Psychological and environmental determinants of myopic loss aversion

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PSYCHOLOGICAL AND ENVIRONMENTAL DETERMINANTS OF MYOPIC LOSS AVERSION

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ABSTRACT:

Each economic actor is characterized by his own evaluations, traits, and strategies. Although heterogeneity of economic actors is widely acknowledged, little is known about the factors causing it. In this paper, we will examine the behavioral bias known as myopic loss aversion, and the environmental and psychological factors leading to different behavioral reactions. Myopic loss aversion has been used to suggest that fund managers should reveal information only rarely, to lead investors to choose options with (on average) higher returns.

Specifically, we experimentally studied the impact of experience, individual differences, and emotions on behavioral responses to feedback frequency in an investment setting. Participants made investment decisions in one of three feedback frequency conditions: (1) they received feedback after each round and had the opportunity to make investment changes each time; (2) they received feedback after each round, but were only given the possibility to make changes every three rounds; and (3) they received aggregated feedback every three rounds, and also had the opportunity to make changes every three rounds. We collected information about personality and individual difference factors before the experiment. Finally, evaluations and emotions were measured every three rounds, immediately after feedback was given.

We hypothesized that myopic loss aversion is not a general phenomenon, but that stable individual differences lead to different evaluations and emotional reactions concerning feedback. This implies that myopic loss aversion will only be present for some groups of people under certain conditions. As predicted, we found that myopic loss aversion is not generally observed; rather, we found both an experience effect and a personality effect. In particular, myopic loss aversion was particularly likely: (1) when initial investment rounds lead to negative investment experiences (i.e., losses); and (2) for investors with low self-efficacy concerning the investment situation. 'Self efficacy' is related to a personality profile characterized by confidence in decision-making abilities, high optimism, and low anxiety. Our results may help explain which individual and situational factors lead to myopic loss aversion, and should help researchers and practitioners provide optimal feedback to different types of investment clients.

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1. Introduction

> *"No two people see the external world in exactly the same way. To every separate person a thing is what he thinks it is -- in other words, not a thing, but a think"*
> Penelope Fitzgeralde

It is an undisputed reality that each economic actor is characterized by a unique set of abilities and characteristics. In the past, these differences were regarded as "interesting" due to their role in motivating market interactions and stimulating gains from mutual trade. More recent research, however, has stressed the importance of economic actor heterogeneity, and some have proposed multi-agent approaches to analyze models involving trait heterogeneity (Axtell, 2007). To make these models optimally predictive, we now need to identify the most salient traits and strategies within the population for specific economic behaviors. Examples for heterogeneity in traits concerning economic behavior include: sophisticated versus naive trading; and responders versus non-responders to explain information processing abilities in financial markets (Haltiwanger & Waldman, 1985; 1991); sensitivity concerning deviations with respect to others for bargaining outcomes (Fehr & Schmidt, 1999); and risk aversion (Holt & Laury, 2002). Although in some cases individual differences have been identified, most economic experiments and studies still analyze results at an aggregate level. This might be because underlying heterogeneity indicators and processes are difficult to understand. Consequently, one of the challenges is to identify factors that can explain and predict stable individual differences. In this paper, we will present an experimental study that has identified individual differences in a financial investment setting, and which shows that the origin of these differences can be both situation dependent, environmental factors as well as stable, individual differences.

Researchers in the area of Personality and Social Psychology[1] attempt to tease apart individual differences and situational factors to explain behaviors within important social domains, and recently including consumer and economic behavior (De Cremer, Zeelenberg, & Murnighan, 2006). However, very few studies have combined psychological models with behavioral differences in economic interactions (Biais et al., 2005). Given the increased interest by economists to use psychological theories and methods that measure neurological (Sanfey et al., 2003), physiological (Ben-Shakhar et al., 2007) and biological (Kosfeld et al., 2005) reactions, it is also desirable that economists and psychologists work together to determine which psychological measures are best suited to help us understand economic behaviors. For example, neurological, physiological, and biological factors may seem objective; however, they generally only provide rough mean descriptions and correlates of economic behavior, without explaining underlying processes and causes (Frijda, 2007). In addition, both standard economic models and neurological or physiological measures filter out useful intra- and inter-individual variation. Although such mean estimates are interesting for basic model building, the inclusion of individual differences should allow us to open up the black box

[1] For more information about this field, please see http://www.spsp.org

of decision-making and build more specific models that take into consideration both situation-specific and person-specific information.

In this paper, we will investigate the behavioral bias of myopic loss aversion, which is crucial for long-term investment decision-making, and which has been repeatedly observed in experimental studies (Gneezy & Potters, 1997; Thaler et al., 1997). We predicted and observed strong individual differences that might or might not lead to the typically observed reactions for myopic loss aversion. Moreover, we identified individual traits that lead to these reactions, and provide insights into the underlying mechanisms of myopic loss aversion. Finally, we will show that similar behaviors can be caused by environmental factors. Taken together, our results will allow us to propose possible solutions to diminish the effects of myopic loss aversion.

The rest of the paper is structured as follows. In Section 2 we will give an overview of the existing literature on myopic loss aversion. Section 3 will review the psychological literature concerning individual differences, emotions, and evaluations and make predictions concerning different personality types. Section 4 will present the design and procedures of the study. Section 5 will present behavioral results across treatments and identify individual differences in evaluations and emotions that could account for them. Section 6 will conclude.

2. Myopic loss aversion

The fact that investment in stocks is lower than realistic levels of risk aversion would predict (known as the 'equity premium puzzle'), has been widely discussed in the financial and economic literature (Mehra & Prescott, 1985). Numerous explanations for this anomaly have been proposed, one of which is the principle of *myopic loss aversion* (Bernartzi & Thaler, 1995). Myopic loss aversion is based on the principle of (1) *loss aversion* (Kahneman & Tversky 1979; Tversky & Kahneman 1992), due to which losses loom larger than gains, and (2) *mental accounting* (Kahneman & Tversky 1984; Thaler 1985) *i.e.*, a thematic grouping of expenses and gains.

Risky investment options that show on average high returns are usually characterized by short term losses, which will be cancelled out by occasional gains in the long run. An overvaluation of losses compared to gains can render such an investment less attractive, compared to a safe investment option with lower average returns but less volatility. Less frequent feedback might increase the attractiveness of a risky asset by presenting only aggregate gains. The effect of feedback from investment and its impact on investment has been experimentally studied by economists (Gneezy & Potters, 1997; Thaler et al., 1997) and psychologists (Shiv et al., 2005a; 2005b). These studies confirm that investment in risky, high return options is higher when aggregate feedback over a number of rounds is given (Barron & Erev, 2000; Gneezy & Potters, 1997; Thaler et al., 1997) and that prices for such an option will be higher (Gneezy et al., 2003). This bias is not simply due to inexperience; professional traders show similar behaviors as non-professionals (Haigh & List, 2005). Some have therefore suggested that fund managers should give portfolio performance information less frequently to induce higher investment levels; a

recommendation that may have already resulted in information policy changes (Gneezy et al., 2003).

