Deciding Emotions

The Role of Immediate and Anticipated Emotions in Risky Decisions

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> The reason acts slowly, with so many examinations and on so many principles, which must be always present, that at every hour it falls asleep, or wanders, through want of having all its principles present.
> Feeling does not act thus; it acts in a moment, and is always ready to act.
> We must then put our faith in feeling; otherwise it will be always vacillating.
>
> *(Blaise Pascal, 1660)*

1. Introduction

Words of the so called last medieval and first modern thinker Blaise Pascal. With his thoughts (pensées) its genius was not only the coequal antipode to Descartes but beyond it's time in many respects. Not only mathematics today can be said to be still influenced by his ideas. It is quite obvious that he had a need for applying them by solving practical problems: among countless other works he invented a mechanical calculator for basic arithmetic operations (starting with it as a teen to help his father doing his business), founded the first public bus system in Paris and invented the roulette table as we know it today. The latter invention has to be noted in connection with his overwhelming interest in betting and lotteries. His studies of probability were carried out by extensively watching his rich friends betting their money in all kinds of games.

Maybe for that reason Pascal was the first who argued that an informed bettor could choose the option which provided the largest combination of value and probability of the outcomes. The product of both quantities today is known as 'expected value'. Later Daniel Bernoulli transformed the pure value of an option to its utility – the subjective value of goods – which then lead to models incorporating 'expected utility' (Bernoulli, 1738). John Maynard Keynes thought about the meaning of risk beyond the pure probability of realization of an outcome (Keynes, 1921). Prospect theoretical approaches focused on the non-linearity of perceived risk given probabilities and

differing hedonic value of objectively similar prizes and losses (Kahneman and Tversky, 1979). Latest approaches try to incorporate relative hedonic value of outcomes ('subjective expected pleasure') by taking account things like surprisingness about the actual event (Mellers, 2000). All these developments followed the idea of the process of decision-making being consequentialistic.

The work on hand draws attention to emotions and what role they play when deciding to take a risk or not. Therefore it is questioned how emotions attached to the possible consequences of a decision affect behavior. With respect to this question additionally it is verified if such anticipations of emotions are exact or turn out as positive or negative dyed illusions.

Leaving behind this consequentialistic tradition the focus then is drawn on how immediate emotions connected to the decision problem itself influence which alternative is chosen – the risky or the save option.

The interrelation of both types of emotions is explored to find out if immediate emotions just can be seen as reflections of those anticipated. The interrelation of the immediate emotions connected to the option to take a risk and the option not to take it is examined to find out if the one can be said to be the negative mirror image of the other.

To find out how the content of anticipated and immediate emotions change when the decision problem is changed, the situation of deciding is manipulated: Either in changing the chances of winning or changing social dependencies connected to the decision.

It then is investigated to what extend the effect of the manipulation of the decision situation on behavior is transported by changes of the emotional content – either via immediate or anticipated emotions.

Especially it is focused on how emotions affect the decision additionally and independent of subjective probability, changes of objective chances, the grade of ambiguity or the grade of social dependencies of the decision.

To follow this whole line of arguments the reader might find it helpful to use the Figure 1 down below.

I hope that this work contributes to the question what drives human behavior when deciding under risk and uncertainty. It could also be seen as a reflection about the question – to put it with Pascal – of how the specific interplay of body, heart and mind motivates decisions.

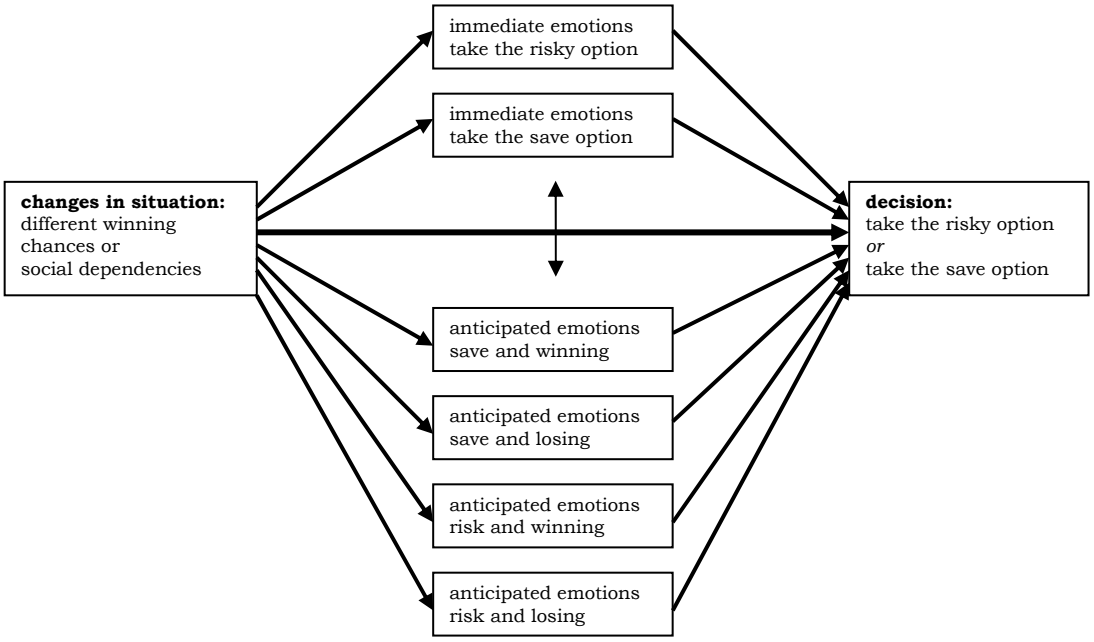

Figure 1: Framework of Argumentation

2. What a feeling?

What would Adam Smith think about the fact that his second large work, *The wealth of nations* (1776), is much more influential today in economics than his *The theory of moral sentiments* (1759)? Unfortunately we cannot ask him, but we do know that he put overwhelming effort into both. In his earlier book he investigated and emphasized the role that "passions" and their struggle with an "impartial spectator" within each of us, play in human behavior. Whereas, the more remembered book stands for the idea that economic behavior is motivated only by (rational) self-interest. Their very different fates regarding their reception may serve as a parable for the decline of interest in the power of emotions in economic judgment and decision making, and in almost the whole discipline of economics. The development of the common expected utility approach to describe the evaluation of options was accompanied by cutting out the emotional contents of utility. On that same way the happiness going with one alternative and not another was replaced by a calculation of own preference, fulfilling, at the least, the principles of weak order, independence and continuity (Neumann and Morgenstern, 1944; Savage, 1954; Anand, 1993; Anscombe and Aumann, 1963; Schmeidler, 1989; Camerer, 1995). The idea of risk – with all its bells and whistles like the weighing of information acknowledged already by Keynes (1921) – accordingly was reduced to the probabilities of (or the belief in) the realization of outcomes.

More descriptive approaches, like the prospect theory (Kahneman and Tversky, 1979), also focus on a calculating impartial spectator, albeit one who is imperfect or 'biased'. Consequently, expected-utility based theories presume that decisions are predictable because people think about the likelihood and severity of consequences of all possible alternatives and translate that information, by some calculation process, into their actual choice (Loewenstein, Weber, Hsee, Welch, 2001). This calculation process

might be biased or include errors (bounded rationality, heuristics), but at least it is assumed to be a process of higher order. Thus, for a long time, economic theory acted as though emotions played little or no role in decision making – that people chose to risk (or not) based on the cold calculation of expectations. To be sure, outcomes brought pleasure, but the degree of pleasure merely entered into the cold calculation that was consequentialistic in nature.

Here, we suggest that emotions *do* play a central role when decisions are made under risk and uncertainty. Furthermore we show that not only emotions attached to the outcomes influence decisions, but that immediate emotions emerging from the decision process itself have a strong effect on actual behavior.

2.1. Decisions and Emotions

Recently, there has been a revival of interest in emotions among economists (van Winden, 2007; Bosman and van Winden, 2006; Elster, 1998, 1994). In the early 1980's, regret and disappointment were analyzed formally by Loomes and Sudgen (1982, 1986), as well as Bell (1982, 1985), then later by Wu (1999). However, all so far upcoming approaches assumed that the decision maker was consequentialistic, as described above. This can be said for most psychological approaches also: Mellers and others, in their decision affect and subjective expected pleasure theory, focus on anticipated emotions (Haselhuhn, Mellers, 2005; Mellers, McGraw, 2001; Mellers, 2000; Mellers, Ritov, Schwarz, 1999). In gambles they showed how anticipated pleasure about an obtained outcome decreased when an unobtained outcome became more desirable (disappointment). When the outcome of an unchosen gamble was more appealing, the anticipated pleasure from the less attractive, chosen gamble decreased (regret). Besides these comparison effects, Mellers et al. were also able to show how surprisingness (a small probability that a specific outcome occurs) amplifies anticipated pleasure or pain of

that option and hence, differs from the pure utility of that option. It was also shown how these systematic deviations, captured in their concept of subjective expected pleasure, contribute to the prediction of choice beyond subjective expected utility.

A different perspective is taken by the affect-as-information theory (Clore, Schwarz, and Conway, 1994; Schwarz, Clore, 1988, 1983). Here the affect, attached to specific risks, serves as information that changes the emotional content, and hence the value of anticipated outcomes (Slovic, Finucane, Peters, McGregor, 2004; Slovic and Peters, McGregor, Finucane, 2005). Thus, a positive affect makes pleasurable outcomes seem better, and a negative affect makes the probability of a bad outcome seem higher. Hence, in this theory affect is assumed to operate on traditionally economic and consequentialistic factors, including probability and value of outcomes.

Slovic and colleagues also showed how changing the presentation of probabilities from frequency to a percentage format increased clinicians' willingness to discharge patients who actually presented the same dangerousness to public safety (Slovic, Monahan, and McGregor, 2000). They also showed that expressing a gamble in probability terms affects the attractiveness of a gamble much more strongly than the monetary outcome (Slovic and Lichtenstein, 1968). This proportion dominance declines when there is a chance of losing a small amount. These results are explained with a process of affective mapping, where probability *per se* maps on a scale of attractiveness. However, a monetary outcome finds its place on the scale only by contrast with another non-zero outcome (e.g., a loss). Consequently, as the anticipated affect of outcomes increases (e.g., from winning or losing a little money to a lottery jackpot, or a positive HIV test), the influence of variation in outcome probability decreases (Loewenstein et al., 2001). Such effective tags influence behavior,

even when the information that causes these effects remains unconscious (Finucane, Alhakami, Slovic, and Johnson, 2000).

Contrary to described approaches, cognition-based approaches analyze intuitions as preferences. By design, there is no room left for inquiry into the effects of emotions. A special case is the extended expected utility model by Chaplin and Leahy (2001), who integrated anticipatory anxiety evoked by uncertainty (and not risk) about future options. This model builds, in part, on the approach suggested by Elster and Loewenstein (1992) that utility may also be gained from anticipation as well as from memory. However, it has been shown by Elster (1998) that incorporation of emotions as psychic costs or benefits, or as a source of (temporary) preferences, is insufficient to explain motivations or resulting behavior.

Findings of Bechara et al. (1997), in line with Damasio, show that subjects with "normal" emotional reactions (without brain-damage in the area of the frontal lobes) "began to generate anticipatory skin conductance responses whenever they pondered a choice that turned out to be risky, whereas patients [with pre-frontal damage] never developed anticipatory skin conductance responses, although some eventually realized which choice where risky". These results show that conscious awareness of costs and benefits is neither necessary nor sufficient for rational choice (Elster, 1998). Earlier, Damasio (1994) found that those patients being "emotionally flat" tended to make "worse" trails of choices compared to normal subjects, when deciding to draw from either more or less risky decks of cards. The patients showed normal skin conductance reactions to monetary loss, but showed no such *anticipatory* responses in the situation of immediately making their selection of a card from a bad deck.

2.1.1. Risk-as-Feelings

Our attempt to implicate emotions in decision making is most squarely understood as an operationalization of the *risk-as-feelings*

hypothesis (Loewenstein et al., 2001). This hypothesis states “that feelings play a much more prominent role in risky decision making than they are given credit for by the cognitive-consequentiality tradition of J/DM [judgement and decision-making] research” (Loewenstein et al., 2001, p. 274).

The theory proposes “a distinction between anticipatory emotions and anticipated emotions. *Anticipatory emotions* are immediate visceral reactions (e.g., fear, anxiety, dread) to risks and uncertainties. *Anticipated emotions* are typically not experienced in the immediate present but are expected to be experienced in the future.” (Loewenstein et al., 2001, p. 267). Anticipated emotions are the answer to the appropriate question “How will you feel when the decision for alternative X leads to consequence Y?”. In contrast to this consequentialistic view, Loewenstein et al. define anticipatory (or immediate) feelings as “gut feelings experienced at the moment of making a decision, which are often quite independent of the consequences of the decision.” They suggest that gut feelings “can play a critical role in the choice one eventually makes” (Loewenstein et al., 2001, p. 281). The appropriate question for immediate feelings reads “How do you feel in the moment of choosing alternative X?”

Following this differentiation of the Risk-as-Feelings theory, our approach is not consequentialistic. Our approach is not only concerned with reproducing results indicating that emotions, in general, do matter. Our approach specifically attempts to provide greater insight into how immediate emotions come into play. How much explanatory power do these emotions possess? Are they are connected to the anticipated emotions attached to outcomes or do they stand independent of them? Finally, do both types of emotion explain anything beyond subjective probability?

Thus, in our analysis, we aim at finding out what specific contribution to the decision is carried out by immediate and anticipated emotions. Furthermore, our analysis is an attempt to

separate the impact of emotion that is not due to cognitive factors, such as subjective probability. Additionally we want to find out how changes in cognitive evaluation (by changing actual probabilities) gave rise to feelings that, in turn, affect the decision.

In our approach, immediate emotions are defined as integral emotions, which are caused by the decision itself. It is not about incidental emotions caused by factors which are not related to the decision problem but are external (Pfister and Böhm, 2008).

Up until now, immediate emotions were merely objects of research. Therefore, we do not have a specific theory about their content. However, it seems reasonable that these contents may vary depending on situational and individual differences. It also seems reasonable to hypothesize that if these variations exist, they will influence decisions. So, with respect to the emotional content, the following studies are explorative.

2.1.2. Predictions

In all, we conducted four studies to examine the role played by immediate and anticipated emotions in risky decision making. In each study, we asked five specific questions. First, to what extent was the decision to take or avoid a risk influenced by changes in objective or subjective probabilities? Second, to what extent did anticipated and immediate emotions predict a person's decision to take a risk or to avoid one? Third, what was the relationship between immediate and anticipated emotions? Was their impact on decision-making independent, or did immediate emotions mediate the relationship between anticipated emotions and the decision the participants made? Fourth, were these emotions produced by or related to cognitive factors, such as subjective probability, or did they stand independent of such factors? Fifth, were immediate emotions connected to both alternatives of a decision independent of one another? Finally, in the fourth Study, we asked if effects of anticipated emotions are the result of exact anticipations or biased

illusions. The design of the first study allowed for answering of all raised questions, except the first and the last one. The first question, then, was addressed during the second, third and fourth studies, the last only in Study 4.

2.2. Study 1: Coin Flip

In all studies, participants made decisions under risk or uncertainty. A very easy form of such a situation is to bet money on a coin flip. Thus, this is exactly what we asked participants to do in the first study. We asked participants to express their emotions, both at an immediate and anticipated level, and examined to what extent these emotions predicted who would choose to gamble on a coin flip and who would pass on the opportunity.

2.2.1. Method

Participants. Eighty-seven participants (33 male, 54 female) were given a chance to gamble €5 on a coin flip toss to possibly win €10. One male participant had to be excluded because his answers suggested he did not take the situation seriously. Participants were visitors at a lecture at the University of Cologne in Germany, and were between 21 and 33 years of age (M=24.44). Most of the participants studied business administration (70.1%), some studied economics or social sciences (13.7%); the remainder had other majors.

Material and procedures. All participants received an envelope containing the questionnaire and €5. Anonymity was assured by generating an individual password via a specific rule. The participants then had to indicate their emotional states thinking about all four possible *anticipated* outcomes with the following verbalization of the situations:

1. “Imagine you decided to keep the €5. And the coin flip shows that you have lost. This means: you get a total of €5. Your decision not to flip the coin induced not to lose the €5.”

2. “Imagine you decided to keep the €5. And the coin flip shows that you have won. This means: you get a total of €10. Your decision not to flip the coin induced not to double the €5 to €10.”

3. “Imagine you decided to bet the €5. And the coin flip shows that you have lost. This means: you get a nothing (€0). Your decision to flip the coin induced to lose the €5.”

4. “Imagine you decided to bet the €5. And the coin flip shows that you have won. This means: you get a total of €10. Your decision to flip the coin induced to double the €5 to €10.”

All scenarios ended with the question “How do you feel in this situation?” and each was followed by a self-assessment manikin (SAM) instrument.

In the section regarding immediate emotions, participants were then asked to concentrate on feelings they sense immediately before they come to their decision:

“Now it’s about the feelings you sense now, right in this moment immediately before you actually make your decision to flip the coin or not. So please concentrate on the upcoming decision and describe the feelings connected to this. For this reason, we will now ask you how you would feel with both alternatives available to you.”

For both possible immediate situations of betting *or* keeping the money, participants then had to indicate their emotional state again via SAMs after the following questions:

1. “Assuming you bet the €5 by flipping the coin. How would you feel in doing so?”. 2. “Assuming you keep the €5 by not flipping the coin. How would you feel in doing so?”.

After these questions, and before presenting the SAMs for each of the questions, the following was added: “Please fill out the following SAMs in any case, even if you won’t decide in this way.”

The order of the immediate and anticipated measurements was altered. No order effects on the decision were noticed. We then asked the participants to make their concrete decision, as to whether or not to flip the coin, and if so, to tell us their winning side. Those *not* betting just kept the money they received before; those taking the chance to double the money laid the €5 back into the envelope. Once everybody finished, questionnaires were collected and the coin was flipped by a volunteer in front of the class. This coin flip was representative for all those betting. At the end of the lecture (about 1 hour later), we handed over the prize of €10 to all winners using envelopes with their individual passwords printed on them.

Assessment of Emotions. Participants described their anticipated and immediate emotions via the Self-Assessment-Manikin (SAM) (Lang, 1980), which asks participants to describe their emotional state along three dimensions: *pleasure*, *arousal* and *dominance*. As seen in Figure 2 (p.18), each dimension is assessed by a 5-point scale. Pleasure is depicted on the SAM by a comic-like figure looking very happy on the very left side to very sad on right. Arousal is depicted by figures looking very aroused on one side to calm and relaxed on the other. Dominance is depicted by figures that vary in their size, from small to large.

