** you receive **4000** forints bonus
- at least **800** points, you **get back** your **1000** forints **plus** you receive **8000** forints bonus

Imagine that you are before the **7th round**. The organizer wants to make the game even more exciting by letting you bet on numbers as well. There are 36 numbers on the roulette, and you can win even more with betting on the numbers. As usual, there are two bets.

At the first bet you can choose between two options.

As usual, you can bet on the color (**red or black) for 50** points,

Alternatively, you can bet on one of four groups of 9 numbers (**1-9, 10-18, 19-27 or 28-36**). If any number in that range wins, the bet pays **150 points**.

What would you choose if during the first six rounds you have collected
*- no more than 250 points? red / black (for 50 points) OR one of the four groups (for 150 points)**
*- between 300 and 500 points? red / black (for 50 points) OR one of the four groups (for 150 points)**
*- over 550 points? red / black (for 50 points) OR one of the four groups (for 150 points)**

*Please underline the appropriate answer.

For the second bet of the 7th round there are even more challenges. **150 points will be added** to your points. You have to choose again between the same two options (betting on the color OR betting on the number groups).

If you choose to bet on the color and you win, you can keep **50 points,** and give back 100 points. If you lose, you have to give back the 150 points.

If you choose to bet on the group of numbers and you win, you can keep all **150 points**. If you lose, you have to give back the 150 points.

What would you choose if during the first six rounds you have collected
*- 250 points plus the 150 extra points just received? red / black (for 50 points) OR one of the four groups (for 150 points)**

- *between 300 and 500 points plus the 150 extra points just received? red / black (for 50 points) OR one of the four groups (for 150 points)**
- *over 550 points plus the 150 extra points just received? red / black (for 50 points) OR one of the four groups (for 150 points)**

*Please underline the appropriate answer.

Appendix C

Post experimental questionnaire

How risky was it to choose the more difficult question? (4 very much 1 not at all)
How much did the riskiness of the choice alternatives influence your choice? (4 very much 1 not at all)
Did choosing the more difficult question present a danger of worsening your grade? (4 very much 1 not at all)
Did choosing the more difficult question present an opportunity for improving your grade? (4 very much 1 not at all)
What did you feel during the test:
enjoyment(1) /sadness(7);
excitement(1) /calm(7)
Which grade would you be satisfied with in this subject? (5 highest grade 1 failure)
How much the grade you would like to get influenced your choice? (4 very much, 1 not at all)
Did you suspect that you took part in an experiment? (yes – no)
Did you find the test questions and the process of the experiment fair? (4 very much, 1 not at all)