The principle of myopic loss aversion is based on the assumption that losses 'feel' worse than equally sized gains, which points at the importance of emotions for this type of decision. Moreover, patients with focal lesions in brain areas related to emotions react less strongly to losses and show higher average investment in risky situations than normal controls (Shiv et al, 2005a; 2005b). These results suggest that individual differences in emotional reactions might influence investment choices. However, to date neither individual differences nor emotional reactions in connection with frequent or infrequent investment feedback has been explicitly studied.

The aim of this study is to determine the relation between the display of myopic loss aversion and personality. We therefore measured character traits as well as evaluations and emotions in an experimental investment game. An analysis of the interaction of events (earnings and losses), emotional reactions, and behaviors (amount invested) should allow us to identify external circumstances as well as personality factors that are likely to lead to myopic loss aversion.

To make our results easily comparable to the existing experimental literature, we used the design proposed by Gneezy and Potters (1997). We also included a third treatment to disentangle feedback effects from investment flexibility effects (cf. Bellmare et al., 2005). Because behavior can differ significantly when specific parameters are changed (Langer & Weber, 2001; 2005), we applied the same probabilities and outcomes as these earlier studies.

3. Evaluations, personality, and decision making

Contemporary emotion theory suggests that the same situation, such as a monetary win or loss, can result in very different emotions (Ellsworth & Scherer, 2003). This is because emotions do not emerge from situations, but rather from the subjective evaluations a particular individual ascribes to the situation. For example, a loss will bring about strong negative emotions, such as anger, if the person expected to earn a lot and believes that he or she "deserves" to earn the money, or if he believes that another agent treated him or her unfairly. However, the same loss could bring about mild irritation or even indifference if the person believes that the investment was a gamble with only minor earning chances. These evaluations are considered a crucial link between situations or events and the ensuing emotional and behavioral reactions. Thus, although losses tend to lead to negative emotions and earnings to positive emotions, the specific emotional reaction can be quite varied and will be based on theses subjective evaluations.

Because evaluations are subjective and inherently personal, it seems logical that stable individual difference should systematically influence these evaluations and therefore the ensuing emotions (Wranik, 2005). For example, a person who strongly believes in fair treatment will be more sensitive to unequal shares or gains. This person will evaluate many situations as unfair, and be more likely to feel angry than a person who believes

that life in inherently unfair and expects to be treated unfavorably most of the time. Past research has examined several predictions concerning which individual differences should influence which evaluations and found support for this proposition concerning a number of factors in various experimental settings (Griner & Smith, 2000; Van Reekum & Scherer, 1997; Wranik & Scherer, 2008). Research in workplace settings has referred to the fundamental, subconscious conclusions individuals reach about themselves, other people, and the world as "core evaluations" (Judge et al., 1998).

Systematic evaluation biases, such as expectations, beliefs, and attributions, are crucial for the decision-making process in general and should therefore play a large role in understanding investment decision-making. Indeed, researchers have identified a range of personality and emotional processes and variables that may systematically influence investment decisions including self-efficacy, optimism, emotion regulation, impulsivity, pessimism, anxiety, and irritation (Ellis, 2002; Hilton, 2001; Salovey, 2001); however, there is still very little empirical evidence to determine the impact and importance of these variables (for exceptions, see Ameriks et al., 2007 and Wranik et al., 2008). A systematic examination of the interaction between individual differences, evaluations and emotions in the investment situation is beyond the scope of this paper and is treated in more detail in Wranik and Hopfensitz (2008). In this paper, we will focus our discussion on the core evaluation that we expected to predict myopic loss aversion; namely, self-efficacy.

We will use validated personality scales and evaluation questionnaires to determine if and how feedback frequency of investment returns influence individuals with high and low self-efficacy. Based on past research, we have defined self-efficacy as a core evaluation which includes general optimism, specific confidence in decision-making abilities, and lack of anxiety (Judge et al. 1998). In particular, optimistic persons tend to look positively into the future and will continue to hope for future earning despite past losses (Carver & Scheier, 2002). Similarly, persons who believe in their ability to make good decisions will try to minimize losses and also look to the future for more earning possibilities. This construct is similar to task-specific self-efficacy, which predicts that people will persevere in the face of hardship and initial failure in a task (Bandura, 1997). Finally, nervous or anxious persons are generally sensitive to uncertainty and therefore prefer to avoid risk (Maner & Schmidt. 2006). Taken together, individuals with general optimism, specific confidence in decision-making abilities, and lack of anxiety should evaluate losses as less negative, report weaker or less negative emotions, and be less influenced by feedback frequency (Seligman & Csikszentmihalyi, 2000). They should also be future-oriented and present less myopic loss aversion.

4. Experimental design, procedures and predictions

To allow comparison with earlier results, our experiment was based on the research designs by Gneezy and Potters (1997) and Bellemare et al. (2005). In the baseline treatment, participants faced 15 consecutive investment rounds[2]. Participants received 100 points for each round, which could be fully or partially invested into one of two

[2] In Gneezy and Potters (1997) as well as in Bellemare et al (2005) only 9 rounds were played.

options. Earnings from previous rounds could not be used for future investment.[3] One of the two investment options was safe (*i.e.*, every point invested in this option would be added to the final earnings), and the other option was risky. The risky option returned the invested points multiplied by 3.5 with p=1/3, and returned nothing in 2/3 of the cases. Thus, participants could either earn 2.5 times their investment (relative to the points they had received at the beginning of the round) or lose their investment. To make losses salient, the instructions and computer interface clearly stated that participants had an initial amount of capital which they could either keep or invest. The expected value of the risky option was therefore larger than the expected value of the safe option.[4]

We compared the baseline treatment with two treatments based on Bellemare et al. (2005). In the baseline treatment, participants had to make a new investment decision in each round and received investment performance feedback after each round. We therefore called this treatment High (short for 'high feedback'). In contrast, participants in the Low treatment ('low feedback') were required to fix their investment choice for three consecutive rounds and received aggregate feedback about their returns from these three rounds. Finally, to disentangle the effects of feedback from those related to the opportunity to change the amount invested, we included a third treatment. In this Medium treatment, participants again fixed their investment choice for three consecutive rounds; however they received feedback every round. Thus, these participants would see if they won or lost in each of the 15 rounds, but they could only make a new decision every three rounds.

Since the aim of our study was to identify individual differences, evaluations, and emotions underlying myopic loss aversion, we asked participants to respond to questionnaires before and during the task. First, they filled out several questionnaires to asses their personality and other individual differences (see Appendix B:5). This was done during a separate one-hour session, which took place approximately one week before the experimental session. We thereby ensured no carry-over effects from the questionnaires onto the behaviors in the experiment. During the experimental session, we measured baseline evaluations and emotions before the first investment round (see Figure 1). Then, every three rounds, after receiving feedback concerning their investment, subjects were asked to: (1) indicate and rate the most prominent emotion they experienced; (2) answer a number of questions concerning evaluations of past and future rounds.