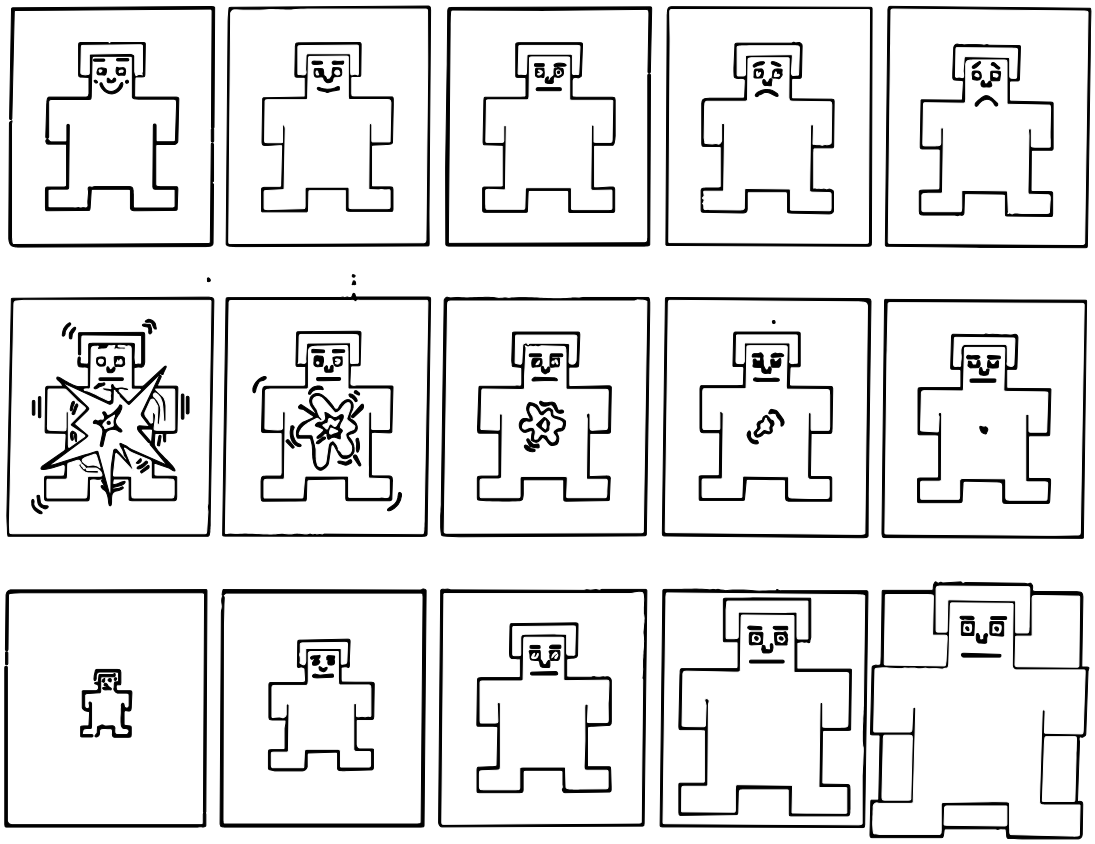

Figure 2: The Self-Assessment-Manikin (SAM)

The visual method of the SAM has substantial advantages over verbal queries. Open questions tend to contain mostly post-rationalizing statements, and closed queries always open the gate for attribution processes. A visual technique minimizes these problems (Morris, Woo, Geason, Kim, 2002; Poels and Dewitte, 2006). Morris (1995) also showed in several studies that the SAM allows for consistent measurement across cultures. The SAM allows fast and repeated measurement, which is important when measuring emotional states in imagined and real situations successively. The SAM is also a valid measure of emotion. Selected pictures of the International Picture System IAPS (CSEA, 1999) have been used together with the SAM, physiological measures like skin-conductance and heart-rate measures, and Facial Electromyographic (EMG) Measurement (Bradley, Codispoti, Cuthbert, Lan, 2001). The data show how well the SAM measurements fit to the physiological

measurements related to emotion (see also Arcos, Verdejo-García, Peralta-Ramírez, Sánchez-Barrera, Pérez-García, 2005; Hillmann, Rosengren and Smith, 2004; Güntekin and Basar, 2007; Dickert, in press; Hochman, Glöckner, and Yechiam, in press, for further validation data). Furthermore, SAM is easily integrated into a questionnaire-based study addressing cognitive systems. Nevertheless, SAM may be able to measure emotions as a sum of reactions to the entire process of decision. These reactions should include feelings informing the reasoning-based process and emotions released by this process. Beyond these, the reactions should also include feelings not mediated by the mind, due to direct visual access and empathic nearness to the SAM. This might hold the key to predicting risky decisions better than questions using specific emotional words (e.g., 'regret'), inquiries about reasons, preferences or beliefs.

2.2.2. Results and Discussion

In all, 18 participants (20.7%) decided to flip the coin and 69 participants (79.3%) kept their €5. How much were immediate and anticipated emotions related to that decision? Table 1 (p.20) displays how much emotional valence, for both anticipated and immediate measures, predicted whether people bet their money.

	Model 1 Anticipated emotions		Model 2 Immediate emotions		Model 3 All emotions	
Variable	Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)
anticipated valence						
keeping and losing	- .17	.84			- .03	.98
keeping and winning	- .75*	.47			- .70*	.50
betting and losing	.34	1.40			.23	1.26
betting and winning	.27	1.31			.27	1.31
immediate valence						
betting			.41	1.50	.46	1.58
keeping			- .91**	.40	- .84*	.43
constant	- .55	.57	.52	1.69	0.33	1.39
Nagelkerke's R^2	.11		.16		0.23	

Significant effect on the decision to bet: *p < .05 **p< .01 ***p < .005

ΔR^2 Model 2 to Model 3 *sig.* (p<.03)

Table 1: Study 1: Summary of Binary-logistic Regression Analysis for Valence within Immediate and Anticipated Scenarios Predicting the Decision to Bet.

Anticipated valences as predictors. Binary regression Model 1, in Table 1, includes only anticipated scenarios as predictors. The anticipated scenario of keeping & winning the money generates a significant coefficient. But this is not interpreted here because, overall, this first model does not support sufficient predictive power due to the fact that the increase of variance from the 0-Model is not significant (Nagelkerke's R^2=.10; χ^2=5.9, p=.21). Hence, this model suggests that anticipated emotions do not solely predict peoples' decisions to flip the coin[1].

Immediate valences as predictors. The second model, in contrast, uses only the immediate emotion valence connected to the decision as predictors. Here, the valence of keeping the money significantly predicts the decision. The better the participants felt about keeping the money, the more they were willing keep it. By changing one unit to the positive on the 5-point valence scale, the chances to bet relative to the chances to keep the money are reduced by 60% (e^{β}=.40, p<.01). This second model on its own gains sufficient predictive power against the 0-Model (Nagelkerke's R^2=.16; χ^2= 9.4, p<.01).

Immediate and anticipated valences as predictors. The third model combines the previous two by adding anticipated emotions (1) to the immediate model (2). This leads to a significant increase of predictive power (Nagelkerke's R^2=.23; χ^2= 7.70, p<.02). In this way, controlling for mutual influences, the only anticipated scenario significantly predicting the decision is the scenario of keeping and winning the money. The stronger the positive feelings the

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[1] In the following descriptions please take into account that *negative* values of the coefficient β, in a logistic regression, map onto a value of e^{β} (the odds ratios) between 0 and 1. To the contrary, *positive* values of β realize a value of e^{β} larger than 1. This means that the strength of an effect can be seen more easily from the β, but the interpretation of effects is much easier with e^{β}. Note that values of e^{β} very close to 0 gain strong effects because it is the lower bound of the possible interval.

subjects predict to have in this situation, the less the subjects were willing to bet the money. This translates into anticipated disappointment. The less disappointment the subject is predicted to feel in the case of not taking the chance and winning, the easier is it to keep the money. Changing one unit to the positive on the 5-point scale of valence halves the chances to bet relative to the chances the subject will keep the money (β=-.70, e^{β}=.50, p<.05). Less anticipated disappointment about keeping and winning lowers the chances to bet (increases the chance to keep the money). Simultaneously, the influence of immediate emotions already shown in Model 1 stays stable in this combined Model. The immediate positive feelings connected to keeping the money significantly reduce the selection of the risky alternative (β=-.84, e^{β}=.43, p<.02).[2]

However, it might be the case that immediate emotions only mirror the anticipated emotions connected to the outcomes, and in this sense only act as straw-men of anticipations?

Interrelation of immediate and anticipated valence. On a bivariate level, the independence between the relevant anticipated and immediate valence described above, revealed by the fact that they fail to correlate significantly (r =.11, p=.32, Table 2 (p.23) shows correlations of the predictors used in the regression). Furthermore, no significant connection between the immediate valence in the case of *betting the money* and all other four anticipated measures of valence could be found.

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[2] To find out if these results might be explained by different levels of valence, evoked only by the decision in general, or if it stays substantially on an emotional, individual level, a 2x2 within-subject (measured valence at two different scenarios) by factor (between-subject: decision) analysis was conducted. It confirms that the interaction-effect of decision with the immediate emotions connected to betting vs. keeping the money is significant (p<.005). The same is true for the anticipated scenarios of keeping the money and winning vs. betting the money and winning (p<.053). Hence the results cannot be explained by a plain level effect of change in valence grouped by the decision. Deciding to bet or not to bet the money *is* influenced by anticipated and even more by immediate valence connected to the decision itself.

Variable		1	2	3	4	5	6
anticipated valence							
keeping and losing	1	1	.04	- .12	.29**	.07	.25*
keeping and winning	2		1	.31**	- .17	.08	.11
betting and losing	3			1	- .32**	.00	- .17
betting and winning	4				1	.19	.26*
immediate valence							
betting	5					1	.09
keeping	6						1

significant correlations (two-sided): *p < .05 **p< .01

Table 2: Study 1: Correlations of Valence within Immediate and Anticipated Situations.

The immediate valence for the case of *keeping the money* is moderately positively connected to the anticipated valence in the case of keeping and losing (r =.25, p=.02), as well as betting and winning (r =.26, p=.02). Taken together, these findings show that both immediate emotions are *not* just mirrored anticipated emotions. But the latter connection questions for a closer inquiry into its causes aiming to an answer to the question if immediate emotions might be only mediators of those anticipated.

The valence indicated in the immediate scenario of keeping the money – the one which significantly influences the decision – could be found to be moderately connected only to anticipated scenarios, which had no significant influence on the decision. Hence, it is impossible for immediate emotional states to only be mediators transporting the effect of anticipated emotions on the decision. The influence of immediate and anticipated emotions on the decision could be found to act independently – as it was confirmed in regression Model 3.

Interrelation of both immediate valences. The question still remains if both immediate emotions are not connected just perfectly with each other, in a sense that feeling good in the immediate scenario of taking a risk automatically leads to feeling bad when

keeping the money. The connection between the immediate valence in the case of betting versus keeping the money, could be found to be insignificant (r=.09, p<.41). This shows that immediate valence in the case of keeping the money is not just the opposite of valence in the case of betting. This finding reveals that immediate emotions regarding choosing a risky option or not do not map onto one single dimension of valence (or utility). Therefore, it points to an analysis which should capture more emotional content.

2.2.3. Summary of Study 1

The results of Study 1 show that immediate and anticipated valence can predict the decision to flip a coin up to a substantial level. Both types of emotions, in the form of measured valence controlled for their interrelations, significantly affect the decision. In this study we did not try to capture beliefs about the likeliness of winning (subjective probability). To determine how this belief is connected to the decision and how that interacts with emotions we measured it in the following Study 2. Additionally, we will now switch the perspective on the three measured dimensions of emotions from a one-dimensional to a more complex one.

2.3. Study 2: Throwing a Die

The second study answers the question of how subjective probability effects the decision accomplished by, and compared to, richer measured emotional influences. Because such a small group of participants decided to gamble in the coin-flip study, we decided to raise the proportion of people gambling by making the odds of winning more favorable. In addition, all three dimensions (valence, arousal, dominance) were used as predictors in a specific manner.

In the study, participants were asked to throw a die, and had a 66% chance of winning. As in Study 1, their immediate and

anticipated emotions were measured to see how well these emotions predicted the choices that participants made.

2.3.1. Method

Participants. 167 participants of a psychology class at the University of Cologne were asked if they would like to take the chance to double €5 by throwing a die. Aged between 19 and 32 (*M*=24.6), most of the participants studied business administration (62.7%), some studied economics or social sciences (22.3%), and the rest had other varying majors.

Material and procedures. The winning chances were fixed to 4/6 (66.6%). Participants were told they would win €10 when a 6, 5, 4, or 3 showed up. Otherwise, they would lose their money. As always, this was not a simulation but a real event[3]. The general proceeding of the experiment was explained, the possibility to ask questions personally was assured. The procedure replicated that of Study 1 in detail. Additionally, participants gave a measure of their subjective probability (or belief in winning) by answering the following question. "Independent of the alternative you actually chose, how probable do you think is it that you personally will win?" on a 7-point scale ranging from "absolutely not probable" to "extreme probable".

2.3.2. Results and Discussion

Overall, 110 out of 167 participants decided to throw the die in an attempt to double their €5 to €10 (65.5%); 57 participants decided to keep their money without rolling the die (34.5%).

Clustered Emotional States. Contrary to the first study, the analysis used here was now enriched, using all three dimensions to capture the potentially more complex nature of the participants' emotional states. All individual emotional profiles from all emotional measures within the six situations (two immediate, four anticipated)

[3] I thank Hannes Fetchenhauer for reasonable help playing the part of The Good Luck Fairy.

were classified using a two-step cluster analysis[4]. In order to investigate how emotions and choosing a risky option are connected, the results of the measurements of the SAM in the four anticipated and the two immediate scenarios form the basis for a clustering process. This data classification groups the emotions indicated by each individual via SAM within the six scenarios in the form of clusters within each one of the six scenarios. Thus, for every scenario a different cluster solution can be found, most probable resulting in A) different emotional meaning of the clusters and B) a different number of clusters for each scenario.

For example, imagine the immediate emotions someone might feel when deciding to bet the money. A cluster analysis, based on how people rated valence, arousal, and dominance associated with betting the money, might result in two groups that are rather distinct from one another in their ratings, but rather uniform internally. For example, two clusters like those in Figure 3 (p.27) might result.

[4] applying a log-likelihood-approximation using the Bayesian Information Criterion for goodness of fit.

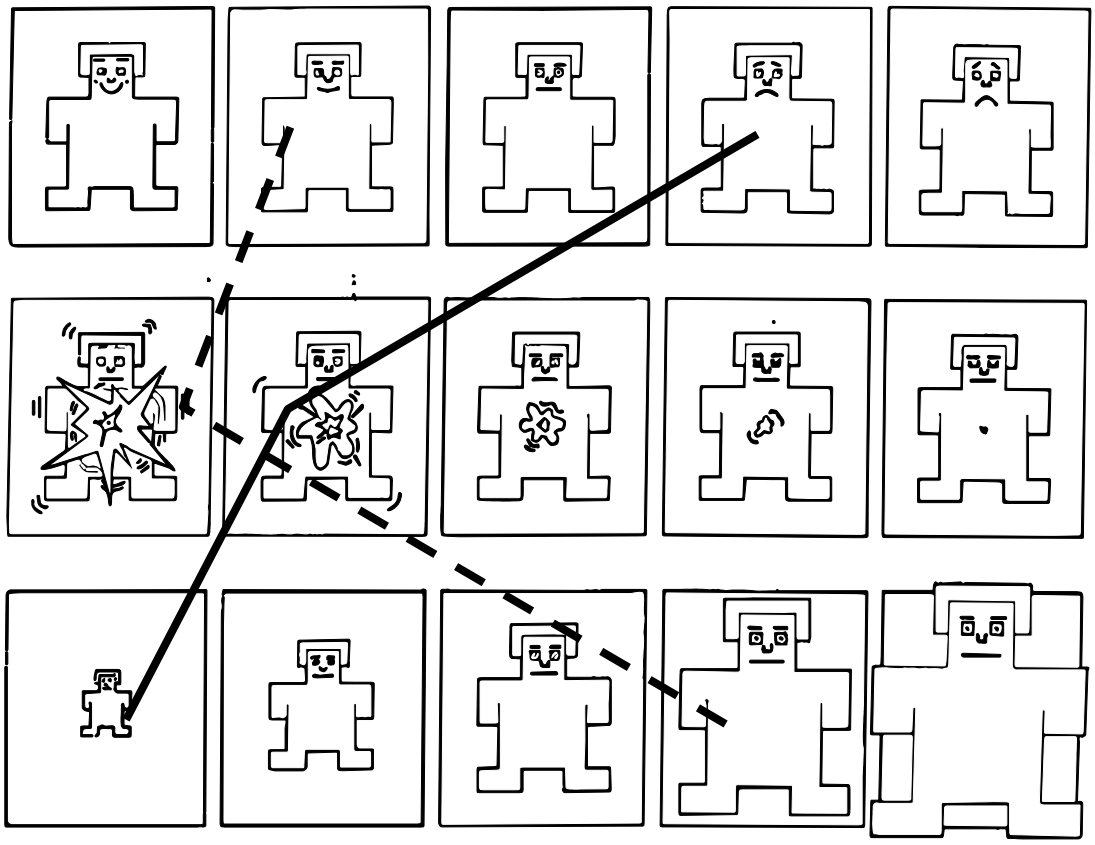

Figure 3: Two samples for emotional clusters displayed on the SAM (bold: cluster 1, dashed: cluster 2)

Group 1, on average, might perceive negative valence combined with higher arousal and low dominance, which might lead participants to avoid the act of betting. The second group (cluster 2) might perceive higher arousal connected with more positive valence and a feeling of higher dominance, which might lead participants to choose the thrilling and exciting option of betting. We should again note that the cluster process is open in number; for different scenarios, a different number of clusters may be extracted.

In a second step, for easier handling and understanding, these clusters were given labels. The average values on the three dimensions of each cluster were translated into distinctive emotional words via an emotional dictionary. Where did this dictionary originate? 151 emotional words (Russel and Mehrabian , 1977) were translated by Fischer and Brauns (1998) into 145 German emotional

terms. Subsets of these words then were presented in a large series of studies (N=567) to groups of students. For every word, these subjects had to indicate the meaning of that specific emotional word on the SAM (Fischer et. al, 2002). We use this dictionary to retranslate the three average values of one cluster to a specific emotional term. To gain a wider spectrum of emotional words, the given standard deviation of the collected data for a specific emotional term was varied analogously for every dimension from +0, +- 0.05 and +- 0.1. Changing the wideness of the target corridors consequently leads to a varying degree of specification. In this way, at least one emotional term was assigned to every cluster as a label. If more than one word is mentioned in the following descriptions, this assigning occurs with a decreasing degree of specificity.

We should note that this analysis is exploratory. The emotional labels given to clusters should help us to understand what is going on. We do not claim that every subject captured in the clusters of averaged emotional states feels like we describe it – especially due to the fact that the labels of that averages base on information gained from other subject pools. However, this is an attempt to understand the emotional content, and as you will see these labels make much sense in the current context.

Dimensional vs. cluster approach. Evidence for that the cluster approach does not lead to distortions of results is given by the comparison with the results of a traditional, one-dimensional, perspective just using the dimension of valence in Table 4 (p.31). Regarding which emotional scenarios are relevant for the decision, the results using clusters of emotional states are mostly similar to those given by only the valence. However, it is apparent that the cluster approach is more appropriate in the sense that interactions of valence, arousal and dominance are incorporated without overloading the regression with too many predictors, which would be the case for three dimensions and their interactions for all six scenarios are used

(6*6 predictors). Additionally, the labels given for grouped emotional states give an intuitive meaning of what emotions play a role in the scenarios. For a comparison of the traditional and the new cluster approach, refer to the comparison of Table 4 (p.31) with Table 3 (p.30). In the following we only describe the results of the new cluster approach.

Regression. The cluster memberships in the four anticipated and the two immediate situations, as well as subjective probability, were used as predictors for the decision to bet or keep the money in a binary logistic regression. Model 1 used subjective probability as the only predictor. Hence, Model 1 answers the question to what extent the decision to take or avoid a risk was solely influenced by subjective probability.

Effects of Membership of the numbered Cluster relative to the Membership of the last Cluster for all six Situations.

		Model 1		Model 2 Anticipated emotions		Model 3 Immediate emotions		Model 4 All predictors	
Variable		Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)
anticipated emotions									
keeping and losing	Cluster 2								
	Cluster 1			.41	1.5			.19	1.22
keeping and winning	Cluster 3								
	Cluster 1			- .47	0.62			- .13	.88
	Cluster 2			-1.11	.33			- .72	.49
betting and losing	Cluster 3								
	Cluster 1			-0.74	.48			-1.35*	.26
	Cluster 2			-0.08	.92			-0.40	.67
betting and winning	Cluster 4								
	Cluster 1			- .05	.95			0.14	1.15
	Cluster 2			- .05	.95			-0.15	.86
	Cluster 3			- .21	.81			-0.12	.88
immediate emotions									
betting	Cluster 2								
	Cluster 1					- .26	.77	.21	1.23
keeping	Cluster 3								
	Cluster 1					-1.61***	.2	-1.88***	.15
	Cluster 2					- .13	.88	- .21	.81
subjective probability		.53***	1.69	.51***	1.67	.59***	1.81	.62***	1.86
constant		-1.92	.15	-1.38	.25	-1.57	.21	-1.15	.32
Nagelkerke's R^2		.13		.18		.26		.31	

Significant effect on the decision to bet: $*p < .05$ $**p < .01$ $***p < .001$
ΔR^2 Model 1 to Model 2 n.s.; ΔR^2 Model 1 to Model 3 *sig.* ($p<.001$); ΔR^2 Model 3 to Model 4 *n.s.* ($p<.49$)

Table 3: Study 2: Summary of Binary-logistic Regression Analysis for Clusters of Emotional States within Immediate and Anticipated Scenarios Predicting the Decision to Bet or to Keep the Money.

	Model 1 Subjective probability		Model 2 Anticipated emotions		Model 3 Immediate emotions		Model 4 All predictors	
Variable	Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)
anticipated valence								
keeping and losing			- .76	.47			- .43	.65
keeping and winning			- .56†	.57			- .25	.78
betting and losing			.91†	2.48			1.09†	2.98
betting and winning			- .46	.63			- .12	.89
immediate valence								
betting					1.01**	2.74	.61	1.83
keeping					-1.72***	.18	-1.83***	.16
subjective probability	.53***	1.69	.53***	1.69	.51***	1.66	.49***	1.64
constant	-1.70	.18	- .2	.82	-1.45	.23	-0.27	0.77
Nagelkerke's R^2	.12		.19		.28		.32	

Significant effect on the decision to bet: †p<.10 *p < .05 **p< .01 ***p < .005

ΔR^2 Model 1 to 2 marg sig. (p<.075), Model 1 to Model 3 sig. (p<.001), Model 2 to 4 sig. (p<.001), Model 3 to 4 n.s. (p<.32)

Table 4: Study 2: Summary of Binary-logistic Regression Analysis for Valence within Immediate and Anticipated Scenarios Predicting the Decision to Bet.

Subjective probability as predictor. As seen in Table 3, subjective probability significantly predicted the decision to gamble. Those participants who decided to bet saw their average chance of winning with M=4.9 (SD = 1.04) substantially higher than those who kept their money (M=4.0, SD = 1.48). This difference in the subjective probability of winning is significant ($t(164) = -4.00$, $p<.001$). In a logistic regression (Table 3, Model 1), this means that a one unit change on the scale of subjective probability induces an increase of the odds to bet versus not to bet with 169% ($e^{\beta} = 1.69$, $p<.001$).

Anticipated emotions as predictors. Model 2 added anticipated emotions into the mix. This is done to gauge whether they predict additional variance beyond subjective probability. As seen in Table 3, the relationship between anticipated emotions and the decision was non-significant. Additionally, the change in the models predictive power against Model 1 reveals to be not significant (ΔNagelkerke's $R^2 = .05$, $\chi^2 = 6.1$, $p=.64$). This also holds true when stepping from a 0-Model (no predictors, only constant) directly to Model 2, without subjective probability as a predictor.

Immediate emotions as predictors. Model 3 assessed the relationship of immediate emotions, along with subjective probability, on the decision to gamble. The model shows that immediate emotions regarding keeping the money predicted significant variance. Being a member of cluster 1 strongly reduced the odds of betting by a factor of 1/5 ($e^{\beta} = .20$, $p<.001$) relative to those belonging to cluster 3. The emotional state captured in cluster 1 is translated to the emotional terms 'interested' and 'activated'. Cluster 3 is translated to 'astonished' and 'tense'. Consequently 70.9% of the participants in cluster 3 decided to bet their money; the majority were wondering why to keep it. Contrary to this, only 45.3% of those captured in the first cluster did so; thus, a minority was wondering whether to keep their money in this case. Contrary to Model 2, this shows the immediate emotions raised by the decision problem itself, and not

those emotions attached to the outcomes that affect the decision to take a risk or not.

Immediate and anticipated emotions as predictors. Model 4 takes into account immediate and anticipated emotions along with subjective probability, affirming the role played by immediate emotions. The factor of reducing odds for the immediate emotional measures captured by asking "You keep the money and do not throw the die" is reduced to 1/6.6 (e^{β}=.15, p<.001). The impact of anticipated emotions for one scenario becomes significant, but weak. Only the situation of throwing the die and losing gained significant influence (e^{β}=.26, p<.05). The reactions to the connected question "You decided to throw the die. The die shows you lost" can be captured in two clusters. Participants grouped in cluster 1, on average, indicated a feeling translated to the strong emotional words of 'dread', 'fearful' or 'helpless'. Of those 54.9% decided not to take a risk and kept their money. On the contrary, cluster 3 encompasses those whose feelings translate to 'angry but objective' and 'wonderingly'. Consequently, a larger majority of 71.9% decided to bet, anticipating less strong feelings compared to those of the 1st cluster. In short regression terms, this means that if the subject is a member of cluster 1 ('dread', 'fearful', 'helpless', similar to anticipated regret of taken the risk), the ratio of the odds of gambling reduces with a factor of e^{β}=.26 (1/3.85) compared to the odds of those belonging to cluster 3 ('angry but objective', 'wonderingly' similar to anticipated disappointment). Given these results, the question should be answered if immediate emotions might only be reflections of the emotions anticipated for the outcomes.

Interrelation of immediate and anticipated emotions. The cluster memberships for the relevant immediate emotions when keeping the money are independent of those in the relevant anticipated scenario of betting the money and losing (ϕ=.22, n.s.). This shows that the immediate emotional state cannot be seen as a

simple reflection of the anticipated emotional states. Note again that this finding is also confirmed with the last model 4, including all predictors simultaneously where immediate emotions independently gain substantial influence beyond subjective probability or anticipated emotions.

Interrelation of subjective probability and emotions. How are the emotional cluster-memberships within the scenarios relevant for the decision related to subjective probability? A multinomial regression, with the subjective probability as the independent variable and the cluster-memberships as the dependent variable, reveals that a significant interrelation exists. However, for the immediate emotions in the case of keeping the money, the explanatory power of subjective probability is rather weak (Nagelkerke's R^2=.045). This weakness is also reflected by a rather low value (spans from 0 to 1) of the directional measure η of .22 assuming the cluster-membership as the dependent. For the anticipated emotions in the scenario of betting and losing, the multinomial regression reveals that there is no significant interrelation (Nagelkerke's R^2=.019). η yields a quite similar but also low value of .21, reflecting, again, the findings of the regression in Model 4. Both types of emotions affect the decision independently of subjective probability.

Is it possible that the effect of subjective probability (the chances participants believe to have that they personally will win) on the decision is mediated by emotions? Are emotions only triggered by subjective beliefs? The regression model already pointed in the direction a mediation analysis reveals, no significant indirect effects via emotions could be found ($p<.05$). To sum this up, both types of emotions affect the decision of whether or not to take a risk, independent of subjective probability.

Do the immediate emotional states follow a simple structure in a sense that the one is the just opposite of the other? Study 1 already showed that this might not be the case.

Interrelation of both immediate emotions. The cluster-memberships of both immediate situations were statistically independent from each other (χ^2 = 3.88, n.s.; ϕ =.15, n.s.). This shows that there is not an easy on/off structure of immediate emotions determining the decision, but that there are complex emotional states to capture.

2.3.3. Summary of Study 2

In summary, the results of Study 2 show the following: there is a strong relationship of subjective probability to the decisions made by the participants. Anticipated emotions only show weak influence overall. However, there is also found immediate emotions connected to the situation of keeping the money predict the decisions participants made substantially. Their influence on the decision is immune to possible interrelations with subjective probability and anticipated emotions. The independence of the relevant immediate and anticipated emotional state is confirmed, the former is not the mirror of the latter. Immediate emotions connected to both alternatives found to be independent of each other, too. A comparison of the new cluster based approach and a traditional perspective using valence as a predictor of the decision reveals that clustering does not lead to distortions of the results' structure.

2.4. Study 3: Altering Objective Probabilities

In the previous study, we measured the participants' subjective beliefs of winning. With this third study, we aim to investigate how actively changing the objective chances of winning influences decisions and emotions. Is it possible that changing one's chances alters one's emotional reactions to gambling, and thus alters one's

willingness to gamble? Is there a mediating function of immediate (or, of anticipated) emotions? To find out, we grouped participants into five conditions, each of them with a different chance of winning, and asked them to throw another die.

2.4.1. Method

Participants. Participants were attendees (127) of a beginner-level lecture at the University of Cologne (economics faculty), were aged 21 to 33 (*M*=24.52), and were asked to take the chance to double €5 to €10 by throwing a die. Of the participants, 77 (61.1%) were female, 49 (38.9%) male, and one of unknown gender. 70.6% of them studied business, 11.1% studied economics or social sciences, and the rest studied various other majors.

Material and procedures. Subjects received an envelope containing a password procedure, the questionnaire and €5. Five different, equally distributed, versions of the questionnaire (each given to 25±1 participants) were generated. The chance of winning varied from a minimal 1/6 ("You win if a 6 shows up.") to 5/6 ("You win if a 6, 5, 4, 3 or 2 shows up."). The general procedure of the experiment was explained aloud, ensuring the possibility to ask questions. The procedure replicated Study 2 with one exception. Participants' views of subjective probability of winning were not collected. Nevertheless, we think that these results provide additional insight into the role of emotions when choosing risky options. This is achieved through analyzing possible mediation of the effect of changing probabilities on the decision by emotions.

2.4.2. Results and Discussion

A total of 42 (33.1%) participants decided to gamble on the die, while 85 (66.9%) participants decided to keep the money. The objective probability of winning had a clear impact on the likelihood that participants would gamble. Among those with the lowest chance of 1/6, nobody bet their money; among those with a chance of 2/6,

7.7% bet the money; of those with a chance of 3/6), 34.9% threw the die; of those with a chance of 4/6, 50% tried their luck; and, among those with the highest chance of winning (5/6), 75% of the subjects gambled.

Obviously, changing objective risks influence decisions. But what role did emotions play beyond that influence? To answer this question, we again conducted binary logistic regressions. In addition to the measures of immediate and anticipated emotions, objective probability was also included as an independent variable (Table 5, p.38).

Effects of Membership of the numbered Cluster relative to the Membership of the last Cluster for all six Situations.

		Model 1		Model 2 Anticipated emotions		Model 3 Immediate emotions		Model 4 All predictors	
Variable		Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)
anticipated emotions									
keeping and losing	Cluster 3								
	Cluster 1			.50	1.64			1.27	3.55
	Cluster 2			.50	1.64			1.32	3.75
keeping and winning	Cluster 2								
	Cluster 1			-1.69***	.18			-1.73**	.18
betting and losing	Cluster 2								
	Cluster 1			1.42**	4.13			.31	1.37
betting and winning	Cluster 2								
	Cluster 1			.50	1.65			.39	1.47
immediate emotions									
betting	Cluster 3								
	Cluster 1					-0.12	0.89	.39	1.47
	Cluster 2					- .03	.97	.59	1.81
keeping	Cluster 3								
	Cluster 1					-1.59***	.20	-1.56*	.21
	Cluster 2					- .68	.51	- .47	.63
objective probability		1.18***	3.25					1.4 ***	4.07
constant		-4.63	.01	-1.21	.30	.05	1.05	-5.62	0.0
Nagelkerke's R^2		.43		.22		.10		.61	

Significant effect on the decision to bet: $*p < .06$ $**p < .01$ $***p < .001$

ΔR^2 Model 1 to Model 4 *sig.* (p<.05), ΔR^2 Model 3 to Model 4 sig. (p<.005)

Table 5: Study 3: Summary of Binary-logistic Regression Analysis for Clusters of Emotional States within Immediate and Anticipated Scenarios Predicting Decision to Bet or to Keep the Money.

Objective probability as predictor. Model 1 only shows the influence of objective probability of winning (1/6 up to 5/6) on gambling. Belonging to a condition with a higher chance of winning (one step means +16.6%) led to an increase of the odds of betting the money with a factor of e^{β} = 3.25 (p<.001). This reflects the above descriptive results of proportions of betting, given the different conditions shown above.

Anticipated emotions as predictors. But what about the emotions participants connected to the different outcomes of the gamble? Model 2 solely shows *their* influence on the decision. Obviously, anticipated emotional states in the situation of betting and winning, as well as betting and losing, do play a role. Being a member of the emotional cluster 1 ('confused') and not cluster 2 ('impotent, helpless') for the scenario of betting and losing increases the chance of taking the risk vs. not taking the risk by 313% (e^{β} =4.13, p<.01). The regret attached to the outcome of betting and losing comes along in two forms here: in a milder form of those grouped as feeling confused in a form of worry and irritation (cluster 1), and those feeling real anxiety of lost control and heavy regret (cluster 2). Consequently those in the latter group tend to keep their money more than the others.

Being a member of those grouped as 'wondering, skeptic' (cluster 1) and not a member of those labeled 'confused, embarrassed' (cluster 2) in the anticipated scenario of 'keeping and winning' reduces the odds to risk vs. keep the money by 82% (e^{β} =.18, p<.001). Those grouped as 'confused, embarrassed' anticipate more disappointment when they will learn that they could have been better off by betting the money, because they would have won. So they are more willing to take the risk. Using solely anticipated emotions as predictors for the decision results in an explanatory power of Nagelkerke's R^2 =.216.

Immediate emotions as predictors. Model 3 solely includes immediate emotions as predictors. Here only emotions connected to keeping the money play a role. This effect remains quite unchanged in the combined Model 4, so for it's detailed description please refer to the following description. For now, it can be said that emotional cluster-memberships in the immediate scenario of keeping the money affect the decision to take a risk or not.

Immediate and anticipated emotions as predictors. Model 4 combines all predictors simultaneously and is the basis for the following interpretation. Adding the objective probability back into this last model reduces the influence of anticipated emotions of betting and losing that showed up in Model 2. There is a connection between subjective probability and anticipated emotions for which Model 4 controls for – see later explanation. Nevertheless the influence of the anticipated situation of keeping and winning stays stable. Belonging to cluster 1 (feeling 'wondering' and 'skeptical' 75.6% do not bet) reduces the odds of betting vs. not betting by 82.4% (e^{β} =.18, p<.01; a factor of 1/5.7) compared to those belonging to cluster 2 (feeling 'confused' and 'embarrassed' only 47.5% do not bet). The latter group anticipates higher disappointment regarding *not* betting (especially showing lower values of valence and dominance) than those in cluster 1. Consequently, they are more driven to take the chance and bet.

What might immediate emotions' *additional* contribution be? In the situation of keeping the money, belonging to cluster 1 (feeling 'friendly', 'cooperative', 'relaxed' and 'secure') and not cluster 3 (feeling 'uninterested') reduces the ratio of chances of betting the money vs. keeping the money with a factor of 1/4.7 (e^{β} =.21, p<.057). Respectively 83.3% of those grouped in cluster 1 keep the money, 66.7% of cluster 2 ('astonished' and 'wondering') and only 46.8% of those belonging to cluster 3 do so. For those in cluster 3, the option to keep the money just seems to be very uninteresting.

In the combined model 4, the influence of objective probability is affirmed given the increased odds ratio of e^{β}=4.07, relative to Model 1 (e^{β}=3.25). But despite this variable's large predictive power on the decision, again both types of emotions played a significant unique role (model 1 to model 4: ΔNagelkerke's R^2 = .18, p<.05).

Interrelation of immediate and anticipated emotions. Note that there is a weak dependency (ϕ=.24, p<.031) between the emotional cluster memberships of the relevant immediate and anticipated scenarios. However, this connection is not strong enough to hinder anticipated and immediate emotions to contribute independently and significantly to the decision – as shown in regression model 4. Now that is has again been shown that both, immediate as well as anticipated, emotions do influence the decision to take a risk, the question arises of whether the effect of changes in objectives chances to win on the willingness to bet is mediated by emotions.

Interrelation of changes in probability and emotions. Do emotions, at least in part, explain the connection between objective probability and the decision to bet? That is, do anticipated or immediate emotions serve as a mediator between the chance to win and the decision to gamble? Our data suggest that immediate emotions do play a mediating role (Figure 4, p.42).

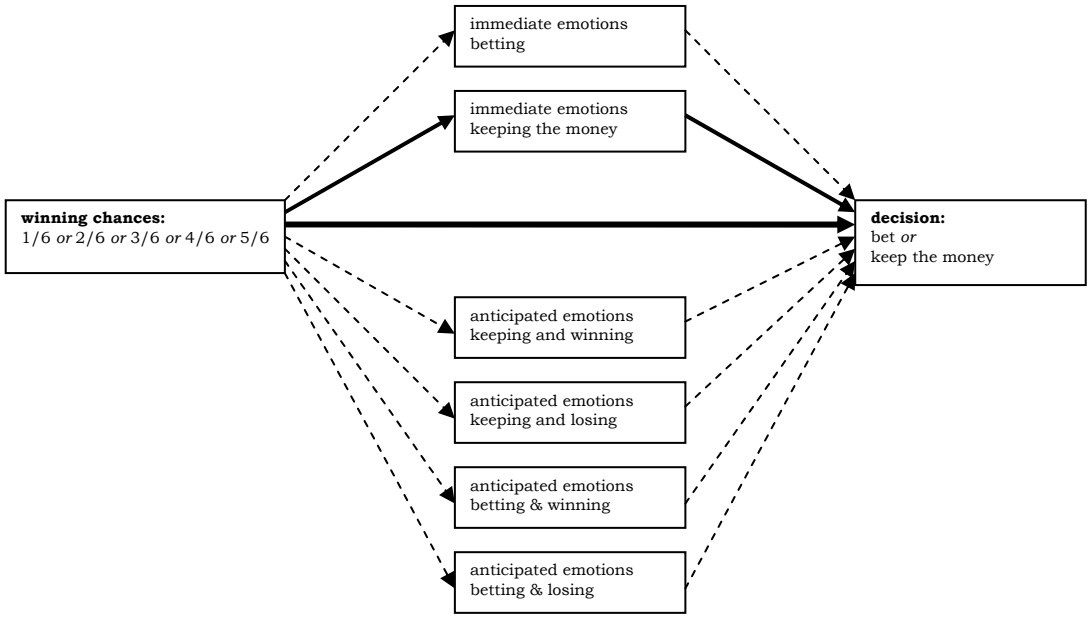

Figure 4: Study 3. How emotions mediate the effect of changes in probability to changes in behavior

A multinomial regression, with the change in objective probability as a predictor and the membership in the emotional states as the dependent variable, shows a significant influence of the immediate emotional state in the situation of keeping the money (Nagelkerke's R^2 =.14, p<.04; ϕ=.36, p<.04), foremost predicting the membership to cluster 3 (where a majority bets the money). That these immediate emotional states in the situation of keeping the money significantly influence the decision was shown in Table 5 (p.38), Model 4. To conclude mediation, it has to be shown that the direct effect of changing objective probabilities on the decisions is significantly reduced when mediators in the form of relevant emotional states are added simultaneously. By controlling for non-normality distribution of the indirect effect, a bootstrap test with 5000 re-samples (Baron and Kenny, 1986; Kenny, 2008; Preacher and Hayes, 2008a, 2004) reveals that this is indeed the case for the mentioned immediate emotions (with a 4% probability to err). The effect size measured as *index of mediation* (Preacher and Hayes, 2008b) yielded an effect of

.084 (lower level 96% confidence interval = .001, upper level 96% confidence interval = .242). Following MacKinnon and Dywer (1993) and Sobel (1982) the indirect effect size measured as the proportion of the total effect that is mediated yielded 7.05%. Note that such a specific indirect effect could only be found along the immediate but not with any of the anticipated emotions[5].

Interrelation of both immediate emotions. Can it be said, again, that the structure of emotional states within both immediate scenarios was independent of one another? Are the emotions connected to keeping the money just the opposite of those connected to taking a risk? No. Independence is again confirmed here (ϕ=.22, Cramers' V=.16, p<.20).

2.4.3. Summary of Study 3

In summary, Study 3 showed the unique impact of both types of emotions on the decision to throw a die. The results show the strong effect of objective changes in probability. Anticipated emotions gain significant influence on the decision. Beyond that, immediate emotions influence the decisions directly *and* carry additional effects of changing probabilities as a mediator.

2.5. Study 4: Ellsberg – Risk vs. Uncertainty

The first three studies examined simple decisions under risk. With the fourth study, we applied our approach to a classical paradigm of decision-making research: The Ellsberg-paradox (which is similar to Keynes' pedagogical example in *Treatise on Probability*, 1921).