Evaluations reflect an individual's *subjective* evaluation of situations and events, and can therefore only be measured by self-reports. Even though the use of self-reports is frequently regarded with skepticism by experimental economists, their use is necessary whenever internal, non-observable states are measured. Moreover, studies employing physiological measures suggest the consistency and reliability of these reports (van Reekum et al., 2004).

[3] By keeping participants endowment fixed over rounds, we circumvent problems due to differences in budget constraints across participants.
[4] EV(risky) = 1.16 > EV(safe) = 1

Procedures

The experiment was conducted in computer laboratories at the University of Geneva, Switzerland. Participants were recruited by announcements promising a monetary reward and were asked to sign up for two one-hour sessions. The first was a questionnaire session; the second was the experimental session in which participants completed the investment task. Participants were paid their earnings from the investment task plus a show up fee of 10 CHF at the end of the second session. Average earnings were 32 CHF (approx. $ 27). In total 114 students (age: $M = 24$, $SD = 5.75$; 71 female, 43 male) from a variety of fields (psychology, economics, law) participated in the experiment.

During the first session, participants were informed that they would have to fill out a number of questionnaires concerning their personality. It took participants between 40 to 60 minutes to answer all the questionnaires. To match answers from the two sessions, participants also had to provide personal information[5] (i.e., first letter of their father's name, first letter of their mother's name, the day of their birthday, and the month of their birthday) which was used to create a personal identifier and which participants had to provide again during the second session.

At the beginning of the second session, participants were informed that they would participate in an investment game in which they could earn points that would be converted to real money at a specified exchange rate at the end of the session. They received 20 CHF (i.e., 1500 points) as initial capital and were handed the money in envelops. This money was the capital that could be used in the 15 rounds of the investment game. In each round, participants made decisions concerning 100 points from their initial capital. Points had to be distributed between two options: a safe option and a risky option. Investment in the risky option could either result in gains of 2.5 times their investment (with probability =1/3) or result in the loss of the invested points. Dependent on treatment, participants had to either make a new decision each round (High) or to fix their decision in rounds 1, 4, 7, 10 and 13 for the next three consecutive rounds (Medium and Low).

The Medium and Low treatments differed in how investment outcomes were presented. In the Medium treatment, participant saw their gains and loses for every round, and had to press a button to proceed from one round to the next. In the Low treatment, participants passed through three consecutive screens informing them only about the number of the current round ("This is round 4"). They then received information concerning aggregate gains or losses over the last three rounds ("In the last three rounds you earned (lost) … points"). After participants had read the instructions for their treatment, they answered a number of control questions and were invited to address any remaining questions to the experimenter.

To keep feedback comparable across treatment, outcomes from investment were predetermined by random sequences that were equally distributed across treatments.

[5] The code derived from this information ensured a unique matching while also guaranteeing anonymity.

Predictions and Hypothesis

In the following section, we will describe our hypothesis and predictions concerning behavior in the investment task and the anticipated interactions of personality traits, emotions, and behavior.

Choices: Expected value maximization predicts the selection of option B. Expected utility maximization, however, should lead to the selection of either option A or option B, dependent on the individual's level of risk aversion. This implies that either everything or nothing should be invested. However, experiments of budget allocations across two comparable options have already shown that the majority of participants actually choose non extreme investment (Hopfensitz & van Winden, 2008).

Following our previous discussion of myopic loss aversion and earlier experimental results, we expected to see differences between treatments High and Low. Indeed, investment is expected to be higher when aggregate feedback is given; however, it is not clear if this effect is due to learning or anticipation. Since past research has shown that humans are not very good in anticipating their future emotional states (Loewenstein & Schkade, 1999), we expected the effect to be only partly due to anticipation. In addition, we expected experiences from early rounds to play an important role. How treatment Medium should affect investment behavior is less clear. If lack of performance information and thus protection from potentially negative emotional experiences due to losses drives the effects of myopic loss aversion, we would expect Medium to be similar to treatment High. If, however, the effect of MLA if mainly due to lack of investor flexibility, which in turn reduces overreactions to either gains or losses, we would expect Medium to be closer to treatment Low. Earlier experimental studies have shown evidence for both possibilities. Bellmare et al (2005) concluded that behavior in Medium is similar to High, while Langer and Weber (forthcoming) found the opposite effect.

We therefore have the following hypotheses concerning investment behavior across feedback treatments:

H1: *Overall investment is higher with aggregate feedback (High) than with detailed feedback and investment flexibility (Low). Allowing for feedback but restricting flexibility (Medium) might be sufficient to compensate the effect of myopic loss aversion.*

H2: *Humans are limited in their ability to predict future emotional states. We therefore expect myopic loss aversion to increase over time. In addition, participants who encounter many negative events in early rounds and thereby profit from an aggregate presentation of earnings, should show stronger myopic loss aversion.*

Emotions: Myopic loss aversion is based on the assumption that losses are experienced as worse than the pleasure obtained from equal sized gains, and that aggregate feedback reduces the pains from losses. We therefore expect that participants will experience less negative emotions in treatment Low compared with treatment High and Medium. We will

also test the assumptions, that experiencing negative or positive emotions will predict future investment.

This leads us to the following hypotheses:

H3: *Aggregate feedback will lead to the experience of less negative emotions. Therefore, participants in the Low condition will report less negative emotions than participants in the High and Medium treatments.*

H4: *Differences in experienced emotions are related to behavioral differences. Therefore we expect to be able to predict future behavior based on emotional reactions.*

Personality: While the literature has considered myopic loss aversion to be a general phenomenon, the aim of this study is to challenge this claim. We therefore hypothesize that myopic loss aversion will only be present for individuals with certain personality characteristics. In this study, we will focus on 'self-efficacy', and hypothesize that participants exhibiting high self-efficacy will be less vulnerable to myopic loss aversion than participants with low self-efficacy.

H5: *Myopic loss aversion is not a general phenomenon but will depend on personality. Participants with high self-efficacy will get less influenced by losses and feedback frequency than those with low self-efficacy.*

We will now turn to the results from our experiment.

5. Results

5.1. Investment

Does behavior in our experiment replicate the observed treatment differences concerning low and high feedback from previous experiments? Table 1 and Figure 2 summarize investment behavior by treatment for the five blocks of three rounds. Average investment across all rounds was: 50.13 (High), 54.20 (Medium) and 54.87 (Low). Differences across treatments were not significant (Mann-Whitney test[6], $p > 0.418$) neither for average investment over all rounds, nor for any individual block of three rounds. This means that, contrary to previous research, we do not find a general effect of myopic loss aversion. Given the strong previous evidence of its existence we will therefore have to consider that myopic loss aversion might depend on certain external circumstances or on individual characteristics. We will discuss these possibilities below. Our conclusions concerning Hypothesis 1 can be summarized as:

RESULT 1: *We observed no overall effect of feedback on investment behavior. Average investment is the same in all three treatments.*

[6] All tests in this paper are (if not otherwise noted) two-sided.

Not only were average investments the same in all three treatments; we also did not observe changes over time (see Figure 2: B). Moreover, participants could experience more or less frequent gains or losses in early rounds of the experiment. Since more frequent gains in early rounds might lead to less aversive reactions to frequent feedback, we expected that only participants who were initially exposed to frequent losses would profit from aggregate feedback in future rounds. In our experiment, 63% of the participants encountered more than two successive rounds with losses during the first six rounds (the first two blocks of our experiment).[7] When we compared future investment behavior for these two groups, we observed a striking difference (see Figure 3). While participants that encountered frequent gains during the first six rounds showed no differences across feedback conditions, we observed the predicted pattern of myopic loss aversion for participants initially facing frequent losses.

For participants facing initial losses, average investment over rounds 7 to 15 was: High: 40.3, Medium: 59.8, and Low: 55.5. Tests confirm that investment is higher in the Medium and Low treatments compared to High (Mann-Whitney test, $p<0.049$, for all test results see Table 2). For 'lucky' participants, we find no effect (investment rounds 7 to 15: High: 72.6, Medium: 55.7, Low: 56.9). Investment in High is overall higher when participants were initially lucky (Mann-Whitney, $p=0.009$), while initial events have no impact in the Medium and Low treatments (Mann-Whitney, $p>0.386$).[8] Similarly, Langer and Weber (2001) showed that an aggregate presentation of a gamble is less accepted when the gamble is characterized by a small probability of high losses. A repetition of such a gamble will result in a large number of winning rounds (with an occasional high loss), which might be similar to our lucky participants. Figure 4 illustrates the shift in the investment distribution in treatments Low and High from round 1 to round 15. Thus, in treatment High, investment in the last round is either positively or negatively skewed dependent on initial rounds. In treatment Low, initial rounds show no effect on the distribution in the final round.

RESULT 2: *Participants who initially encountering more than two successive rounds of losses, exhibit the behavior patterns typically ascribed to myopic loss aversion. Participants that are "lucky" during the first six rounds, and encounter few losses, show no such effect.*

[7] 72 out of 114 participants encountered more than two successive rounds of looses in the first six rounds. This ratio was very similar across treatments. For the three treatments 'unlucky' versus 'lucky' participants were distributed as follows: High: 24 (unlucky)/14 (lucky); Medium: 22 (unlucky)/15 (lucky); Low: 26 (unlucky)/13 (lucky).

[8] The difference between treatment High and treatments Medium and Low is not significant for the case of initially lucky outcomes (Mann-Whitney, $p>0.14$). However note that our number of observations is much smaller for 'lucky' cases then for 'unlucky' cases.

5.2. Emotions and evaluations

We will now turn to our measures of emotions and evaluations during the experiment to investigate if we can find evidence for variations in emotional reactions when feedback and flexibility are altered.

Because participants were required to select only one (main) emotion out of a list of emotion terms, we first report which emotions were chosen. Joy, hope, disappointment, regret and surprise are the predominantly reported emotion terms (see Table 3:A). Across treatments we observe that joy is more often reported in treatments Low and Medium (Kruskal-Wallis, p= 0.008) and that worry and irritation, has a tendency to be more often reported in treatment High (Kruskal-Wallis, worry: p=0.021; irritation: p=0.051). Grouping emotions dependent on them generally being considered to be negatively (shame, regret, irritation, worry and disappointment) or positively valenced (joy, pride and hope) gives even stronger results (see Table 3:B)[9]. Negative emotions are significantly more often reported in treatment High (Kruskal-Wallis, p=0.004) while positive emotions are more often reported in treatments Medium and Low (Kruskal-Wallis, p=0.031). With respect to Hypothesis 3 we therefore conclude:

RESULT 3: *As myopic loss aversion predicts, aggregate feedback (Low) increases positive emotions and decreases negative emotions. However positive emotions are also increased if feedback is given frequently but choices cannot be adjusted (Medium).*

Myopic loss aversion correctly predicts less negative emotional reactions when losses are not directly observed; however, it is not clear if emotional experience will predict future investment behavior. We therefore regressed investment at time t (with t=4, 7, 10 and 13), on emotions experienced after the previous block of three rounds. We see that emotions do not predict investment (see Table 4). Thus, even though emotional reactions are dependent on treatment, they are not related to behavior. In other words, we observe no interaction between emotional experience and investment behavior.

RESULT 4: *Emotional experience cannot predict future investment decisions.*

Emotions are elicited as predicted by loss aversion, however cannot explain behavior. Since we also asked participants to evaluate their expectations concerning future investment rounds, we can compare the predictive power of these evaluations to the emotional experience. We observe that evaluations concerning the future[10] (i.e. answers to the questions: "What are you expectations concerning the future?" and "What is your confidence in reaching your goal?") are strongly correlated with overall investment (Spearman: +0.30; p=0.001). Moreover, evaluation of future events at time t-1, significantly predict investment at time t (Table 6). For a detailed discussion of the

[9] We leave surprise out of this classification, since in can fall in either category.

[10] Factor analysis confirms that appraisals concerning past events and appraisals concerning future events can be represented by two separate factors (Table 5). We therefore generate two grouped variables: appraisal_past_events and appraisal_future_events that consist of mean values of the elements of each factor.

precise interaction dynamics between emotions, evaluations, and personality we refer to Wranik and Hopfensitz (2008). We summarize with the following result:

RESULT 5: *Evaluations of future investment rounds can predict investment behavior in future rounds and are related to overall investment.*

5.3. Personality and investment

Positive evaluations and optimism concerning the future are generally related to personal characteristics (Carver & Scheier, 2002; Seligman & Csikszentmihalyi, 2000). Thus, after having observed that optimistic future evaluations can predict investment choices, we examined the personality profiles responsible for such optimistic evaluations. Our hypothesis is that the personality construct of "self-efficacy", which includes specific confidence in decision-making abilities, general optimism, and lack of anxiety, will result in more positive evaluations of the future.

Specific confidence in decision-making abilities was measured by the question at the beginning of the task: "How confident are you in your ability to generally make good decisions?" As expected, individuals with high scores on this question also present low anxiety (STAI trait; Spearman: -0.546, $p < 0.001$) and high optimism (LOT-R; Spearman: 0.366, $p < 0.001$).[11] In addition, self-efficacy is correlated with evaluations concerning the future (Spearman: +0.651, $p < 0.000$) and with overall investment. Thus, while participant scoring below mean self-efficacy (N=55) invested 45.47 points on average, participants above mean self-efficacy (N=59) decided to invest 60.16 points on average. This difference is highly significant (Mann-Whitney: p=0.006).