Imagine the following situation: "You now have the possibility to win $5, based on which chip is drawn out of an urn. There are two urns to choose from: Urn 1 contains a total of 100 chips, some chips

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[5] These tests were conducted with the latest available scripts by Preacher & Hayes (2004, 2008) and were confirmed with Mplus software Version 5.2 (Muthén, L.K. and Muthén, B.O. (1998-2007)

are red and some are black. Urn 2 contains a total of 100 chips, 50 of these are red and 50 are black. You choose which color wins: if a chip of that color is drawn, you have won. In this case, you win $5. If a chip of the other color is drawn you lose and therefore receive $0."

Most people decide against the ambiguous first urn. But this observation is inconsistent with expected utility theory because it implies that the subjective probabilities of black and red are greater in the 50:50 urn than in the unknown urn, and therefore cannot sum to one for both urns (Fox and Tversky, 1995). Obviously most people don't automatically draw the analogy to Raiffa's (1961) reasoning that ambiguity always can be reduced to risk by tossing a coin to decide whether to guess red or black. Another way to come to the conclusion that the risk with the ambiguous urn is the same as choosing the risky urn is the following gedankenexperiment.

As long as participants are allowed to choose any of the two colors and they don't know which proportion the experimenter prepared in the ambiguous urn, there are equal chances for any proportion of reds and blacks in it. It might be the case that this specific urn contains 99 red and 1 black chip or the other way around. By choosing the color, the specific distribution might give a great chance to win (e.g., for red in the first case) but also a very little chance to win (red in the case of urn 1, with 99 black and 1 red in it). These distributions obviously are the most extreme, but any of the other distributions between those are *equally* possible – due to the fact that one lacks the knowledge about which distribution it is. In this way, drawing from that urn one might end up with a red or a black chip – equally probable, finally it is just like a coin flip. This is the reason why objectively both urns should be objectively evaluated as the same risks, and also the reason for why we used the same 50:50 urn as the ambiguous urn in the drawings.

Applying our theoretical framework to the Ellsberg-Paradox, we wanted to determine the extent to which this paradox was driven by

immediate versus anticipated emotions. How does the choice between a known risk and an unknown risk, or ambiguity, translate into emotions and subjective probability. Through which channel does ambiguity aversion translate to the behavior of average participants? Additionally, we also wanted to find out about participants' ability to anticipate emotions by comparing anticipated emotions with emotions evoked when consequences were unveiled.

2.5.1. Method

Participants. 108 students, mostly undergraduates attending various lectures at Cornell University, were invited to take part in a study on decision. With 44 females (40.7%) and 64 males (59.3%) aged 18 to 28 years (*M*=20.07), Ellsberg's (1961) classic experiment was conducted.

Material and procedures. Participants were told that they might win $5 in the upcoming experiment, then they received envelopes containing the password procedure and first questionnaires. They faced exactly the situation we asked you to imagine before, with the same question wording.

Participants' immediate emotional states regarding the choice of either the ambiguous urn 1 (unknown proportion of chips) or unambiguous urn 2 (50 black and 50 red chips), as well as the four anticipated emotional states connected to the possible outcomes, were measured. Again, we asked participants' individual views on the subjective probability of winning for each of the urns on a 7-point scale reaching from "not probable at all" to "highly probable". We counterbalanced the order of presenting the ambiguous and unambiguous urn as well as the color of choice.

After all participants made their decision, first questionnaires were collected and the drawing was conducted right in front of the group by a blindfolded volunteer. First the drawing from the 50:50 urn took place. After that, those who had chosen this urn knew if

they had won. After a short explanation as to why the same urn was used for the second drawing, a second volunteer drew from this, then denoted ambiguous urn. After that, the participants who chose the ambiguous urn knew if they had won.

This procedure was followed by handing out a second questionnaire, which asked for an indication of the perceived emotions now that the outcome was known. This is a measure of the perceived actual emotional state connected to the real outcome. The session was then finished by a debriefing (giving theoretical background information) and the payment of $5 to those who won.

2.5.2. Results and Discussion

72 (66.7%) participants chose to bet on the unambiguous urn and 36 (33.3%) decided for the ambiguous urn ($p<.001$). These results replicated common findings (Camerer and Weber, 1992) that the clear bet is preferred over the vague bet.

We ask how the average preference for known risks over unknown risks might reflect and be explained by considering emotions, especially immediate emotions connected to the actual choice of either the ambiguous or unambiguous alternative. Table 6 (p.47) shows the results of a binary-logistic regression divided into four models predicting the choice for the known risk option vs. the ambiguous option.

Effects of Membership of the numbered Cluster relative to the Membership of the last Cluster for all six Situations.

		Model 1		Model 2 Anticipated emotions		Model 3 Immediate emotions		Model 4 All predictors	
Variable		Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)
anticipated emotions									
ambiguity and losing	Cluster 3								
	Cluster 1			1.18*	3.26			1.37*	3.93
	Cluster 2			- .31	.73			- .27	.76
ambiguity and winning	Cluster 3								
	Cluster 1			1.96**	7.06			1.57	4.82
	Cluster 2			1.12	3.08			.81	2.24
known risk and losing	Cluster 2								
	Cluster 1			.93	2.53			.86	2.35
known risk and winning	Cluster 2								
	Cluster 1			1.14*	3.13			.87	2.39
immediate emotions									
ambiguity	Cluster 2								
	Cluster 1					1.07**	2.93	.99*	2.69
known risk	Cluster 4								
	Cluster 1					.52	1.68	1.05	2.86
	Cluster 2					.43	1.53	.75	2.12
	Cluster 3					.49	1.63	.83	2.29
difference in sub. prob.		-1.62***	.2	-1.67***	.19	-1.51***	.22	-1.48***	.23
order of measurement		1.27*	3.56	1.26*	3.52	1.17*	3.22	1.31*	3.71
sub. prob. * order		1.09*	2.97	1.06*	2.9	1.08*	2.96	.96	2.62
constant		- .8	.45	-3.19	.04	-1.51	.22	-3.89	.02
Nagelkerke's R		.26		.39		.31		.43	

Significant effect on the decision to choose the unambiguous urn 2: *p < .10 **p< .05 ***p < .005

ΔR Model 1 to Model 2 sig. (p<.027), ΔR Model 1 to Model 3 n.s. (p<.16), ΔR Model 3 to Model 4 *marg. sig.* (p<.057)

Table 6: Study 4: Summary of Binary-logistic Regression Analysis for Clusters of Emotional States within Immediate and Anticipated and Scenarios Predicting Decision to Bet on Unambiguous Urn 2 vs. Ambiguous Urn 1.

Although not previously mentioned in this study, we altered the measurement of subjective probability between the beginning of the questionnaire (before the decision was made) and the end of it (after the decision). The latter measure was significantly connected to the actual decision ($p<.001$). For this reason, we controlled for such effects in all regressions by adding the order of measurement as well as its interaction with the measure. In all models, the control variables gained no significant change in explained variance when added. Its contribution to Nagelkerke's R decreased from when added to the simplest model of solely subjective probability (ΔNagelkerke's $R^2= .056$, *n.s.*) to an increase of .034 (*n.s.*) when added to the comprehensive model containing subjective probability and both types of emotions. So how does subjective probability controlled for measurement effects affect the decision to choose a known or an unknown risk?

Subjective probability as a predictor. Model 1 introduces the difference in subjective probability that every participant indicated by answering her personal chance of winning for both alternatives. The difference was composed by subtracting the subjective probability to win choosing the ambiguous urn versus the unambiguous one. Hence, higher positive values mean a larger subjective probability to win with the ambiguous urn, lower negative values mean a larger subjective probability to win with the unambiguous one. The negative coefficient β=-1.62 in the first regression model shows that with one unit increasing subjective winning chances attached to ambiguous urn 1, consequently the odds of choosing the known risk option (urn 2) vs. ambiguous urn 1 decrease with a factor of 1/5 (e^{β} = .20, $p<.005$). This effect of a one unit change is so large because, in this case, the change on the scale already yields about one standard deviation of that value (SD=1.02). The difference in subjective probability gains substantial predictive power (Nagelkerke's R^2=.26, together with the control variables).

Anticipated emotions as predictors. Model 2 then adds anticipated emotions as predictors for the decision, simultaneously controlling for influences of subjective probability. The increase in predictive power is significant (ΔNagelkerke's R^2=.14, p<.03). When only anticipated emotions attached to the outcomes are taken into account, several emotional contents of the scenarios affect the decision. But as Table 6 (p.47) reveals, most of these influences vanish when immediate emotions are allowed for simultaneously. Only the emotional states connected to one scenario – choosing the ambiguous urn and losing – gain influence in the comprehensive Model 4. Interestingly enough if only anticipated emotions connected to the outcomes would have been considered their role would have been overestimated.

Immediate emotions as predictors. So, before interpreting the effect of one anticipated scenario in detail, let us first have a look on the immediate emotions in model 3: the emotions connected to the act of choosing the ambiguous urn 1 gain significant effect (e^{β} = 2.93, p<.05) on the decision despite the strong effect (e^{β} =.22, p<.005) of subjective probability. This effect stays stable in the comprehensive Model 4, as represented by the following detailed description.

Immediate and anticipated emotions as predictors. Model 4 now includes both types of emotion measures (immediate and anticipated) as well as subjective probability. Relevant anticipated emotions show up for the situation of choosing the unknown risk and losing. Being a member of emotional cluster 1 ('confused, embarrassed') and not of cluster 3 ('wondering, undismayed') increases the odds ratio of choosing the unambiguous urn vs. the ambiguous urn (e^{β} =3.93, p<.077).

Cluster 1 might be interpreted as strong regret in the case of choosing the unknown risk and losing. Consequently 27 out of 34 (79.4%) participants grouped in this cluster chose the unambiguous urn. Only 22 out of 38 (57.9%) did so in the 'wondering cluster'. The

latter cluster obviously captures those who are, on average, light hearted in this situation, and thus are more able to check out a different, more vague choice. Interestingly, those going for the known risk rated the valence for *any* anticipated losing scenario lower, the arousal higher and the dominance lower than those choosing the ambiguous urn.

So, the question arises of how immediate emotions come into play. *Beyond* the influence of the anticipated emotional states, being a member of cluster 1 ('shy') and not of cluster 2 ('curious', 'surprised', 'tensioned') in the immediate situation of choosing the ambiguous urn increases odds to chose the known risk by 169% (e^{β} =2.69, p<.081). Hence a large majority of 44 out of 54 participants (81.4%) grouped in the 'shy cluster' chose the unambiguous urn, but only 28 of those 53 (52.8%) captured in the 'curious cluster' did so. The latter group obviously contains those striving for the thrill of the ambiguous choice[6].

Thus, perceiving immediate arousal when going for the ambiguous option does not necessarily lead to avoidance of it. In fact the contrary is true. This finding might show how the design of context in Keynes' experiment influences decision makers. Because they have to choose one of the urns, they do not have money in their hands to lose, so going for the vague option might somehow be used as an option to gain fun or thrill just from the decision itself.

A clarifying insight might be given by participants' comments: "I was originally going to choose urn 2 [unambiguous], but changed my mind at the end, realizing that both still lied on the 50/50 chance of which color I choose and that urn 1 [ambiguous urn] just seemed more exciting and with the same amount of risk involved." B.t.w this is one of the uncommon cases where reasoning led to the right

[6] The interaction of the between-subjects factor (decision) and the within-subject factor (values of three dimensions within all six measured situations) is significant for the dimensions of arousal (p=.033) and dominance (p <.001) and only very weakly significant (p=.128) on the dimension of valence.

analysis. Others formulated it more straightforwardly: “I decided to go for the bigger chance of excitement” or even, “Going with something that is unknown might turn out to be a pleasantly surprising.”

The source of this possible pleasure is to be found in the incomplete information of the distribution of chips compared to the unambiguous urn. Interestingly, it is this lack of information which makes others feel uncomfortable betting on the ambiguous urn: “…more certain information seems to be better.” or “With urn 1 [ambiguous] I have no idea which is scary/unpredictable.” This might point to an analysis of relevant personality traits – which were collected – but would go beyond the scope of this article.

Interrelation of immediate and anticipated emotions. Recall that cluster memberships for the described relevant anticipated and immediate emotions are independent of each other (ϕ=.013, p<.99). This confirms that immediate emotions are not just mirrors of anticipated emotional states. The fact that the effects of anticipated emotions on the decision are reduced when immediate emotions are considered, points to latent connections between both types of emotions. But, if anticipated emotions were the better predictors of the decision, in the sense that they carried the core of emotional information which triggers the immediate emotions, the effects of the latter would not have survived in the comprehensive Model 4. On the contrary, then the effects of anticipated emotions would have been strengthened, which was not the case.

Interrelation of subjective probability and emotions. Do emotions, at least in part, explain the connection between subjective probability and the decision to bet? In Study 2, this was not the case. Do anticipated or immediate emotions serve as a mediator between the chance to win and the decision to take a known or an unknown risk? A multinomial regression, with the cluster-membership in the relevant immediate scenario of taking the ambiguous risk as the dependent and the difference between both subjective probabilities

connected to both alternatives as the independent variable, reveals that a significant ($p<.02$) connection exists (Nagelkerke's $R^2=.076$). It can be said that, the higher the chance to win with the unambiguous urn and the lower the chance to win with the ambiguous urn (the difference increases) is believed, the chance to be grouped in cluster 1 ('shy') increases ($\eta=.30$). The same procedure with the anticipated emotions for the scenario of betting on the ambiguous urn and losing shows no significant ($p<.6$) connection to the measure of subjective probability in a non-significant model (Nagelkerke's $R^2=.013$), $\eta=.26$.

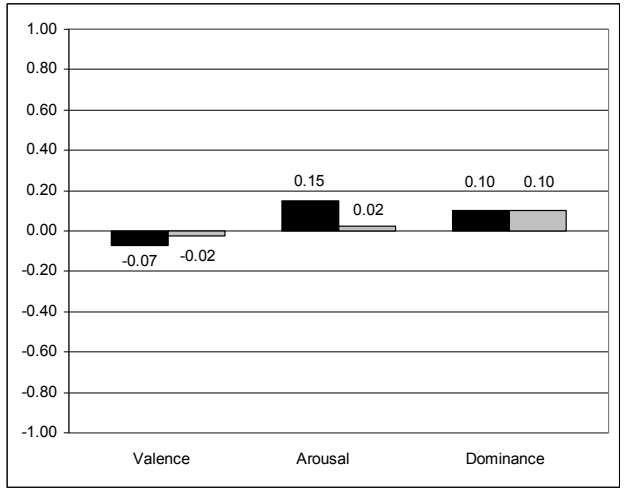
Still the question remains, do emotions mediate subjective probability in the case of the Ellsberg-Paradox. A mediation analysis similar to the one in Study 3 reveals the following: using both the decision affecting emotions, an indirect effect is found via the immediate emotions to choose the ambiguous urn. The effect size, measured as *index of mediation* (Preacher and Hayes, 2008b), yielded an effect of .043 (lower level 95% confidence interval = .013, upper level 95% confidence interval = .371). Following MacKinnon and Dywer (1993) and Sobel (1982), the indirect effect size measured as the proportion of the total effect that is mediated yielded 4.62%. Note that such a specific indirect effect could only be found along the immediate but not with anticipated emotions.

Interrelation of both immediate emotions. As shown consistently before, the immediate emotions connected to the option of to taking an unknown risk are not just the opposite of those connected to taking a known risk ($\phi=.09$, $p<.83$). So this independence holds true for this problem of deciding between a known and an unknown risk as well.

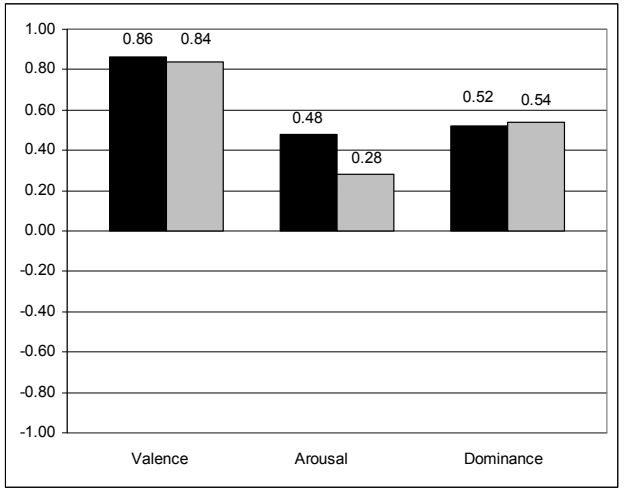
The idea of anticipated emotional states influencing decision requires the ability to predict these reactions to outcomes to a more or less exact degree.

Anticipated vs. experienced outcomes. As said above in this study, participants indicated their perceived emotions when they

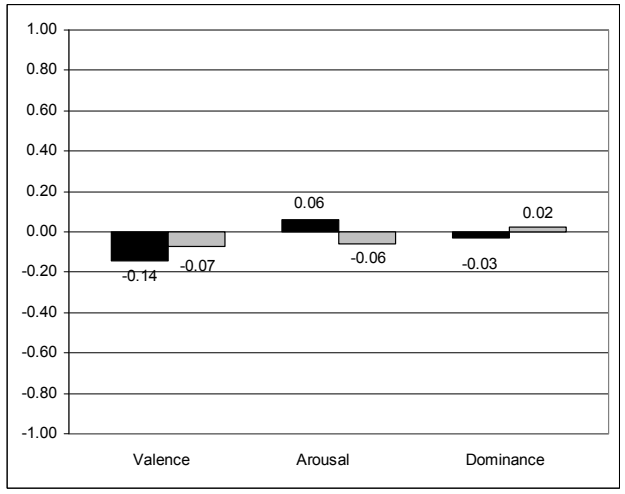
learned about the actual real outcome. This enables us to compare these perceived emotional states with those they anticipated before. If predictions would not fulfill a level of certainty, these beliefs would just be illusions and hence lead to wrong decisions made on the wrong basis.



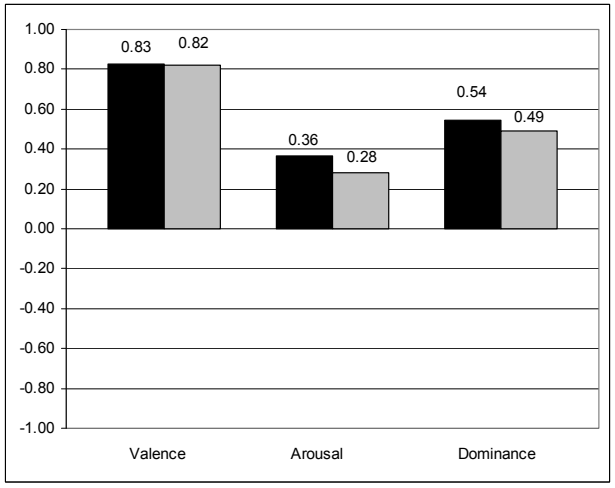
Study 4. Comparison of average values in emotional dimensions of the anticipated (black) and experienced emotions (grey) in the situation of *Choosing ambiguous urn 1 and losing (outcome 1).*



Study 4. Comparison of average values in emotional dimensions of the anticipated (black) and experienced emotions (grey) in the situation of *Choosing ambiguous urn 1 and winning (outcome 2).*



Study 4. Comparison of average values in emotional dimensions of the anticipated (black) and experienced emotions (grey) in the situation of *Choosing unambiguous urn 2 and losing (outcome 3).*



Study 4. Comparison of average values in emotional dimensions of the anticipated (black) and experienced emotions (grey) in the situation of *Choosing unambiguous urn 2 and winning (outcome 4).*

Figure 5: Study 4. Averaged values of emotional dimensions of anticipated emotions versus experienced emotions for all four event groups

As shown in Figure 5 (p.54), participants were well able to predict their average emotional states regarding the outcomes. Bars show the average values of each of the three dimensions (valence, arousal and dominance) for every event group. A total of 25 participants chose the ambiguous urn and failed to win, the comparison of what they anticipated and what they actually indicated after learning about their outcome (experienced emotions) reveals no significant differences. In the group that decided to chose the ambiguous option and won $5, this is also true for the dimensions of valence and dominance, but not for arousal. Participants facing this situation overestimated their arousal in the future ($t(19)=3.68$, p=.002, all tests are paired t-test).