Given these observations, we expected that individuals with high self-efficacy will continue to invest larger sums in future rounds, independent of feedback frequency. Figure 5 summarizes investment for participants scoring either above mean or below mean self-efficacy. Participants scoring above mean self-efficacy show no behavioral differences for different feedback frequencies. However, we observe a strong effect of myopic loss aversion for participants with below mean self-efficacy (Mann-Whitney, High vs. Low: p=0.049, High vs. Medium: p=0.032). This effect is amplified if we focus on those participants who had initially encountered more than two successive losses (Mann-Whitney, High vs. Low: p=0.005, High vs. Medium: p=0.002).[12]

RESULT 6: *Investors present large variability in self-efficacy, a personality profile characterized by specific confidence in decision-making abilities, general optimism, and lack of anxiety. Participants with low self-efficacy show a strong reaction to feedback*

[11] In a debriefing questionnaire we also asked participants about: (1) their experience concerning investment; (2) their interest in investment; (3) their competence regarding mathematics and statistics and (4) how much they enjoy topics related to investment and finance. Positive answers to these questions are strongly correlated with high ratings concerning 'power' (Spearman, +0.33, p<0.001). Also men report higher levels of power than women (Mann-Whitney, p=0.009).

[12] However the inverse myopic loss aversion effect is not significant, i.e. the difference between treatment High and treatments Medium and Low is not significant for the case of initially lucky outcomes (Mann-Whitney, p>0.14). This might though be due to the reduced number of observations for this case.

frequency and flexibility and exhibit characteristic myopic loss aversion behaviors. Participants with high scores on self-efficacy are not influenced by feedback frequency and flexibility and show no evidence of myopic loss aversion.

6. Discussion and Conclusion

In this paper, we discussed the psychological and environmental determinants of myopic loss aversion. We report two main results: First, myopic loss aversion is influenced by outcomes from early rounds of the experiment. This 'priming' effect leads to myopic loss aversion only when initial rounds resulted in relatively unlucky outcomes. In particular, aggregate feedback and reduced flexibility are obscuring losses and are only effective if losses are frequent. In contrast, we observe an almost reversed effect of myopic loss aversion when returns during initial rounds are lucky. Under conditions with reduced flexibility (Low), participants invest to a similar degree whether they were initially lucky or unlucky. In contrast, participants with detailed information about their gains and the option to react to them immediately (High), are motivated to invest more when they are initially lucky. Since other experimental studies did not control for the effect of past experience on overall investment, differences across treatments and studies might be partially explained by random differences in the order of gains and losses (Langer & Weber, forthcoming).

Our second result concerns the psychological determinants of myopic loss aversion. We investigated the relation between character traits, evaluations, emotional responses, and investment behavior and identified a specific personality profile, self-efficacy, which predicts myopic loss aversion. Self-efficacy is characterized by specific confidence in decision-making abilities, general optimism, and lack of anxiety. Low self-efficacy participants are characterized by uncertainty and pessimism about the future, and react strongly to detailed feedback, especially if this feedback is initially negative. Consequently, these low self-efficacy participants profit most from aggregate feedback and reduced flexibility. Their investment in the risky option and hence their earnings are substantially higher when decisions can only be changed every three rounds.

Evaluations and emotions measured during the task are essential to understand the mechanisms underlying this effect. For example, we observe that joy is least often reported in the High treatment. Moreover, joy is significantly higher in the Medium treatment, even though participants witnessed the same number of wins in both treatments. Since participants can immediately react to winning rounds in the High treatment, they can also regret this action afterwards, which could explain the lower levels of joy. Finally, the larger number of joyful experiences does not predict investment behavior. In sum, the assumption that reduced feedback will make a risky option feel ‘better’ is confirmed; however, this is not the driving force behind increased investment.

Higher investment levels under reduced flexibility are mainly due to differences in how future events are appraised. Insecure participants show increased confidence concerning

future rounds when aggregate feedback is given, or if they were not allowed to react immediately to outcomes. This increase in confidence leads to higher investment and can help explain the effects of myopic loss aversion.

Our results address the same concept, confidence concerning the future, with two different mechanisms. Confidence is related to more frequent trades (Barber & Odean, 2001) and partially explains why prices exceed their expected value (Gneezy et al., 2003). Similarly, our initially lucky participants are not negatively influenced by frequent feedback. This is because positive feedback increases confidence about future rounds. However, initially unlucky periods will decrease confidence, especially when participants are already insecure about their abilities (e.g., low self-efficacy). This means that advisors must increase investor confidence if they want to increase investment in risky but high return options. This is especially true for those investors who are insecure and show low self-efficacy. One way to increase confidence is to reduce flexibility and present aggregate feedback. However other methods might be just as effective or even more effective. For example, providing potential investors with detailed information and education about financial markets and investment strategies could result in comparable effects.

Appendix

A. Instructions:

General instructions

Welcome: you are about to take part in a decision making experiment, in which you can earn real money. The amount of money you can earn will depend on the decisions you make.

Dependent on the quality of your decisions, you can earn up to 70 CHF.

During the experiment your earnings will be calculated in Unige Francs (UGF). At the end of the session, these UGF will be converted into CHF and your earnings will be paid out to you in CHF using the following exchange rate:

100 UGF = 1.33 CHF

At the beginning of the experiment you will receive from us 20 CHF, which =1500 UGF. This is your capital stock. You can decide to either keep these UGF or to invest them in the experiment and try and earn more money. The details of this investment procedure will be explained to you below. At the end of the experiment we will pay you any earnings that you accumulated in addition to your 1500 UGF capital stock. If you loose money during the experiment, you will have to pay us back the losses from your capital stock at the end of the experiment.

During the experiment we will also ask you to answer a number of questions. These questions concern what you think and how you feel.

There are no right or wrong answers. You need to follow the decision strategy that feels right to you and to make those choices that come natural and that seem like the best choices for you. In addition, you should report those evaluations and emotions that are closest to your real thoughts and feelings. All answers are completely anonymous and confidential.

Instructions

During this experiment you will have to make investment decisions for 15 rounds. In each of these rounds, you can invest 100 UGF from your capital stock of 1500 UGF.

Each round you have to decide how you want to split these 100 UGF over two investment options.

We will call the two options: <u>option A</u> and <u>option B</u>.

Option A: In this option you will neither gain nor loose money. In other words, will always keep the number of UGF you put into option A.

Option B: The outcome from this option will be determined at the end of each round. In particular, we will pick one random number between **1** and **6**. This is equivalent to rolling a dice.

- If the number is **1** or **2** (that is in 1/3 of the cases) the UGF you placed in this option will be multiplied by 2.5. You will then receive 2.5 times the number of UGF you put into option B, in addition to the number of UGF you originally placed into this option.
- If the number is **3**, **4**, **5** or **6** (that is in 2/3 of the cases) you will lose the number of UGF you put into option B.

Example

Imagine that in one round, you decide to split your 100 UGF by placing 50 UGF into option A and 50 UGF into option B.

If the random number turns out to be either 1 or 2, you will receive 2.5*50 = 125, in addition to your 100 UGF for that round. Your capital stock will therefore increase by 125 UGF.

If the random number turns out to be either 3, 4, 5 or 6, you will lose the 50 UGF you put in option B. Your capital stock will therefore decrease by 50 UGF.

Summary

- In each round, you can decide how to split 100 UGF of your capital stock between two options.
- At the end of each round we will pick a random number between **1** and **6**.
- If the number is **1** or **2** your earnings will be:

<u>100 UGF + 2.5 * the number of UGF you placed into option B</u>

- If the number is **3**, **4**, **5** or **6** your earnings will be:

<u>100 UGF – the number of UGF you placed into option B</u>

B. Questions:

B.1. Emotion questions:

Which of these most closely captures your current emotional state (select one and rate intensity on scale from 0 to 100):

- Shame
- Joy
- Regret
- Pride
- Irritation – anger
- Hope
- Worry – Anxiety
- Surprise
- Disappointment

B. 2. Questions before first round:

1. How important is it for you to do well in this task
not at all important *very important*

2. How important is it for you to earn as much money as possible
not at all important *very important*

3. How well do you think you will do in this task
very poorly *very well*

4. Compared to the other individuals who will participate in this task, how well do you think that you will do
much worse *much better*

5. How much money would you like to earn in this task
I do not care *the maximum amount possible*

6. How confident are you in your ability to generally make good decisions
not very confident *very confident*

B. 3. Appraisal questions between rounds:

1. The outcome from these last three rounds is
very negative *very positive*

2. The outcome from these last three rounds is
very unfair *very fair*

3. My performance so far is
much worse than I expected *much better than I expected*

4. The outcome from these last three rounds is
very negative for my overall goal *very positive for my overall goal*

5. My performance so far is caused by
me making bad decisions *me making good decisions*

6. My performance so far is caused by
extremely bad luck *extremely good luck*

7. In the next three rounds, I expect to do
much worse *much better*

8. In my ability to reach my goal at the end of this task, I feel
very non-confident *very confident*

B. 4. Questions after last round

1. How important was it for you to do well in this task
not at all important *very important*

2. How important was it for you to earn as much money as possible
not at all important *very important*

3. How well do you think you did in this task
very poorly *very well*

4. How satisfied are you with the decisions you made in this task
very dissatisfied *very satisfied*

5. Compared to the other individuals who participate in this task, how well do you think that you did
much worse *much better*

6. Do your earnings reflect the quality of the decisions you made in this task
not at all *yes, absolutely*

7. How fair was the overall task
very unfair *very fair*

8. Do you have experience investing money in stocks or investment funds
no experience at all *a great deal of experience*

9. Are you interested in finance and investment
not at all interested *very interested*

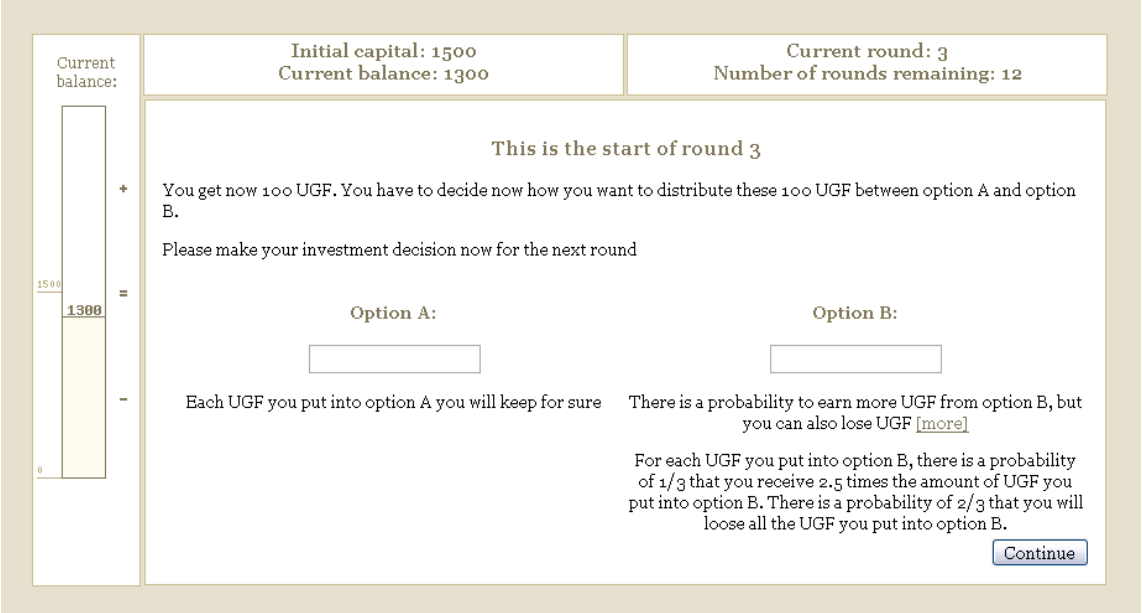
10. How competent are you in the domains of mathematics and statistics
very incompetent *very competent*

11. Do you enjoy conversations about finance and investment
not at all *yes, absolutely*

B. 5. Personality traits collected during first session:

1. STAI (anxiety)
2. MBSS (monitoring - blunting)
3. Looming scale
4. DERS (Difficulties in Emotion Regulation)
5. LOT (life orientation test)
6. UPPS (impulsivity: Urgency, lack of Premeditation, and Sensation Seeking)
7. BFI (Big five)
8. ERQ (Emotion Recognition Questionnaire)
9. ASQ (Attribution Style)
10. STAXI (anger)

B. 6. Screen shot of investment screen (treatment: High):



C. Figures and Tables:

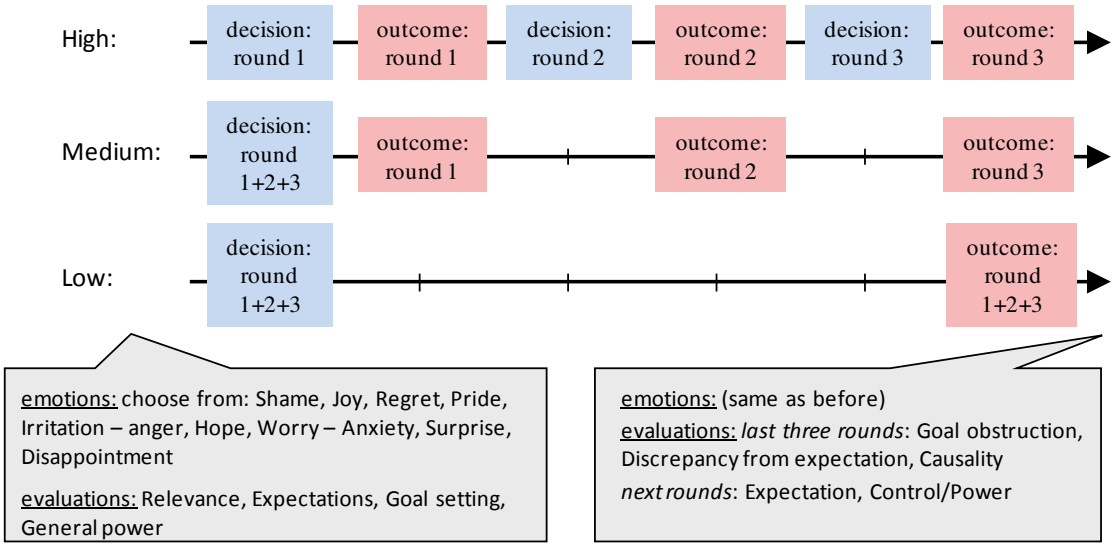


Figure 1: Overview of treatments and self report measures taken during experimental task.