In addition, the case of 'choosing unambiguous urn 2 and winning nothing' was experienced by 43 participants. There was a significant difference ($t(42)=2.17$, p=.036) between average predicted and actual arousal connected to this outcome, overestimating future arousal. A marginal difference was found for the valence dimension ($t(42)=-1.75$, p=.09), underestimating this value for the future just a bit. So, at the end, these participants feel better and less aroused than expected, which might be the result of a coping strategy to handle this event.

The situation of taking the unambiguous risk with the unambiguous urn 2 and winning came true for 44 participants. They only slightly overestimated their future arousal connected to that outcome ($t(43)=1.85$, p=.07). For all possible situations, arousal was more or less overestimated, which might reflect the feelings of surprise people incorporate when comparing the possibility of a prize or a loss.

This effect might be called surprisingness of options, comparable to the findings by Mellers, Ritov and Schwartz (1999) or Mellers (2000). Or it simply reflects the finding that people tend to adapt instantly to changes in conditions (Loewenstein, O'Donoghue

and Rabin, 2003). Note that our results regarding the comparison of anticipated and experienced emotions are not comparable to those of Van Winden, Krawczyk and Hopfensitz (2008) because they measured anticipated emotions *after* the risky decision was made (and not before), and they focused on the effect of delayed risk resolution.

Despite the small failure in predicting the states of arousal connected to the revealed outcomes participants' predictions were strikingly accurate. Nevertheless, only one of these correct anticipations (the scenario of choosing the ambiguous urn and losing) affected the decision. Furthermore, the anticipations for winning with the one or the other urn look quite similar overall, participants anticipated feeling good in either case. Such similarity also can be found for the anticipations regarding both scenarios of losing. This is another hint that for decisions between a known and an unknown risk, anticipated emotions might not act as a useful guide.

2.5.3. Summary of Study 4

In summary, Study 4 showed that the difference in subjective probability between the two options gains strong influence on the decision. Beyond that, anticipated emotions show that those anticipating strong regret when choosing the ambiguous urn and losing the money go for the known risk. Those choosing the unambiguous urn rate the valence for *any* anticipated losing scenario lower, the arousal higher and the dominance lower than those choosing the ambiguous urn. Whereas, those taking the ambiguous urn, do not predict themselves hurt that much in case of not winning anything. The significant, unique effect of immediate emotions connected to choosing the ambiguous option is two-faced. On one hand, it is responsible for people to be shying away from it, on the other hand the mixture of higher valence, and especially higher arousal, is form of thrill that some participants go for.

2.6. General Discussion

It could be shown that the decision to take or avoid a risk is influenced by changes in objective or subjective probabilities. Both anticipated and immediate emotions substantially predict a person's decision. Although weak interrelations occur, immediate emotional states cannot be seen as simple reflections of those anticipated, attached to the outcomes. Immediate emotions only partly mediate the relationship between anticipated emotions and the decision participants made. By controlling for the relationship between immediate and anticipated emotions, it was shown that *immediate* emotions contribute specifically to the prediction of risky decisions. Endogenous, subjective probabilities of outcomes substantially influenced the decision, but immediate as well as anticipated emotions gained independent influence on the decision.

Immediate emotions connected to keeping the money carried a part of the effect of exogenous changed objective chances of winning on the decision to bet the money as a mediator. Immediate emotions connected to bet on the ambiguous urn in the Ellsberg-Paradox carried a fraction of the effect of subjective probabilities regarding both alternatives on the decision to bet on a known or an unknown risk. Immediate emotions connected to both alternatives of a decision could be found to be independent of one another. Hence, immediate emotions for one or the other option do not follow a simple on/off structure in a sense that the one reflects the opposite emotional content of the other, but they are rather independent of one another.

Anticipations regarding the emotional states for the different outcomes in the Ellsberg-Paradox were quite exact, although did not gain much influence on the decision to bet on unknown or an unknown risk.

2.6.1. Are Immediate Emotions Tautological?

One might argue that the shown strong effects of immediate emotional feelings are just an artifact of tautology. If people decide to bet, they surely indicate compatible emotional states when asked about them after they have made their decision. But, the participants were asked to indicate their feelings for both possible alternatives of betting and keeping the money immediately *before* they had to make their final decision. The connection of the values of valence found between the two possible immediate situations was weak and insignificant in Study 1. More importantly, the independence of emotional cluster memberships for both possible options was confirmed repeatedly. There was no evidence for a pattern of cross-over group interrelationship for the clusters in both immediate scenarios for Study 2, 3 and 4. These findings of independence reflect the existing diversity of immediate emotions. An indication of positive emotions in the situation of keeping the money does not automatically determine the existence of a bad feeling when betting and vice versa.

The same is especially true when only concentrating on the one dimension of arousal. High levels of arousal connected to betting the money do not automatically lead to avoiding the risky option, but to the contrary especially motivate a substantial group of participants to go for it. Perhaps this is due to fact that arousal promotes the dissociation of automatic (immediate emotions) from deliberative (prediction of emotions) processes, which compete to give responses and in this way create inconsistency (Hochman, Glöckner, and Yechiam, in press). Furthermore Glöckner and Hochmann (2009) found that anticipatory physiological arousal was modulated by cognitive cues, and increased with increasing inconsistency between cognitive and affective cues. In Study 4, we found those participants choosing the ambiguous urn felt significantly more arousal in the immediate situation of choosing this urn, compared to the immediate arousal measured for going with the known risk. A finding that fits

the data shows that anticipatory physiological arousal is higher for risk seekers as compared to persons scoring high on risk aversion tests (Glöckner and Hochmann, 2009).

2.6.2. Taking the Riskless Perspective in a Risky Decision

In a sense, immediate emotions can be seen as the reliable, riskless aspect of a risky decision. In study 4 participants had quite similar predictions for the cases of winning and losing, but no specific predictions for either of the two urns. One way to deal with such a lack of information is to use immediate emotions, connected to of going with the known or the unknown risk, as a cue. The information regarding how you feel about one or the other might be quite clear. These emotions might base the decision more than the anticipated emotions. Our findings suggest that this holds true even for a simple condition like flipping a coin, where mere anticipations should play a role, according to consequentialistic thinking.

Consequently, an approach to capture distinct emotional states seems to be advisable as people obviously experience distinctive states, which affect the decision to bet in a sophisticated manner. It is not a dichotomous on/off structure of mutually exclusive binary good or bad feelings that determine the decision to choose the risky option. Such complex states cannot only be found for immediate emotions but also for the anticipated emotions.

2.6.3. Emotions and Subjective Probability

Our data showed that emotional influence on a decision is quite independent of our measures of subjective probability. We could show that the effect of changing objective probabilities of winning on the decision was partly mediated by immediate emotions. Effects of the differences in the subjective probabilities, regarding both urns, on the decision were partly mediated by immediate emotions in the Ellsberg-Paradox.

In none of the four studies was subjective probability measured simultaneously when objective probabilities were changed. Hence, it is unclear how emotions influence the process of translating changes of objective chances to changes in subjective probabilities. Especially the strong risk-aversion and/or loss-aversion seen in the lower chance conditions (1/6, 2/6) compared to the better chances conditions in Study 3 reflect the well-known finding that probabilities are not perceived linearly.

We were not able to analyze whether these deviations can be explained by emotional influences. By controlling for the endogenous variable of subjective probabilities in the regression models in Studies 2 and 4, we focused on the additional, unique influence of emotions on the decision. Therefore, the influence of emotions might still be underestimated in our approach. Future analyses might show that emotions already contribute to the process of forming objective to subjective probability. This question remains open for further research.

2.6.4. Risk-as-Feelings and Affect-as-Information

Due to the rather unclear differentiation between both theories, provided by their inventors, it is difficult to form specific statements about the different predictions based on their different assumptions regarding the processes by which affect comes into play. As far as we understand, for the affect-as-information approach, affect is always derived from the special features of the object being evaluated. For example, when thinking about the risks of building an atomic power plant, the risk perception is influenced by the emotions attached to the power plant. This affect changes as the risk perception changes, which only can be derived from anticipations. These changes are then reflected in the evaluation of the risk now (i.e., anticipatory affect). In this sense the risk-as-feelings theory is more specific than the risk-as-feelings approach: affect is changed only by emotions raised by the features of the anticipated object. Consequently, this means that

immediate emotions must always mirror these anticipations and are not independent of each other. The Risk-as-feelings theory, on the contrary, opens the underlying processes to other emotions from other sources and especially to those, which are raised from the process of deciding itself. Our data shows that immediate and anticipated emotions are independent of or very weakly connected to each other. This means that immediate emotions act quite independently from anticipated emotional states, as hypothesized by Loewenstein et al. (2001).

2.6.5. Anticipating Emotions

As shown in Study 4, participants were able to anticipate the emotional states they would experience when confronted with the consequences of their decision. At first sight, this contradicts the findings of Van Boven, Loewenstein, Dunning (2005), but they assumed the influence of arousal on behavior, which *cannot* be anticipated. In this sense, they focused on if people are able to anticipate their immediate reactions to a behavior in a high arousal situation (i.e., singing a song in front of the audience). This setting is different to the decision problems analyzed in our studies in several respects. First, the duty to sing a song in front of your study colleagues surely is more embarrassing than losing $5 in a lottery. Secondly, revealing the outcome of a lottery was not connected to do anything embarrassing in the public's eye – like, for example, going to the front of the class and carrying a sign lettered "LOSER". In this sense, our results are not directly comparable to those studies. We argue that participants in our experiments are already in a kind of 'hot' state when making their predictions regarding emotional reactions to the outcomes. With our measurements of emotions, we encouraged them to go through all the possibilities that might happen and fully engage in the decision. In this sense, they might not predict a 'hot' situation on the basis of a 'cold' state.

In Study 4, for both losing scenarios, participants overestimated their arousal slightly but not substantially, a hint that people instantly began to adopt the negative event. Despite this, overall, participants were strikingly exact in their predictions. This contradicts findings by Gilbert and colleagues (Wilson and Gilbert, 2005), as their studies showed that people tend to overestimate the intensity and duration of emotional reactions to future positive and negative events. We cannot say anything about duration because there was no second point in time when emotions regarding the outcome were measured in this study.

As shown in Study 3, participants who anticipated strong disappointment in the case of keeping the money and learning that they would have won were prone to take the risk. Anticipated emotions in this sense worked against loss aversion, which came into play by the direct effects of objective probability on the one hand, and beyond this by the immediate emotions regarding keeping the money. The group clustered as feeling relaxed is really to distinguish from those who are labeled as 'uninterested' when keeping the money. Therefore, loss aversion partly seems to take effect through immediate emotions and not only through anticipated reactions. Regarding the source of loss-aversion, this contradicts findings of Kermer, Driver-Linn, Wilson, and Gilbert (2006).

In Study 4, the impact of winning something was rated with a much higher impact than losing the money on all three dimensions of valence, arousal, and dominance. This finding might not be used to attract more critics on loss-aversion, as an affective forecasting error because in the Ellsberg-Paradox participants have to choose between both urns, so they have to bet their money anyway. This makes the ratings of emotional reactions to a loss incomparable to the situation where the participant is allowed to take the money and deny the risk. This question will be addressed in our future research.

Overall, our finding that participants are able to predict the future pleasure and pain of outcomes, but only partly use these cues for the decision, are extremely incompatible with the common, rational-choice utility-based perspective, in which participants show different individual utility-functions due to the fact that some bet and some do not. However, these differing functions do not mirror in differing anticipations. Those participants who did bet had precisely imagined the outcome of the situation as well as those who decided to keep the money. There was no positively-dyed illusion moderating the bad feelings arising in the situation of losing the money, which might have led those who bet.

2.6.6. Immediacy of Outcomes

All mentioned experiments took about 30 to 40 minutes, including answering the questionnaires and any lottery procedure. In Studies 1 to 3, the payments took place at the end of the lecture (about one hour later). In Study 4, through a special collection procedure of the envelopes that assured the anonymity of the decision, the money was paid to the winners immediately after the session. These very short gaps between the actual decision and receiving the outcome make it hard to believe that time discounting changed prospects and therefore influenced decisions.

2.7. Conclusion

To our knowledge, this is the first series of studies that examined the relative role and relative importance of immediate and anticipated emotions in simple risky decisions. This is in contrast to other findings, which have not focused on actual decision-making using self-reports and did not implement a physio-psychological measure like the SAM (Kobbeltved et. al, 2005). A clear direct effect of immediate emotions on actual decisions could be found. Also anticipated emotions affect the decisions.

Finally, it must be said that in the specific site of experimental examination of decision-making under risk and uncertainty (which definitely resides outside the dance floor), people tend to follow Irene Cara's vocalized strategy:

> *'Take your passion and make it happen'. What a feelin'!*

3. Trust – Just another bet?

The risk-as-feelings hypothesis argues that many risky decisions are not only predicted by anticipated emotions, as most consequentialistic decision-making theories would assume, but that they are influenced also by immediate emotions. Immediate emotions refer to the emotions experienced at the very moment the actual decision is made, contrary to the anticipated emotions imagined regarding the possible consequences of a decision. This study focuses on the role of both types of emotions in the decision-making process under risk in social and non-social contexts. Accordingly, participants had to indicate their emotional states regarding the anticipated outcomes in a (non-social) simple coin flip, and in situations incorporating social dependencies: an Extended Coin Flip implying monetary consequences for another person and a situation of trusting an anonymous Person (Trust Game). In all three conditions, subjects also indicated their immediate emotions at the moment of making the decision.

3.1. Introduction

3.1.1. Dual System Model.

First, an experiential "System 1" describing the processes of thinking, which are fast, automatic, effortless, associative, difficult to control or modify and emotional. Second, an analytic system "System 2" containing the processes of thinking that were described as slow, serial, effortful, controllable, consciously accessible and neutral (Kahnemann, 2003; Stanovich and West, 2000). Only recently has this dichotomous view been softened (Beachara and Damasio, 2005; Bechara, Damasio, Tranel, and Damasio, 1997). In addition, today it can be said that decision-making without emotional involvement might be far from optimal or not even possible (Damasio, 1994).

3.1.2. Consequentialistic Thinking.

Using this distinction as a starting premise, Loewenstein and others applied it to the field of decision making by focusing on the intuitive System 1 with their *Risk-as-feelings* hypothesis (Loewenstein et al. 2001). Until then, consequentialistic approaches in form of (subjective) expected-utility theories were clearly dominant in that field. Such theories presume that decisions are predictable in a way that people think about the likelihood and severity of consequences of all possible alternatives and translate that information by some calculation process into their actual choice (Loewenstein et al., 2001). This calculation process might be biased or include errors (bounded rationality, heuristics), but at least this process is assumed to be a process of the analytic System 2. So, for a long time, theorists acted as though intuitive processes played no role in decision making - that people chose to take risks (or not) based on the cold calculation of expectations (beliefs). In addition, that this should not only hold true for decisions without consequences for others (e.g., to flip a coin to win some money) but also for behavior which directly effects the outcomes of other persons (e.g., trust).

3.1.3. Risk-as-Feelings

The risk-as-feelings theory emphasizes the role that is played by emotions when people make decisions. It suggests, “that feelings play a much more prominent role in risky decision making than they are given credit for by the cognitive-consequentiality tradition of J/DM [judgment and decision-making] research” (Loewenstein et al., 2001, p. 274). The basis for this statement is formed by the findings of sub-fields of psychology, which basically filtered out different determinants for the perception of risk related to System 1 or System 2. Probability and expected outcomes do influence cognitive evaluations of risk (Slovic and Lichtenstein, 1968). Emotional reactions to risk are sensitive to the vividness of the imagined situation (Finucane, M. L., Alhakami, A., Slovic, P., and Johnson, S.

M. (2000), Slovic, Finucane, Peters, McGregor, 2004; Slovic and Peters, McGregor, Finucane, 2005), the time gap until consequences take effect (Loewenstein, 1996), and other variables that only minimally effect cognitive evaluation (e.g. surprisingness of an outcome, (Haselhuhn, Mellers, 2005; Mellers, McGraw, 2001; Mellers, 2000; Mellers, Ritov, Schwarz, 1999)).

The risk-as-feelings theory proposes "a distinction between anticipatory emotions and anticipated emotions. *Anticipatory emotions* are immediate visceral reactions (e.g., fear, anxiety, dread) to risks and uncertainties. *Anticipated emotions* are typically not experienced in the immediate present but are expected to be experienced in the future" (Loewenstein et al., 2001, p. 267). Anticipated emotions are the answer to the appropriate question "How will you feel when decision for alternative X leads to consequence Y?" Such anticipations become salient through deliberative thought about the object of outcome and hence must be seen more on the side of System 2. In contrast to this consequentialistic view, Loewenstein et al. centre on anticipatory (or immediate) emotions as "gut feelings experienced at the moment of making a decision, which are often quite independent of the consequences of the decision" and suggest that they "can play a critical role in the choice one eventually makes" (Loewenstein et al., 2001, p. 281). Such emotions should be counted more to the intuitive System 1 processes as unaware underpinnings of a behavior. The appropriate question for immediate emotions reads, "How do you feel in the moment of choosing alternative X?" Following this differentiation, our approach is not consequentialistic; it is an attempt to provide more insight on how immediate emotions come into play and how much explanatory power they gain. We also examine if and how immediate emotions are connected to the anticipated emotions attached to outcomes. Finally, we investigate if and how both types of emotions can explain decisions in a social and a non-social context.

3.1.4. Social and Non-Social Risky Decisions.

To find out how emotions influence such choices an experiment with three different conditions was carried out where participants could either lose (0€) or double (10€) an amount of money they received before (€5): 1) A simple coin flip as the very basic form of a risky decision. 2) A socially extended version of a coin flip, similar to the design used by Fetchenhauer and Dunning (in press). If participants bet on a coin flip and won, they would receive €10 and another anonymous person would also get €10. If they lost, participants had to return their €5 and this anonymous person would get €20. The idea of the design is to make the decision to bet on the coin relevant for another person. It could be the case that altruistic motives are at work in this situation - in a sense that people follow the logic of "enlarging the pie" (Becker, 1974; Coate, 1995) hence, are less focused on their personal pay-off compared to a simple coin flip. 3) As explained in the following section, participants faced the situation of the so-called Trust Game in the role of a person (trustor) who has to decide to trust an anonymous person (trustee) or not.

3.1.5. Social vs. Risky Decisions.

Especially in situations involving other people, decision-making under risk and uncertainty might be less based on reasoning as suggested by different critiques of the consequentialists' view on judgement and decision-making (Loewenstein et al., 2001). Such situations might be more similar to moral judgements as defined by David Hume: "They are derived from sentiment, not reason, and we attain moral knowledge by an 'immediate feeling and finer internal sense,' not by a 'chain of argument and induction'." (Hume, 1777/1960, in Haidt, 2001, p. 2). This idea may lead to an explanation that might solve the problems that expected-utility-based models face when they predict decisions with social dependencies by assuming the character of common risky choices.

As described extensively later in this article, Fetchenhauer and Dunning (in press, 2005) showed that, especially behavior in Trust Games does not follow the traditional model. The willingness to accept the vulnerability of being exploited constitutes in subject's behavior, but not in their beliefs. This opens the field to integrate emotions as a channel through which decisions in social and non-social risky situations are causally influenced.

3.1.6. How to Measure Trust Behavior?

In classical game theory, trust is analyzed as a risky option or decision under uncertainty – hence trust from this perspective is just another bet. To examine such decisions under a controlled environment, an instrument for measuring trust is needed. Starting in the 1980s (Rosenthal, 1982) and especially in the 1990s (Kreps, 1990; Berg, Dickhaut, McCabe, 1995), behavioral economists developed a behavioral measure of trust, which was ideal for the laboratory setting: the Trust Game. A variant of this game used in the present study is briefly described here.

It is played by two persons. Person A moves first, and depending on this Person B then makes the second move. Persons A (the trustors) receive an amount of *X* (e.g., €5) from the experimenter. Person A then has two options: to keep all of the money *or* to give it completely to Person B (trustee). If Person A keeps the money, the game is over. If Person A gives the money to Person B (via the experimenter), this Person B additionally receives the tripled amount of *X* (3*X*, e.g., €15) from the experimenter. So Person B then has a total of 4*X* (Person's A sent *X* + 3*X* sent by the experimenter, i.e., €20 in total) as well as two options: to keep the entire amount *or* to split it equally with Person A so that both are left with 2*X* (4*X* divided by 2, e.g., €10 for each). The willingness to trust is then measured as the proportion of Persons A who are willing to send the money to the trustee. In an analogous way, Persons' B trustworthiness equals the proportion of trustees splitting the money.