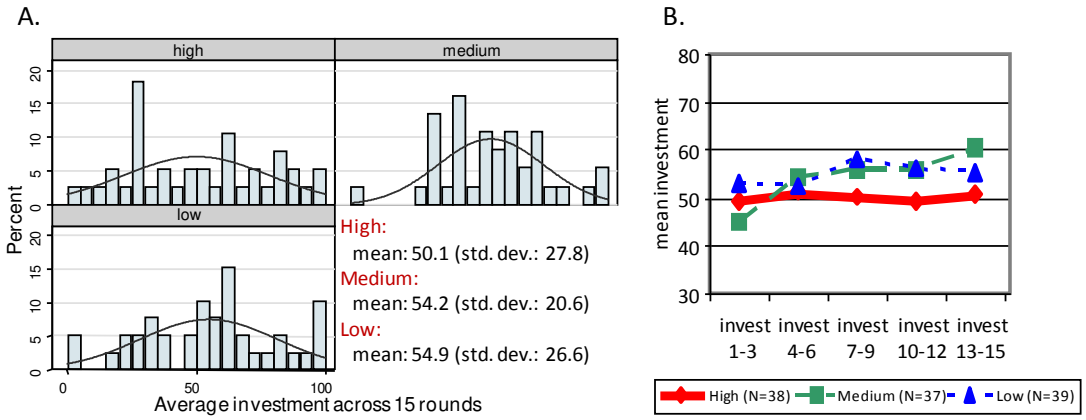


Figure 2: **A:** Histograms of average investment across treatments; **B:** Investment across time by treatment. For treatment High, averages over intervals of three rounds are shown.

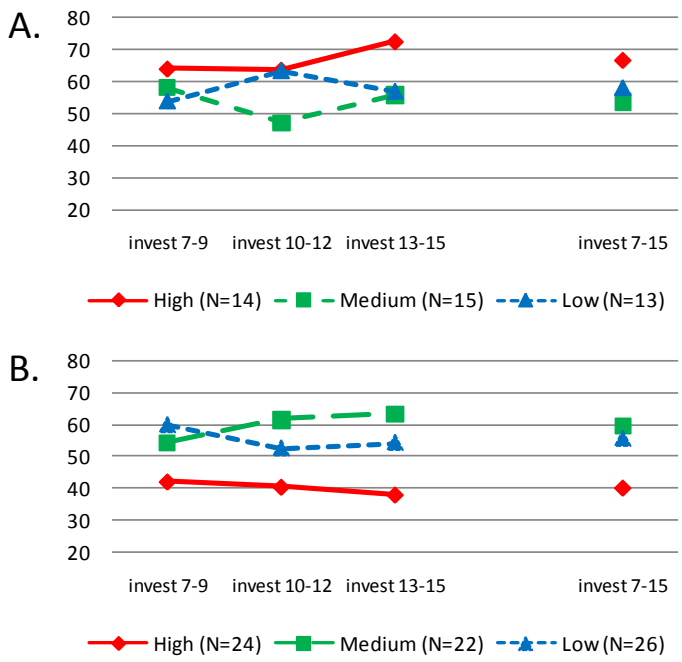


Figure 3: Investment by treatment dependent on number of gains in early rounds. **A:** Subjects experiencing at most two successive losses in first six rounds. **B:** Subjects experiencing more than two successive losses in first six rounds.

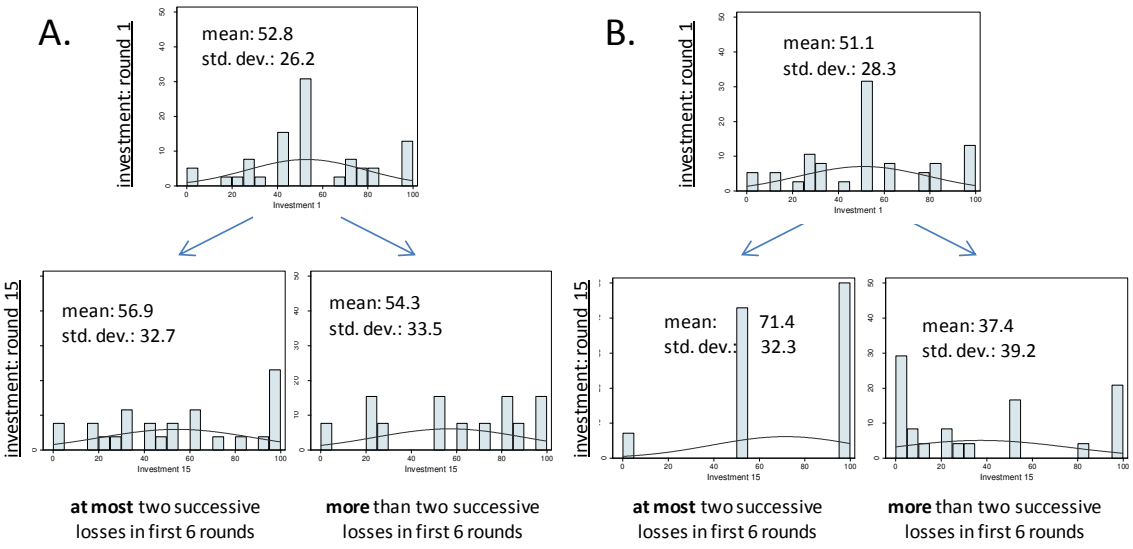


Figure 4: Investment distribution changes from round one to round 15 dependent on experience in first six rounds. **A:** treatment Low, **B:** treatment High