Uncertainty in this case, for Person A is represented by the behavior of Person B, which is directly connected to the chance for Person A to double (2*X*, e.g., €10) or lose the endowment (*X*, e.g., €5). In a variant of the game, uncertainty regarding Persons' B behaviors can be changed into risk by stating what percentage of the group of the responders acted trustworthy. So, for a given rate of trustworthiness of (e.g., 50%) the *rational* chooser should be indifferent due to the fact that the expected values are equal for keeping (1*X*=€5) or trusting (0.5*0*X*+0.5*2*X*=1*X*=€5). However, as empirical findings (prospect-theory by Kahneman and Tversky, 1979) show in this area of probability, people in various lotteries tend to choose the riskless option and keep the sure €5. In this sense, the result of a process of guessing chances and possible outcomes is deduced from behavior. This approach is based upon a consequentialistic perspective for Person A's process of deciding: Taking into account the possible consequences and (subjective) estimations of the linked chances of incidence leads to the corresponding behavior.

Following a long philosophical tradition beginning with Socrates and Plato and continued by Machiavelli and Hobbes (Baier, 1986), no one should trust a person as long as one has no *reason* to do so. In these definitions, one party (the trustor) should only trust another (trustee), if the trustee has a material self-interest not to abuse the trust he received from the trustor. This self-interest to reciprocate is equivalent to a return the trustee will receive in future transactions from the trustor (e.g., "loyalty rebate"). Alternatively, this could be a benefit from not suffering punishment through a third instance (e.g., law, social norms). Only under this condition has a trustor *reason* to trust, because due to sure reciprocation it is guaranteed that potential gain is higher than potential loss, which in sum equates to a positive expected utility (Coleman, 1990). This paradigm is based on the assumptions of rationality, self-interest, and common knowledge (everybody knows that everybody knows that

everyone follows his self-interest). As said before for such situations classical game theory assumes the same cognitive process of building expectations as in other common risky decisions (e.g., in a lottery).

However, the special situation of trust has to be shown as a good example for a decision-making problem where the cognitive understanding of the situation in terms of probabilities and outcomes heavily contradicts actual behavior, as reviewed in the following section.

3.2. Why Do They Trust?

In the following, a spectrum of possible explanations is reviewed for the fact that in general a majority of people acting as a trustor place their trust in Person B. Persons A generally tend to trust at substantial rates ranging from 30% up to 95% where they should never trust expecting the selfish behavior of a trustee (e.g. Eckel and Wilson, 2001, 2004a; Fetchenhauer and Dunning, 2005). This holds true for games where trustors' identities are not known to the trustee and the experimenter and the choices made totally anonymous in games played with double-blind condition. These explanations all share their origin in the consequentialistic tradition mentioned above.

One causation for the trusting behavior of Persons A seems to suggest itself: Persons A's proneness to trust might rely on their intuitive knowledge of Persons B acting in a trustworthy manner in general. This intuition should then precipitate on positive expectations Persons A have regarding the trustworthiness of Persons B.

Taking positive expectations as a main predictor for decisions to trust and a reason for excessive proneness to trust should have the following result: if people's decisions to trust rely on expectations about the behavior of the trustee (probability) and the outcomes *and*

if trustors tend to trust, trustors obviously should tend to have positive expectations. Does this hold true? In a word, no.

3.2.1. Expectations

Subjective beliefs about others' trustworthy behavior do have a significant influence on peoples' decision to trust or not to trust (Fetchenhauer and Dunning, in press). Persons A, who answer more sceptically about their expectations of the trustworthiness of Persons B, significantly less often send their money to Person B (trusted). However, other findings challenge this result, although at first sight it seems clear:

First, people do not seem to be able to estimate actual rates of trustworthiness. Underestimation of the portion of Persons B acting in a trustworthy manner is a stable result, as shown by Fetchenhauer and Dunning (in press). The difference between subjective beliefs and the actual proportion of trustworthy Persons B lay between 31.3 and 34.1 percentage points across the two studies.

Second, comparison of trustors' actual rates of trust with their subjective beliefs about the trustworthiness of the trustee, taking into account individual tolerance of risk, shows that trustors generally 'trust too much' respective to their expectations. In these studies, participants had to express their tolerance of risk in a lottery question by stating minimum needed chance of winning to bet their stake. Additionally, they had to estimate the percentage of Persons B acting trustworthily, their subjective beliefs. A comparison of these values for every participant leads to a value of how many participants rationally should have trusted in Person B. If one demanded a minimum chance to win of 50% in the lottery and at the same time estimated 60% of Persons B acting trustworthy, it was rational to trust. Given this calculation a minority of Persons A, only 30.6%, rationally should have given their money to Persons B. However, the actual rate of trust was 70.5% (Fetchenhauer and Dunning, in press). This result was confirmed by a second study of Fetchenhauer and

Dunning (in press) with 30.7% of participants who rationally should have handed their money over to Person B. A weak relationship between behavioral risk measures and the decision to trust was also confirmed by Eckel and Wilson (2004b).

Therefore, trustors' expectations will simply not fit with their actual behavior, even taking into account individual risk preferences. Obviously, expectations and risk preferences only explain a small part of variations in trusting behavior.

Therefore, expectations are not a main predictor for the decision to trust. Alternatively, are high trusting rates caused by peoples' ignorance with regard to their expectations? People may tend to suppress whispers of rationality because they are playing a game with hypothetical outcomes? Hence, one might argue that people surely tend to take a higher risk in their decision to trust if these games are with hypothetical outcomes. Hence, high trust rates might be just an artifact of experiments using hypothetical outcomes. Does this hold true? The answer is no.

3.2.2. Hypothetical Outcomes

In strong contrast to the gambling hypothesis, Fetchenhauer and Dunning (in press) found that participants were even more, not less, likely to trust in a real than in a hypothetical situation. More reality was induced by playing with real money, which was earned in one hour of work before the experiment started. Moreover, people were even *more* willing to trust when decisions were made more real in a trust game, contrary to the fact that the more real circumstances in a lottery scenario (rationality paradigm) made them more risk-averse. In a more real situation, in contrast to a purely hypothetical one, participants' rates of trust significantly exceeded the rate at which they should have trusted acting rationally (Fetchenhauer and Dunning, 2005, Study 2). Hence, high trust rates and trusting too much given pessimistic beliefs at the same time cannot be explained with the mentioned *unreal* experimental conditions.

3.2.3. Altruism

Trust might be driven by *altruistic motives* of Person A. If I give away my €5 and the bad case of Person B keeping the whole amount comes true, at least *somebody* has €20 and €20 is more than my kept €5. So, sending the money to Person B in every case brings €20 in the world, either in the form of €10 for each of us if Person B acts trustworthily, or in the form of the €20 kept by Person B. Do participants really give away their money to "enlarge the pie" or maximize welfare selflessly for members of the group (Becker, 1974; Coate, 1995)?

This argument was also examined by Fetchenhauer and Dunning (2005, Study 4). Like in this study, they compared a discrete trust game situation with two coin-flip situations, all three situations with the same pay-off structure. The coin-flip situation contained one condition *with* and a second condition *without* possible profit for another person. *Without* possible profit for another meant that participants just had to decide if they want to keep 5$ for definite or to flip a coin with a 50% chance to win 10$. *With* possible profit for another meant that the coin-flip condition without possible profit for another was *socially extended*: if participants bet on a coin flip and won, they would receive $10 and another person from a previous session of the experiment would also get $10. If they lost, they had to return their $5 and another Person would get $20. Altruistic motives are expected to be at work, if both situations involving another person (the trust game and the extended coin-flip with possible profit for another Person) show equal rates of choosing the risky option (trust or bet on the coin-flip) and if these rates are higher than in the situation just effecting benefit of Persons A (simple coin-flip without possible profit for another Person).

With a sample of psychology students at Cornell University, it turned out that players showed equal rates of choosing the risky option (betting) in both coin-flip situations – the one with possible

positive outcomes for another Person and the one just affecting the players' own benefit (both 28%). Nevertheless, in this trust game, 59.3% of Persons A chose to send their money to the responder. So, altruistic motives of welfare-maximization could not explain the motivation to trust in this context.

3.2.4. Fairness

If altruism cannot explain trusting behavior, what about another common social phenomenon – *fairness*? Perhaps the wish of Person A to carry on and stabilize social norms finds expression in a preference for equal outcomes as an applied rule of equality. This preference may also be expressed as an intrinsically motivated (and not intentional) inequity aversion, which has already explained behavior in other co-operative games (Fehr and Schmidt, 1999). Hence, fairness might also be a reason for choosing the risky option in the trust game. Does this hold true? To some extent yes, but ultimately no. Yes, to some extent.

Fetchenhauer and Dunning (2005) played a trust game with an endowment equality condition, meaning that Persons A were told that Persons B would get equal amount of money (€10) if Persons A decided to keep their endowment of €10 for sure. Participants taking part in this condition took the risky option of placing trust in Person B significantly less often compared to the condition where Persons B would receive no endowment in the case of Person A keeping the money. This influence could be described as self-centered fairness, lowering trust rates as long as Persons A know that they do not harm Persons B by deciding not to trust (trust rate decreases from 70.9% to 56.6%).

But the rate of trust of Persons A in the endowment equality condition (56.6%) still greatly exceeded the rate at which they would take an equivalent risk in a lottery with the same probabilities – a situation where inequality aversion motives are not applicable

(23.2%). So, Persons A still trusted too much, from the perspective of the classical rational-choice theory.

The ultimate answer is 'no' because preference for equal outcomes explains only a small part of variation of trusting behavior in the trust game, due to the fact that a substantial rate of about 57% of Persons A still trusted without a chance to apply norms of fairness.

To sum up the series of experiments, Fetchenhauer and Dunning (in press) showed that this premise does not apply to the situation of trust. Despite being very skeptical about the rate of trustworthiness of the group of anonymous trustees (underestimating it about 30-35%) people tend to trust overwhelmingly. Furthermore, comparing the individual minimal demanded chance to win in a lottery with the trust behavior, given the subjective beliefs about the trustworthiness of the beneficiaries, revealed that only a minority on about 30% should have trusted given rational standards. In this sense, people are risk-averse when the situation is framed as an ordinary lottery (coin flip) and risk-seeking when framed as a situation of trust, meaning that they *trust too much*. This difference also cannot be explained with the eventually hypothetical character of the situation. These findings demonstrate in sum that expectations, unreality of the game and motives of altruism and fairness cannot explain the stable high trust rates found with trust games.

That induced (incidental) emotional states influence trust decisions already was shown by Dunn and Schweitzer (2005). But this study takes a different approach as suggested by Schlösser (2006) by focusing on the role of emotions arising from the decision itself (immediate emotions) and from those attached to the anticipated outcomes. How do such emotions predict the behavior of the decider? What role(s) do differing specific emotions play when deciding under risk in situations with (Trust Game, Extended Coin Flip) and without social dependencies (simple coin flip). Furthermore,

we show that not only anticipated emotions attached to the outcomes influence decisions, but that (immediate) emotions emerging from the decision problem itself take strong effect on actual behavior. In order to conceptualize that differentiation our attempt is an operationalization of the *Risk-as-Feelings* hypothesis (Loewenstein et al., 2001).

Up to now, immediate emotions were merely objects of research; we do not have a specific theory about their content. However, it seems to be reasonable that these contents may vary depending on situation and individual differences. However, it also seems to be reasonable to hypothesize that if these variations exist they should influence decisions. Therefore, with respect to the emotional content the following studies are explorative.

3.2.5. Predictions

We want to elucidate the role anticipated and immediate emotions play when choosing risky options with and without social dependency. Therefore, we ask several questions. On a bivariate level, first we analyze to what extend the decision to take or avoid a risk was *directly* influenced by the change in situation (coin flip, Extended Coin Flip, Trust Game)? Then we ask, how were anticipated and immediate emotions connected to the decision? How did both of them differ regarding the type of situation? Were differences in occurrence of specific emotions in the situations responsible for changes in behavior? For example, were people prone to trust more than gambling because of emotions specific to trust?

With a binary-logistic regression analysis then we ask to what extend both types of emotions independently and together have predictive power for the decision to take a risk. To enrich our findings and understand the results of the regressions better, we then ask how emotions were related to each other - are immediate emotions only reflections of anticipated emotions or do they independently and substantially change decisions? How anticipated emotional states

relate to each other dependent of being anticipated in a social or non-social context? Are immediate emotions connected to take a risk can be said to be mirrors of those perceived when going with the save option? We then ask the question if emotions potentially mediate the effect of changes of the situation to changes in decisions. Finally, we ask if effects of anticipated emotions are the result of rather exact anticipations or biased illusions.

3.3. Method

3.3.1. Participants

Visitors of a lecture at the University of Cologne in Germany (n=189, 64 male, 125 female) took part in the study. All participants were between the ages 21 and 56 (*M*=24.76, SD=3.25). Most of them studied business administration (70.3%), some economics, or social sciences (12.1%), the rest other majors.

3.3.2. Material and Procedures

Participants were assigned to one of three experimental conditions: the coin flip (64), the Extended Coin Flip (66) and the Trust Game (59). The experiment was split into two sessions. In the first session, all participants received an envelope containing the questionnaire with €5 and had to decide to keep or risk the money to eventually double the amount to €10. In a second session, one-week later individual outcomes were revealed. In the meantime, the coin flip was conducted and videotaped to be shown in the second session.

In both coin flip conditions, participants faced the risky option to eventually double their €5, with a 50%, chance of losing it and leaving with €0. In the Trust Game due to prevent the participants doubt about the realness of the situation the probability to meet a trustworthy Person B was set to 48%. Anonymity was assured by an individual password. For each of the three different conditions, the logic of the specific situation (Trust Game, coin flip, Extended Coin

Flip) was described. Wording was held constant as much as possible in these descriptions. At this time, participants did not know that they would play the game themselves later on. After a few control questions regarding the logic of the situations, it was announced that they now would play the game in real life, as Person A. The participants then had to indicate their emotional states via the Self-Assessment-Manikin (SAM; Lang, 1980; see Chapter 2.2.1 (p.15) for the description of the instrument) thinking about all four possible *anticipated* outcomes (*keep & win*, *keep & lose*, *bet/trust & win*, *bet/trust & lose*) with the following verbalization of the situations. Accordingly, the wording of these questions given in the three different conditions only differed in the necessary parts.

For the simple coin flip these questions read as follows:

Coin Flip. In this simple coin flip, participants had to decide to bet €5 with a 50% chance of doubling it to €10. If they lost, they would receive nothing.

1.) *keep & win*: "Imagine you decide today to keep the €5 and not to participate in the coin flip. Then, next week, you learn that you would have won. This means that you get a total of €5."

2.) *keep & lose*: "Imagine you decide today to keep the €5 and not to participate in the coin flip. Then, next week, you learn that you would have lost. This means that you get a total of €5."

3.) *bet/trust & win*: "Imagine you decide today to bet the €5. Then, next week you learn that you have won. This means that you get a total of €10."

4.) *bet/trust & lose*: "Imagine you decide today to bet the €5. Then, the next week, you learn that you have lost. This means that you get a total of €0."

All scenarios ended with the question "How would do you feel in this situation?" In addition, each was followed by a SAM measurement.

In the following section regarding immediate emotions, participants then were asked to concentrate on emotions they sense immediately before they come to their decision:

“Now it is about the feelings you sense now, right in this moment immediately before you actually make your decision. So, please concentrate on the upcoming decision and describe the feelings connected to this.”

For both possible immediate situations of betting *or* keeping the money, participants then had to indicate their emotional state again via SAMs after the following questions:

1.) “Imagine you decide now to bet the €5 on flipping the coin. How do you feel about this?”

2.) “Imagine you decide now to keep the 5€ by not flipping the coin. How do you feel about this?”

After these questions, and before presenting the SAMs for each of the questions, the following was added: “Please fill out the following SAMs in any case, even if you won’t decide in this way.”

Then, we asked the participants to make their concrete decision regarding if they would like to flip the coin and, if so, tell us their winning side. Those *not* betting just kept the money they received; those taking the chance to double the money returned the €5 to the envelope. Once everybody finished, questionnaires were collected. One week later, we presented the result of the coin flip.

Extended Coin Flip. The simple coin flip was extended by introducing another Person, Person B, eventually receiving money as well, dependent on participant’s decision. Participants could decide to keep or bet the €5. In the case of wining the bet, not only the decider himself but also a randomly chosen Person B from another experimental group would receive €10. If the gamble was lost, this Person B would receive €20, the decider €0.

The emotions regarding the emotions in all anticipated scenarios were questioned as follows.

1.) *keep & win*: “Imagine you decide today to keep the €5 and not to participate in the coin flip. Then, next week you learn that you would have won. This means, you get a total of €5 and Person B gets €0.”

2.) *keep & lose*: “Imagine you decide today to keep the €5 and not to participate in the coin flip. Then, next week you learn that you would have lost. This means you get a total of €5 and Person B gets €0.”

3.) *bet/trust & win*: “Imagine you decide today to bet the €5 in the coin flip. Then, next week, you learn that you have won. This means, you get a total of €10 and Person B gets €10.”

4.) *bet/trust & lose*: “Imagine you decide today to bet the €5 in the coin flip. Then, next week, you learn that you have lost. This means, you get a total of €0 and Person B gets €20.”

The introduction and questions regarding immediate emotions were asked the same way like in the simple coin flip condition.

Trust Game. Then the logic of the trust game was explained in principle. Then, it was announced that that Person B is drawn to them is allotted from another experimental group, *which has already made its decision*. Participants were told that 48% of the trustees had already decided to act trustworthily and 52% would not do so. As said before, this was due to minimize suspicion regarding the realness of the situation. But we would argue that this value is close enough to the 50% so that it should be comparable to both other conditions. The understanding of the possible outcomes as a consequence of the trusting behavior of Person A and the allotted Person B, as well as the grade of fixed trustworthiness (48%), was then tested by control questions. Afterwards the participants had to

indicate their emotional states via SAM thinking about all four possible *anticipated* outcomes:

1.) *keep & win*: "Imagine you decide today to keep the €5. Next week, you learn that allotted Person B would have given you €10 back. This means, you get a total of €5 and Person B gets €0."

2.) *keep & lose*: "Imagine you decide today to keep the €5. Next week, you learn that allotted Person B would have kept the full amount of €20 for herself. This means, you get a total of €5 and Person B gets a total of €0."

3.) *bet/trust & win*: Imagine you decide today to give the €5. Next week, you learn that Person B decided to keep €10 for himself and send you €10. This means you receive a total of €10 and Person B receives a total of €10."

4.) *bet/trust & lose*: Imagine you decide today to give the €5. Next week, you learn that Person B would have kept €20 for herself and send €0 to you. This means, you get a total of €0 and Person B gets a total of €20."

For both possible immediate situations of trusting *or* keeping the money, participants then had to indicate their emotional state again via SAMs after the following questions to the question "How do you feel about this?":

1.) "Assume you give the 5€ you just received to Person B."

2.) "Assume you keep the 5€ you just received."

In the second session then, one week later, all participants in all three conditions received an envelope with their individual password printed on. In that they found the description of their individual outcome and the respective amount of money together with a short questionnaire asking how they feel now with their actual outcome.

For capturing emotional states for the anticipated outcomes and within the immediate alternatives to take the risk or the save option a specific method of measuring was used.

Clustering Emotional States. In this study, the similar method of clustering emotional states as described in Chapter 2.3.2 (p.25) was applied. All individual emotional profiles from all emotional measures within the six situations (two immediate, four anticipated) recorded by the SAM were classified using a two-step cluster analysis[7]. This cluster process is open in number, so for different scenarios possibly a different number of clusters were extracted.

In a second step for easier handling and understanding, these clusters were labeled at least with one emotional term of the emotional dictionary (Fischer and Brauns, 1998). If more than one word is mentioned in the following descriptions, this happens with decreasing degree of specification. As stated above, our analysis of emotional content is explorative. The emotional labels given to clusters should help us to understand what is going on. We do not claim that every subject captured in the clusters of averaged emotional states feels like we describe it. However, it is an attempt to understand and these labels mostly make much sense in our context.