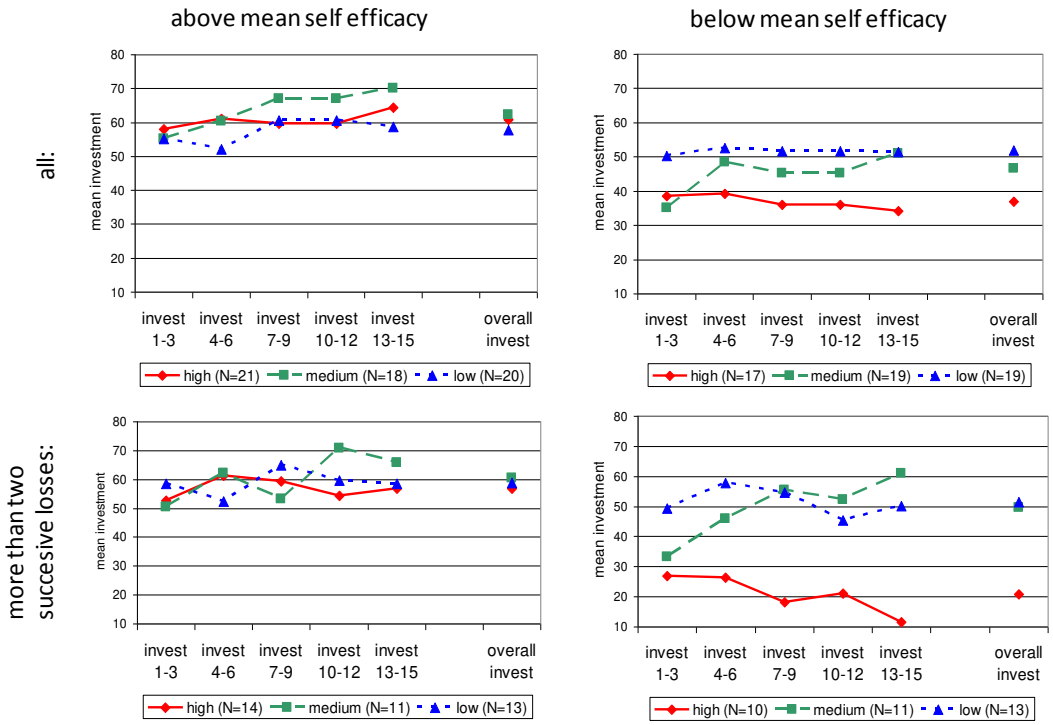


Figure 5: Investment across treatments for participants scoring above or below mean self-efficacy. **Top two graphs:** all observations; **bottom two graphs:** only observations from participants encountering more than two succesive losses in first six rounds.

Table 1. Overview of mean investment across rounds and treatments (standard deviation in parenthesis).

	High	**Medium**	**Low**	**High vs Low**	**High vs Medium**	**Low vs Medium**
	(N=38)	(N=37)	(N=39)	Mann-Whitney test (p =):		
invest 1-3:	49.25	44.86	52.85			
	(27.66)	(25.59)	(26.20)	0.430	0.672	0.297
invest 4-6:	51.28	54.22	52.33			
	(29.33)	(28.51)	(30.62)	0.886	0.602	0.710
invest 7-9:	50.24	55.84	57.82			
	(31.00)	(28.46)	(30.37)	0.296	0.394	0.681
invest 10-12:	49.07	55.81	56.18			
	(31.04)	(30.29)	(33.57)	0.371	0.352	0.887
invest 13-15:	50.81	60.27	55.15			
	(35.33)	(30.84)	(32.81)	0.529	0.199	0.527
overall invest	50.13	54.20	54.87			
	(27.87)	(20.58)	(26.57)	0.463	0.417	0.904

Table 2. Overview of mean investment across rounds and treatments split for **A:** participants encountering **more** than two successive losses in first six rounds and **B:** participants encountering **at most** two successive losses in first six rounds

A. more than two successive losses in first six rounds :

	High	**Medium**	**Low**	**High vs Low**	**High vs Medium**	**Low vs Medium**
	(N=24)	(N=22)	(N=26)	Mann-Whitney test (p =)		
invest 1-3	41.94	41.82	53.88	0.073	0.791	0.165
invest 4-6	46.68	54.14	55.04	0.381	0.332	0.992
invest 7-9	42.18	54.36	59.81	0.046	0.123	0.516
invest 10-12	40.54	61.59	52.54	0.243	0.021	0.381
invest 13-15	38.08	63.41	54.27	0.064	0.008	0.370
overall invest	41.89	55.06	55.11	0.084	0.059	0.951

B. at most two successive losses in first six rounds :

	High	**Medium**	**Low**	**High vs Low**	**High vs Medium**	**Low vs Medium**
	(N=14)	(N=15)	(N=13)	Mann-Whitney test (p =)		
invest 1-3	61.79	49.33	50.77	0.316	0.166	0.943
invest 4-6	59.17	54.33	46.92	0.285	0.600	0.473
invest 7-9	64.05	58.00	53.85	0.354	0.402	0.871
invest 10-12	63.69	47.33	63.46	0.865	0.149	0.195
invest 13-15	72.62	55.67	56.92	0.202	0.134	0.926
overall invest	64.26	52.93	54.38	0.423	0.138	0.596

Table 3. Percentage of reported emotions across treatments.

A:	**High (N=190)**	**Medium (N=185)**	**Low (N=195)**
joy	12.11 %	24.32 %	28.72 %
hope	21.05 %	20.00 %	17.44 %
disappointment	16.82 %	15.68 %	15.90 %
regret	15.79 %	15.14 %	11.28 %
surprise	9.47 %	8.65 %	13.85 %
irritation	8.95 %	7.03 %	2.05 %
worry	8.42 %	3.78 %	2.05 %
pride	6.32 %	4.86 %	8.21 %
shame	1.05 %	0.54 %	0.51 %
B:			
positive emotions	39.47 %	49.19 %	54.36 %
negative emotions	51.05 %	42.16 %	31.79 %

Table 4. Random effects GLS regression of investment at time t, on different emotions being experienced after feedback t-1 and treatments.

R-squared:			
within:	0.030	Number of observations	456
between:	0.001	number of groups	114
overall:	0.008	Prob > chi2 =	0.421
invest time t	*Coef.*	*Std. Err.*	*P>|z|*
joy	-10.214	11.194	0.362
hope	-5.434	11.241	0.629
disappointment	-9.012	11.352	0.427
regret	-7.136	11.488	0.534
surprise	-5.336	11.385	0.639
irritation	-6.944	11.779	0.556
worry	-10.998	11.776	0.350
pride	-19.504	11.921	0.102
dummy_medium	2.328	6.377	0.715
dummy_low	1.528	6.313	0.809
constant	62.513	11.760	0.000

Table 5: Rotated factor loadings of evaluations (using Varimax rotation). Factor 1 representing evaluations concerning past events and Factor 2 representing evaluations concerning future events.

Variable	*Factor 1*	*Factor 2*
proportion of variance explained:	0.844	0.269
positive	**0.844**	0.058
fair	0.441	0.242
performance	**0.835**	0.081
goal	**0.840**	0.023
decision	**0.644**	0.435
lucky	**0.793**	0.112
expect	-0.166	**0.624**
confident	0.263	**0.663**

Overall KMO measure = 0.86

Table 6: Random effects regression of investment at time *t*, on evaluations at *t-1*.

R-sq: within	= 0.0098	Number of observations	570
overall	= 0.0545	Number of groups	114

invest at time t	*Coef.*	*Std. Err.*	*z*	*P>|z|*
evaluations past (t-1)	-0.017	0.011	-1.49	0.136
evaluations future (t-1)	0.126	0.046	2.76	0.006
constant	45.890	6.673	6.88	0.000

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