3.4. Results and Discussion

Over all three conditions, 102 of 189 participants decided to keep the money (54%). In the situation of a simple coin flip, a minority of 28% (18 of 64) of participants decided to bet their money on the flip of the coin. On the contrary, in the socially Extended Coin Flip condition, exactly half (33 of 66 participants) of the participants flipped the coin. In the Trust Game, then, the majority (36 of 59) of participants (61%) decided to trust an anonymous Person B. The difference between the risk rates in the coin flip and the Trust Game was significant

[7] applying a log-likelihood-approximation using the Aikaike's Information Criterion for goodness of fit

($p<.001$), as was the difference between the coin flip and Extended Coin Flip (28% vs. 50%, $p<.01$); the difference between the Extended Coin flip (50%) and the Trust Game (61%) was not significant ($p<.22$).

How can these differences in risk-rates be explained by the emotional states participants faced in the particular situation? Hence, we want to answer the question if the differences in behavior can be explained by the emotional perception of the decision situation itself (immediate emotions) as well as of the emotional perception of the outcomes in that specific condition (anticipated emotions). Does the specific situation of the Trust Game raise different emotions than the situation of flipping a coin? Are these emotions different from those experienced in the socially extended version of a coin flip? In addition, are these eventually occurring differences responsible for different risk rates within the different situations? To inquire about these questions we first will give an overview of the measured and clustered emotional states in the four anticipated and two immediate scenarios.

scenario	keep & win		keep & lose		bet/trust & win				bet/trust & lose	
cluster no.	1	2	1	2	1	2	3	4	1	2
cluster label	easygoing	confused	masterly	unprepossessed	undismayed	triumphantly	competent	delighted	anxious	regretful
a) mean values within the emotional clusters from 1 (low) to 5 (high)										
Valence	3.39	2.22	4.61	3.66	3.95	5.00	5.00	5.00	1.06	2.22
Arousal	1.87	3.22	2.59	2.43	2.75	4.12	1.50	3.54	4.30	3.02
Dominance	3.06	2.72	4.18	2.94	3.58	5.00	4.10	3.77	2.08	2.89
b) share of clusters within experimental conditions										
Trust Game	24.6	75.4	57.6	42.4	30.5	13.6	37.3	18.6	49.1	50.9
Extended Coin Flip	45.5	54.5	37.8	62.2	27.7	21.5	23.1	27.7	18.8	81.3
Coin Flip	44.0	56.0	73.0	27.0	6.3	29.7	20.3	43.8	34.9	65.1
c) bet/trust rates within experimental conditions										
Trust Game	57.1	65.1	58.8	64.0	33.3	75.0	77.3	63.6	51.7	70.0
Extended Coin Flip	56.6	44.4	28.0	63.4	38.8	50.0	46.6	61.1	16.6	55.7
Coin Flip	19.2	35.1	21.7	41.2	25.0	21.0	23.0	35.7	13.6	36.6

Note: due to rounding some sums might not add up to exactly 100%

Table 7: Study 5: Emotional Cluster-Memberships for the Four Anticipated Scenarios within the Three Experimental Conditions.

3.4.1. Anticipated Emotional States

Which emotional states were anticipated for the scenario of going with the save option, keeping the money, and learning that one would have won?

keep & win. In the situation of *keep & win,* participants were asked to imagine the outcome of keeping the money and then learning that they would have profited either by winning the coin flip or by Person B acting trustworthy. Therefore, this scenario is about doing the sure thing and learning that it would have been better to choose the risk – a good reason to be disappointed. Two emotional states could be identified with the cluster analysis: 62.4% of the participants were grouped as feeling *confused* (Cluster 2), while 37.6% as feeling *easygoing* (Cluster 1).

How do these emotional clusters interact with the decision to take a risk? Of those grouped as *confused,* 49.1% decided to give the money away, those captured as *easygoing* about keeping & winning 42.8% later risked the money – so overall no significant interrelation of the emotional states to the decision could be found (ϕ=.06, p<.41).

How were these two groups distributed over the three conditions? Accordingly, did the occurrence of one of the two identified emotional states attached to the anticipated outcome of *keep & win* differ with regard to the framing of the decision-problem? With one word: yes. Experimental conditions significantly influenced emotional cluster membership (ϕ=.183, p<.044). This fact is reflected in the majority (75.4%) of the participants feeling *confused* in the Trust Game, but only 54.5% in the Extended Coin Flip and 56% in the simple coin flip (Table 7b, p.85). Hence, the different framing raised different emotional responses.

Was the occurrence of specific emotions in the experimental variation of the framing of risk responsible for changes in behavior? Hence, was the distribution of emotional clusters connected to the

decisions in the three conditions? In the Trust Game, a majority of 65.1% of the larger cluster of *confusion* sent their money to Person B (Table 7c, p.85). Of those who felt *easygoing,* 57.1% decided to give away their money (ϕ=.07, p<.59). In the condition of the Extended Coin Flip, 44.4% of those grouped as *confused* and 56.6% of those grouped as *easygoing* bet their €5 (ϕ=-.122, p<.32). In the simple coin flip, the difference of 15.9 percentage points between the bet rates of the two emotional clusters (*confused* 35.1%, *easygoing* 19.2%) seemed to be more substantial but (similar to both other situations) did not reach significance (ϕ=.173, p<.17).

Hence, it can be said that the specific occurrence of the identified emotional states in the case of anticipating the scenario of *keep & win* did not significantly influence the decision to take a risk. However, it should be noted that most of those participants facing a trust situation were grouped as 'confused' (75.4%), and that this was the cluster that over all reached the highest risk rate – although the small difference in risk rate compared to the '*easygoing* cluster' within that situation led to the insignificant result.

Which emotional states were anticipated for the scenario of going with the save option, keeping the money, and learn that one would have lost?

keep & lose. In the scenario *keep & lose* participants were asked to imagine the outcome of keeping the money and learn that they would have lost either by losing the coin flip or another Person B revealing not to act trustworthy in the Trust Game. Therefore, this scenario is about doing the sure thing and learn that this was the right decision. Two emotional states could be identified with by the cluster analysis: 44.1% of the participants were grouped as feeling *unprepossessed* (Cluster 2), 55.9% as feeling *masterly* (Cluster 1).

How these emotional clusters interact with the decision to take a risk? Of those grouped as *unprepossessed* 59% decided to give the money, those captured as *masterly* about keeping & losing a minority

of only 35.2% later set the money on stake. So over all the bet rate of the cluster labeled *unprepossessed* was significantly higher (23.8 percentage points) so a significant interrelation of emotions and decision could be found (ϕ=.237, p<.001).

How these two groups were distributed over the three conditions? Accordingly, did the occurrence of one of the two identified emotional states attached to the anticipated outcome of *keep & lose* differ with regard to the framing of the decision-problem? For example, in which condition was the cluster labeled *masterly* dominant? In the Trust Game, 57.6% of participants belonged to this cluster, whereas in the Extended Coin Flip it was a minority of 37.8% and in the simple coin flip a majority of 73%. Hence the interrelation of experimental conditions with emotions was substantial (ϕ=.294, p<.001) (Table 7b, p.85).

Was the occurrence of specific emotions in the three experimental conditions responsible for changes in behaviors? That is, was this distribution of emotional clusters connected to the decisions in the three conditions? The answer is 'no' for the Trust Game and the simple coin flip but as 'strong yes' for the Extended Coin Flip (Table 7c, p.85). In the Trust Game, 58.8% of those grouped as *masterly* and 64% of those grouped as *unprepossessed* imagining keeping & losing, still trusted (ϕ=.052, p<.69). In the Extended Coin Flip, a minority of 28% of those grouped as *masterly* bet their money, but 63.4% of those belonging to the other cluster bet their money – a significant interrelation (ϕ=.344, p<.005). In the simple coin flip, only 21.7% of those labeled *masterly* decided to bet their money, of those labeled *unprepossessed* 41.2% (ϕ=.194, p<.123).

So, the difference in betting rates between the clusters was found to be the smallest within the Trust Game and largest within The Extended Coin Flip. Obviously, participants facing a situation of trust are merely influenced by the emotions connected to a forgone chance (*keep & lose*). For all three conditions the over all result was

resembled: those grouped as feeling *masterly* when anticipating keeping & losing the money choose less often to take the risk than those labeled as *unprepossessed*, which makes sense. So which emotional states then were anticipated for the scenario of taking the risk and learn that one would have won?

bet/trust & win. In the scenario *bet/trust & win*, participants were asked to imagine the outcome of betting the money (or trusting) and learning that they would have won, either by betting on the right side in the coin flip or another Person B acting trustworthy in the Trust Game. This scenario asks for the best situation for the decider: to risk something and being rewarded for that at the end. Four emotional states could be identified with the cluster analysis: 21.3% of the participants were grouped as feeling *undismayed* (Cluster 1), 21.8% as *triumphantly* (Cluster 2), 26.6% as *competent* (Cluster 3) and 30.3% as *delighted* (Cluster 4). Of the participants, 35% in the '*undismayed* cluster', 41.4% in the '*triumphantly* cluster', 54% in the '*competent* cluster' and 49.1% of those in the '*delighted* cluster' decided to bet their money. The range of betting rates (19 percentage points) was not large enough to constitute significant affect of emotional states on the decision (ϕ=.142, p<.29).

How were these four groups distributed across the three conditions? Did participants in the different experimental conditions perceive this scenario differently? Yes, they did. In the Trust Game, a majority was grouped either as *undismayed* (30.5%) or *competent* (37.3%), and a minority as either *triumphantly* (13.6%) or *delighted* (18.6%) (Table 7b, p.85). In the Extended Coin Flip, all clusters occurred fairly equally (ranging from 21.5% to 27.7%). However, the strongest differences were manifest in the simple coin flip: only 6.25% of those participants were labeled *undismayed* in this situation, 20.3% were grouped as *competent*, 29.7% as *triumphantly* and 43.75% as *delighted*. Obviously, the cluster distribution within the Trust Game and the coin flip was almost diametric. Hence, a highly

significant interrelation of the experimental condition with emotional states was found (ϕ=.361, p<.001).

Was the distribution of emotional clusters connected to the decisions in the three conditions? Was the occurrence of specific emotions in the different conditions responsible for changes in behavior? The answer is 'yes' for the Trust Game but 'no' for both other conditions.

In the Trust Game, the majority (77.3%) of those captured as *competent* trusted an allotted Person B (Table 7c, p.85). 75% of those regarded as *triumphantly* and 63.6% of those *delighted* did the same. But only a minority of 33.3% of those grouped as *undismayed* did so – a significant interrelation of clustered emotional states and decision occurred (ϕ=.389, p<.03).

In the Extended Coin Flip, 61.1% of those grouped as *delighted*, 50% of those labeled as *triumphantly*, 46.6% of those captured as *competent* and 38.8% of those clustered as *undismayed* choose to bet - so no significant connection to the decision could be found (ϕ=.168, p<.61). In the simple coin flip, only 25% of those grouped in the minimally occurring cluster of *undismayed* chose to set the money on stake, 21% of those labeled *triumphantly*, 23% of those labeled *competent* and 35.7% of those grouped as *delighted* chose to bet - so no significant connection to the decision could be found here (ϕ=.151, p<.69).

In the situation of trust, a majority of 37.3% of the participants were grouped as feeling *competent* when learning about taking the risk to trust somebody and learn that Person B acted in a trustworthy manner. In both non-social situations, this *competent* cluster accounted only for 20.3%-23.1% of the participants. Of this '*competent*' group, 77.3% trusted and also 75% of those labeled '*triumphantly'* did so too. Obviously, if there is an anticipated feeling that drives behavior in the Trust Game it is the prospect of being

confirmed that it is a good thing to trust somebody. One then is allowed to perceive herself as being a *competent* person. Interestingly, the emotional states of feeling *delighted* in such case occurred only strongly in the simple coin flip (43.75%) but just to a minor degree in the Trust Game (18.6%). Furthermore, the state of feeling *undismayed* has its highest portion in the Trust Game (30.5%) and its lowest within the trust situation (6.25%). We interpret this data as clear signs for the situation of trust emotionally being differently perceived from a simple lottery and that an increase in giving does not go along the same emotional path within the different scenarios. Which emotional states then were anticipated for the last worst-case scenario of taking the risk and learn that one would have lost?

bet/trust & lose. In the scenario of *bet/trust & lose* participants were asked to imagine the outcome of betting the money (or trusting) and learn that they would have lost either by betting on the wrong side in the coin flip or due to another Person B *not* acting in a trustworthy manner in the Trust Game. This scenario asks for the worst situation for the decider, to risk something and then be penalized for the risk. This prospect of loss might raise regret or other negative emotions. Two emotional states could be identified. Over all three experimental conditions, a majority of participants was grouped as *regretful* (66.1%) or others *anxious* (33.9%). Of those captured as *anxious* over all only 31.7% bet the money, of those *regretful* a majority of 52.8% gave their money away. This overall interrelation of emotional clusters with the decision yielded significance (ϕ=.20, p<.006).

How were these two groups distributed over the three conditions? Did participants in the different experimental conditions perceive this scenario differently? Yes, they did. In the Trust Game, 49.1% of the participants could be found in the cluster *anxious*, and a thin majority of 50.9% in the cluster of *regretful* (Table 7b, p.85). On the contrary, in the Extended Coin Flip, only a minority of 18.75%

of the participants was grouped as *anxious* but the rest (81.25%) were grouped as *regretful*. In the condition of the simple coin flip, 34.9% were labeled as *anxious* and 65.1% as *regretful*. Therefore, the cluster *regretful* was most prevalent to the Trust Game and least relevant to the Extended Coin Flip. Hence, the experimental condition was significantly connected to the cluster-memberships of emotional states (ϕ=.261, p<.002).

Was the distribution of emotional clusters connected to the decisions made within the three conditions? Was the occurrence of specific emotions in the different conditions responsible for changes in behavior? The answer is 'no' for the Trust Game, a 'yes' for the Extended Coin Flip and a rather 'weak yes' for the simple coin flip (Table 7c, p.85). In the Trust Game, 51.7% of those in the '*anxious* cluster' trusted, but 70% of those labeled *regretful* did so (ϕ=.187, p<.15). In the Extended Coin Flip, only 16.6% of the *anxious* bet their money, but a majority of 55.7% of the '*regretful* cluster' did the same – yielding a significant connection (ϕ=.305, p<.015). In the situation of a simple coin flip, only 13.6% of those in the '*anxious* cluster' took the risk, but 36.6% of those grouped as *regretful* did so – a marginally significant relation (ϕ=.242, p<.055). This picture makes it clear that despite participants being in a clustered emotional state of anxiety and regretfulness, they were prone to trust in the Trust Game. In both other conditions, anxiety clearly hindered participants from taking the risk.

To sum up, the bivariate analysis revealed that the cluster-membership within all four anticipated scenarios significantly differed by varying experimental conditions. Hence, the framing of the situation affected the anticipated emotions. Furthermore, it can be said the emotional content of the scenario of *bet/trust & lose* only influenced the decisions in the socially Extended Coin Flip, and marginally in the simple coin flip. The same was true for the scenario of *keep & lose*.

The decision to trust was significantly influenced only by the emotional content perceived for the situation of trusting and learning that Person B acted trustworthy (*trust & win*). Those participants grouped as anticipating feeling '*competent*' in that situation, were prone to trust the most. The emotional content of this scenario had no significant influence on the decisions in both other experimental conditions.

scenario	bet/trust				keep			
cluster no.	1	2	3	4	1	2	3	4
cluster label	sceptic	perplexed	challenging	curious	interested	easygoing	shy	surprised
a) mean values within the emotional clusters from 1 (low) to 5 (high)								
Valence	3.12	2.47	3.78	4.11	4.22	4.03	2.36	2.74
Arousal	2.15	4.16	4.11	3.31	3.56	1.69	3.21	3.15
Dominance	2.98	2.48	4.19	3.25	3.15	3.41	1.83	3.15
b) share of clusters within experimental conditions								
Trust Game	35.6	25.4	8.5	30.5	8.5	22	25.4	44.1
Extended Coin Flip	21.2	36.4	25.8	16.6	16.6	25.8	31.8	25.8
Coin Flip	26.6	39	23.4	10.9	17.2	43.7	9.4	29.7
c) bet/trust rates within experimental conditions								
Trust Game	52.4	66.6	60	66.6	60	69	73.3	50
Extended Coin Flip	21.4	25	82.4	90.9	36.4	29.4	61.9	64.7
Coin Flip	5.8	28	46.6	42.8	9.1	25	33.3	42.1

Table 8: Study 5: Emotional Cluster-Memberships for the two Immediate Scenarios within the Three Experimental Conditions.

3.4.2. Immediate Emotions

Up to this point, only emotions attached to the anticipated outcomes were analyzed; we now switch to the emotions connected to the decision itself.

bet/trust. In the scenario of *bet/trust,* participants were asked to indicate how they would feel about betting the money (or trusting) immediately before they made their actual decision. Four emotional states could be identified: over all three experimental conditions, 33.9% of participants were grouped as *perplexed* (Cluster 2), 27.5% as *skeptic* (Cluster 1), 19.6% as *challenging* (Cluster 3), and 19% as *curious* (Cluster 4). Of those captured as *perplexed,* over all 35.9% bet the money. Of those grouped as *skeptic* 28.9% gave their money away. On the contrary, a majority (64.9%) bet the money of those clustered as *challenging* and 69.4% of those in the '*curious* cluster'. This describes a strong overall interrelation of emotional clusters with the decision (ϕ=.341, p<.001).

How were these two groups distributed over the three conditions? Did participants in the different experimental conditions perceive this scenario differently? Yes, they did.

In the Trust Game a part of 35.6% of the participants could be found in the cluster *skeptic*, 25.4% in the '*perplexed* cluster', 30.5% in the *curious* and 8.5% in the '*challenging* cluster' (Table 8b, p.94). In the Extended Coin Flip, the '*skeptic* cluster' was represented by 21.2% of the participants; 36.4% were labeled as *perplexed*, 16.6% as *curious* and 25.8% as *challenging*. In the condition of the simple coin flip, 26.6% were found with the label *skeptic*, 39% with *perplexed*, 10.9% with *curious* and 23.4% with *challenging*.

Hence, the strongest difference of these patterns occurred for the membership of the '*curious* cluster': only in the Trust Game a substantial part (30.5%) of the participants were found in this cluster. And it is also the situation of trust which where taking a risk

obviously is not perceived as a challenge: Only 8.5% of the participants in this situation were labeled as feeling '*challenging*'; in both other situations, this cluster occurred with a share of 23.4-25.8%. The patterns of cluster distribution for the Extended and the simple coin flip were quite similar. Hence, the experimental condition was significantly connected to the cluster-memberships of emotional states (ϕ=.293, p<.013).

Was the occurrence of specific immediate emotions in the different experimental conditions responsible for changes in behavior? That is, was the distribution of emotional clusters connected to the decisions in the three conditions? The answer is 'no' for the Trust Game, a 'strong yes' for the Extended Coin Flip and a 'weak yes' for the simple coin flip.

In the Trust Game 52.4% of those in the '*skeptic* cluster' chose to trust anonymous Person B, 66.6% of those labeled as *perplexed* did so, too (Table 8c, p.94). Also 2/3 of those grouped as *curious* and 60% of those in the '*challenging* cluster' decided to trust. So no interrelation of the emotional cluster-membership the decision could be found regarding the immediate emotions connected to trust (ϕ=.137, p<.78).

In the Extended Coin Flip, the opposite is the case: here a strong connection of the decision to bet on the coin and the emotional clusters could be found (ϕ=.616, p<.001). Of those in the *skeptic* cluster, 21.4% decided to bet, as did 25% of those labeled *perplexed*. However, almost 82.4% of those within the '*challenging* cluster' and 90.9% of the *curious* decided to take the risk.

In the condition of a simple coin flip only 5.8% of those captured in the '*skeptic* cluster' chose to bet, as did 28% of those labeled *perplexed*. 46.6% of those grouped as *challenging* and 42.8% of the *curious* took the risk. This constitutes only a marginally

significant interrelation of the decision and the clustered emotional states within this condition (ϕ=.341, p<.059).

These distribution patterns are more similar for the Extended and the simple coin flip in the sense that, in the *challenging* and the *curious* clusters, more participants chose the risk then those in the *skeptic* and the *perplexed* clusters. Interestingly the differences of the risk rates between these two blocks (*skeptic & perplexed* and *challenging & curious*) are the strongest for the Extended Coin Flip, reaching 63.45 percentage points.

On the contrary, in the Trust Game a majority of those in the *skeptic & perplexed* block chose to trust (59.5%). Only slightly more (63.3%) of those in the *challenging & curious* clusters did the same. To the extreme contrary, only 5.8% of those labeled *skeptic* took the risk of a coin flip, but 52.4% did so in the situation of trust. Those grouped as '*curious*' were most abundant in the trust situation (30.5%, Extended Coin Flip 16.6%, coin flip 10.9%); of these, two-thirds decided to trust. Again this shows that the proneness to risk does not follow the same emotional path within the different situations.

Which emotional states, then, were perceived for the immediate scenario of going with the save option and keep the money? And how did these emotions influence the decision to take a risk within the different situations?

keep. In the scenario of *keep,* participants were asked to indicate how they would feel about keeping the money immediately before they made their actual decision. Four emotional states could be identified: over all three experimental conditions, a minority of the participants of 14.3% was grouped as *interested* (Cluster 1), 30.7% as *easygoing* (Cluster 2), 22.2% as *shy* (Cluster 3) and a majority of 32.8% as *surprised* (Cluster 4).

Of those captured as *interested* thinking about keeping the money, over all only 29.6% bet the money. Within the '*easygoing* cluster' 36.2% set their money on stake. Of those grouped as *shy* a majority of 61.9% did so and of those *surprised* 51.6%. This describes a moderate overall interrelation of emotional clusters with the decision (ϕ=.232, p<.017).

How were these two groups distributed over the three conditions? Did participants in the different experimental conditions perceive this scenario differently? Yes, they did.

In the Trust Game, only 8.5% of the participants within this condition could be found in the *interested* cluster (Table 8b, p.94). A further 22% were grouped as *easygoing*, 25.4% as *shy* and the majority of 44.1% as *surprised* to keep the money.

Within the Extended Coin Flip condition, 16.6% were labeled as *interested*, 25.8% as *easygoing*, a majority of 31.8% as *shy* and 25.8% as *surprised*.

In the simple coin flip condition, 17.2% of the participants were captured as *interested*, a majority of 43.7% as *easygoing*, a minority of 9.4% as *shy* and 29.7% as *surprised*.

The membership of the *interested* cluster obviously was the smallest in the Trust Game, in which the majority was captured as *surprised*. The average difference belonging to the *surprised* within the Trust Game to both other conditions was 16.35 percentage points. The difference in belonging to the *easygoing* cluster was largest between the simple coin flip and both other conditions (19.8 percentage points). Interestingly belonging to the socially connected emotion of feeling shy occurred substantially only in both situations with social dependencies (25.4% in the Trust Game, 31.8% in the Extended Coin Flip, but only 9.4% in the situation of a simple coin flip). The membership to *easygoing* when keeping the money was most prominent in the non-social situation of the simple coin flip

(43.7%, Trust Game: 22%, Extended Coin Flip 25.8%). Hence, the experimental condition was significantly connected to the cluster-memberships of emotional states (ϕ=.315, p<.005).

Was the distribution of emotional clusters connected to the decisions in the three conditions? That is, was the occurrence of specific immediate emotions in the different experimental conditions responsible for changes in behavior? The answer is 'no' for all three experimental conditions.

In the Trust Game, 60% of those labeled as *interested* chose to trust, while 69% of the *easygoing* cluster, 73.3% of the *shy* and the half of those *surprised* also did so (ϕ=.212, p<.45) (Table 8c, p.94). In the Extended Coin Flip, only a marginal significant (ϕ=.310, p<.10) interrelation could be found: 36.4% of those captured as *interested* chose to bet the money, 29.4% of the '*easygoing* cluster', 61.9% of the '*shy* cluster' and 64.7% of those labeled as *surprised* . In the simple coin flip, 9.1% of the group of those captured as *interested* bet their money, while 25% of the '*easygoing* cluster', 33.3% of the '*shy* cluster' and 42.1% of those labeled *interested* did the same (ϕ=.251, p<.26).

To sum up the analysis of immediate emotions for the case of *bet/trust*, the experimental condition was connected to the membership of emotional clusters and these were interrelated with the decision. These effects were the strongest for the Extended Coin Flip and the simple coin flip. For the trust situation, no significant influence could be found.

In the case of *keep,* the experimental condition also was significantly connected to emotional cluster membership. To the contrary, the interrelation of emotional clusters with the decision on a bivariate level only was moderate and only significant for the whole sample over all three experimental conditions. However, within the conditions, these connections did not reach significance. It must be

mentioned here that due to cell sizes significant connections between emotional clusters and the decision are harder to reach in a case of a four-cluster solution compared to solutions with less number of clusters – as they were realized for anticipated emotions.

3.4.3. Binary-Logistic Regression Analysis

On a descriptive bivariate level, we showed how clustered emotional states in the immediate and anticipated scenarios were connected to experimental conditions and the decision. The following five binary-logistic regression models extend these findings.

Model 0 replicates the finding how the manipulation of the situation solely predicts differences in the risk rates within the three different experimental conditions. Model 1 shows how measured emotions regarding the four anticipated scenarios predict the decision (see Table 9, p.101). Model 2 shows how emotional states regarding the immediate scenario, or keep or risk the money, predict the decision. Model 3 then simultaneously uses the cluster memberships in the four anticipated and the two immediate situations as predictors for the decision. Finally, Model 4 jointly uses the variation of the experimental condition to answer the question how emotions contribute to the decision specifically and independently of the framing of the situation.

Effects of Membership of the numbered Cluster relative to the Membership of the last Cluster for all six Measured Situations.

			Model 0 condition		Model 1 Anticipated emotions		Model 2 Immediate emotions		Model 3 All emotions		Model 4 All emotions & condition	
Variable			Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)	Estimation: B	Effect: Exp(B)
anticipated emotions												
keep & win	Cluster 2	confused										
	Cluster 1	easygoing			- .5	.61			- .44	.64	- .42	.66
keep & lose	Cluster 2	unprepossessed										
	Cluster 1	masterly			- .95***	.39			- .87*	.42	- .74†	.48
bet/trust & win	Cluster 4	delighted										
	Cluster 1	undismayed			-1.12*	.33			- .88†	.42	-1.76***	.17
	Cluster 2	triumphantly			- .24	.79			- .47	.62	- .63	.53
	Cluster 3	competent			.04	1.04			.38	1.46	- .28	.75
bet/trust & lose	Cluster 2	regretful										
	Cluster 1	anxious			-1.03**	.36			- .95*	.39	-1.53***	.22
immediate emotions												
bet/trust	Cluster 4	curious										
	Cluster 1	sceptic					-1.7 ***	.18	-1.84***	.16	-1.53**	.22
	Cluster 2	perplexed					-1.46***	.23	-1.51***	.22	- .94†	.39
	Cluster 3	challenging					- .39	.68	- .42	.66	.27	1.31
keep	Cluster 4	surprised										
	Cluster 1	interested					- .85†	.43	-1.04†	.35	- .9	.41
	Cluster 2	easygoing					- .57	.57	- .54	.58	- .01	.99
	Cluster 3	shy					.08	1.08	- .26	.77	- .26	.77
situation	Trust Game		1.51***	4.54							2.34***	10.37
	Extended Coin Flip		.88*	2.41							.98†	2.66
	Coin Flip											
constant			- .97	.38	1.14	3.12	1.15	3.16	2.43	11.33	1.22	3.4
Nagelkekes R^2			.111		.165		.186		.304		.406	

Significant effect on the decision to bet/trust: †p < .10 *p < .05 **p< .01 ***p < .005
ΔR^2 shifting from Model 2 to Model 3 or adding Model 1 to Model 2 sig. (p < .01)

Table 9: Study 5: Summary of Binary-logistic Regression Analysis for Clusters of Emotional States within Immediate and Anticipated Scenarios Predicting the Decision to Bet or Trust.

Situation predicting the decision. How much of the differences in the risk rates within the Trust Game, the coin flip and the Extended Coin Flip can be explained solely by this experimental manipulation, leaving out our attempt to catch emotional influences? Model 0 in Table 9 (p.101) shows that the three conditions significantly predict the decider's choice. As a sole predictor, the variation of the situation significantly increase the explained variance compared to the base model (χ^2=15.84, p<.001) up to a Nagelkerke's R^2 of .111. This is mainly reached through the large difference of risk rates between the simple coin flip and the Trust Game. Compared to the coin flip condition serving as the reference class, belonging to the Trust Game condition increases the odds to bet/trust against keeping the money with a factor of β=4.54 (p<.001). The odds to bet the money in the situation of the Extended Coin Flip, compared to the simple coin flip, increased by a factor of β=2.41 (p<.021). These findings resemble the descriptives.

Anticipated emotions predicting the decision. Model 1 now shows how the clustered emotional states connected to the anticipated outcomes solely predict the risky decision by intentionally not controlling for the impact of the experimental condition. Overall, this model reaches an explanatory power of Nagelkerke's R^2=.165, and the increase of this against the constant model is significant (χ^2=23.98, p<.001). The emotional cluster-membership in the anticipated scenario of *keep & win* do not provide a significant impact on the decision. Indeed, the opposite is true for emotions attached to the scenario of *keep & lose*: belonging to the cluster labeled *masterly* significantly (p<.005) reduces the chances to bet vs. not to bet, with a factor of e^{β}=.39 (=1/2.56) (or reduced by 61%) relative to this ratio in the '*unprepossessed* cluster'. A finding showing that the interrelation found on a bivariate level stays stable controlled for the other three anticipated emotions attached to the outcomes.

In the scenario of *bet/trust & win*, belonging to the cluster of *undismayed* and not to *delighted* reduces the chances to bet vs. not to bet with a factor of e^{β}=.33 (=1/3.03) (or 67% reduction) on a fairly significant level (p<.05). Contrary to the bivariate analysis now in this scenario, there is to constitute a specific relation between the cluster-membership and the decision. Obviously, the simultaneous consideration of the emotional states regarding the other three anticipated emotional states filters out a unique contribution of this scenario.

In the anticipated scenario of *bet/trust & lose* overall experimental conditions, the attribute of being a member of the cluster anxious and not regretful reduces the chance to set the money on stake vs. not, by a factor of e^{β}=.36 (=1/2.77) (or 64% reduction, p<.01).

Immediate emotions predicting the decision. Model 2 shows how immediate emotions gain influence on the decision without controlling for the experimental condition. Compared to the anticipated emotional states (Model 1), this model gains a slightly higher explanative power (Nagelkerke's R^2=.186, χ^2=27.29, p<.001), and this difference in model fit (measured by Bayesian information criterion (BIC)) provides moderate positive support for better fit of this model (ΔBIC= $\Delta\chi^2$=3.31) compared to Model 1.

It is within the immediate scenario of *bet/trust,* where specific cluster-memberships strongly affect the decision to take a risk. Being a member of the '*skeptic* cluster' and not of the *curious,* strongly reduces (by 82%) the chances of betting the money vs. not to bet (by a factor of e^{β}=.18 (=1/5.55). Similar is true for belonging to the cluster *perplexed*: the ratio of bet vs. not bet is reduced by 78% (by a factor of e^{β}=.23 (=1/4.35). Again, the findings of the bivariate analysis are confirmed here.

The anticipated scenario of *keep*ing the money only gains marginal influence on the decision: Being a member of the *interested* cluster and not of the *surprised* reduces the chance to bet vs. not to bet by 57% (with a factor of e^{β}=.43=1/2.33), which is marginally significant (p<.10).

Anticipated and immediate emotions predicting the decision. The question arises if the influences of both types of emotions stay stable when added jointly as independent variables to predict the decision. This is what Model 3 does: By combining both types of emotions in Model 3 now simultaneously it is controlled for potential patterns of dependencies, e.g. belonging to one cluster in one of the immediate measures always combines with being a member of a specific cluster in one of the anticipated scenarios.

Explanative power of this model increases significantly (Nagelkerke's R^2=.304) independent of the direction (adding Model 2 to Model 1 ($\Delta\chi^2$=23.0, p<.001) or the other way around ($\Delta\chi^2$=19.68, p<.003)). This shows that both types of emotions uniquely significantly affect the decision, so that immediate emotions cannot bee seen as the as the mirror of the other and vice versa.

Overall, the patterns of influence stay quite stable but it is to mention that anticipated emotional states in general lose significance. The contrary is true for the influences of the immediate emotions: the strong effects of the emotions connected to the immediate situation of *bet/trust* even increase their influence – the coefficients for the clusters of *skeptic* & *perplexed* grow and hold their high level of significance (p<.005). In the immediate scenario, to *keep* the money belonging to the '*interested* cluster' and not in the *surprised* now gains marginal significance on a 10% level. A possible explanation for these changes is given later.

Anticipated and immediate emotions' unique contribution. Until now, only emotional cluster-memberships were used without controlling for the experimental condition. Model 4 takes the

influence of this variation of the situation into account. Here, we investigate what influence emotional states exhibit *beyond* the power of the situation shown in Model 0.

By adding the experimental manipulation of the framing of the situation as predictor explained variance significantly increases to Nagelkerke's R^2=.406 ($\Delta\chi^2$=18.97, p<.001).

The influences of the experimental variation (Model 0) stay quite stable in this comprehensive Model 4, showing that participating in the situation of a Trust Game heavily changes the chances to set money on stakes: the odds of taking the risk increases by a factor of e^{β}=10.37 compared to the odds in the simple coin flip. Taking part in the Extended Coin Flip moderately increases these odds by 166% (e^{β}=2.66) at a 10% level of significance.

Adding the experimental condition in Model 4 also controls for the interaction of the experimental condition and the emotional states, as well as the influence of the experimental condition on the decision, of course. Hence, those other independent variables with both, a strong connection to the experimental condition as well as strong influence on the decision are influenced the most by this step. This Model 4 also controls for the interaction of the experimental condition with the strength of the interrelations between the independent variables on a latent level.

Over all, controlling for the experimental condition weakens the influence that immediate emotions have on the decision, and strengthens the influence of anticipated emotions by increasing their specificity, as it can be observed when shifting from Model 3 to Model 4. The reason for that is the combination of control for the interaction of the experimental condition with the strength of the interrelation between the independent variables as described in the following.

3.4.4. Interaction Analysis

Can it be said that immediate emotions simply reflect anticipated emotions and thus, in this sense at least, a consequentialistic mode of accessing the decision is decisive for behavior?

Interrelation of immediate and anticipated emotions. In all three conditions, we find an interrelation of the emotional states within the immediate scenario to *bet/trust* and the anticipated to *bet/trust & win*. This connection varies in the narrow corridor of ϕ=.552 (Cramer's V=.318, p<.019) within the situation of an Extended Coin Flip and ϕ=.595 (Cramer's V=.344, p<.007) in the simple coin flip with the Trust Game in between ϕ=.562 (Cramer's V=.324, p<.028). This means that participants clustered in a specific emotional state while thinking about betting the money, now tend also to be clustered in a specific emotional state regarding the situation of trusting/betting and winning.

But this finding does not allow for the assertion that the emotional state in the immediate situation to bet is just a reflection of that state anticipated. If this were true, in a regression analysis, only the decisive, anticipated emotions would gain influence on the decision. But this is not the case due to the fact that this interrelation is far from perfect; hence, the immediate emotions contribute specifically beyond the anticipated.

An interrelation of the cluster-memberships in the immediate scenario of betting and the anticipated scenario of *keep & win* could be found only for the simple (ϕ=.369, p<.035) and the Extended Coin Flip (ϕ=.353, p<.041). This can be read as a suggestion that in a trust situation, anticipation about the disappointment of a foregone chance is not necessarily directly reflected in the emotional experience when thinking about trusting another person. This argument is strengthened because furthermore it is only the case for both lottery situations (simple and Extended Coin Flip) that the anticipated emotional states regarding the situation of *bet & win* is

related to those in the immediate scenario to keep the money (ϕ=.399, p<.018; ϕ=.424, p<.006).

Finally, only in the situation of a simple coin flip could a strong relationship be found between the immediate scenario of to *bet* the money and the anticipation regarding the regrettable outcome of *bet & lose* (ϕ=.644, p<.006). No significant connection was found in either situation with social dependencies.

It was to expect that some relationship would appear between immediate emotions regarding the decision itself and the anticipated emotional states attached to the possible outcomes. However, these connections show a clear pattern of impairment by the experimental condition. It is this pattern that is controlled for by adding the experimental variation to the regression analyses. Accordingly, the effects of emotions shown in Model 4 are specific in the sense that their contribution to the decision beyond the experimental condition can be observed.

How might the interrelations among anticipated emotions dependent on the experimental condition sign responsible for changes when controlling for the situational variation in Model 4?

Interrelations among anticipated emotional states. The interrelation of the cluster-memberships among all anticipated scenarios is weak (from ϕ=-.212, p<.004 to ϕ=.246, p<.001) over all experimental conditions. The influence of the experimental condition on the strength of interrelation among the anticipated emotional states also is weaker than for the immediate emotional states described before. The maximal difference of an interrelation is reached with $\Delta\varphi$=.367 within the scenarios of *keep/lose* and *bet/trust & lose*. This interrelation is found only in the situation of Extended Coin Flip: for both other situations it is not significant. No interrelation could be found in any experimental condition for *keep & win* with *keep & lose* or for *keep & win* with *bet/trust & win*. The

emotional states within *keep & win* and *bet/trust & lose* were found to be significantly connected only in the Extended Coin Flip (ϕ=-.276, p<.027). The interrelation of the emotional clusters within *keep & lose* and *bet/trust & win* did not reach significance in any of the three conditions. Similarly, a strong interaction was manifest only in the Extended Coin Flip (ϕ=.455, p<.001) for *keep & lose* and *bet/trust & lose*. This was also the case for the interaction of the emotional states within *bet/trust & win* and its counterpart *bet/trust & lose*: only in the Extended Coin Flip did the interaction reach marginal significance (ϕ=.347, p<.055).

One result of this short interaction analyses is obvious: in the Extended Coin Flip, participants were most clear what to indicate, as that is where the most excluding patterns of cluster-memberships could be found.

Finally, we address the interrelation of measured emotional states regarding both immediate scenarios. How are they connected, and can it be said that immediate emotions in the case of taking the sure options are just a mirror of those emotions displayed in the option of taking the risk?

Interrelations among immediate emotions. The strength of interrelation varies the most for both immediate scenarios: interestingly the interrelation of the emotional cluster-memberships within the immediate situation to *bet/trust* with those given for *keep* is strong in both the simple (ϕ=.574, p<.012) and the Extended Coin Flip (ϕ=.643, p<.001) but absolutely weak in the Trust Game (ϕ=.248, n.s.). The maximum difference of strength of interrelation is given between the Extended Coin Flip and the Trust Game, with $\Delta\varphi$=.395. This serves as another hint that the trust situation is distinguished from other risky decisions and that it was easier for the participants to apply an on/off structure of the decision in the Extended Coin Flip and the simple coin flip. Here, feeling one thing

regarding the decision to give money often leads to feel the opposite thing when keeping it. The contrary is true for the situation of trust: here emotions to trust or not to trust do not follow a simple structure as feeling bad with one option and good with the other.

Unfortunately, due to our small sample size, we could not control for the investigated interaction effects within the binary-logistic regression. The models would be heavily over-specified even by controlling just for the interaction of the experimental situation with the 3*6 measured emotional states (adding 18 more predictors). This also holds true for controlling for the interaction of immediate with anticipated emotional states.

3.4.5. Mediation

Nevertheless, the regression findings open the gate for investigating the question of which emotional scenario mediates the influence of the experimental manipulation.

Mediation Model I. The question arises of whether or not the effect of emotions is traceable as mediation in such a way that a different condition influences the immediate or anticipated emotions which then affect the decision (Figure 6, p.110). In short: our data show that this path does exist for taking the route of anticipated emotions.

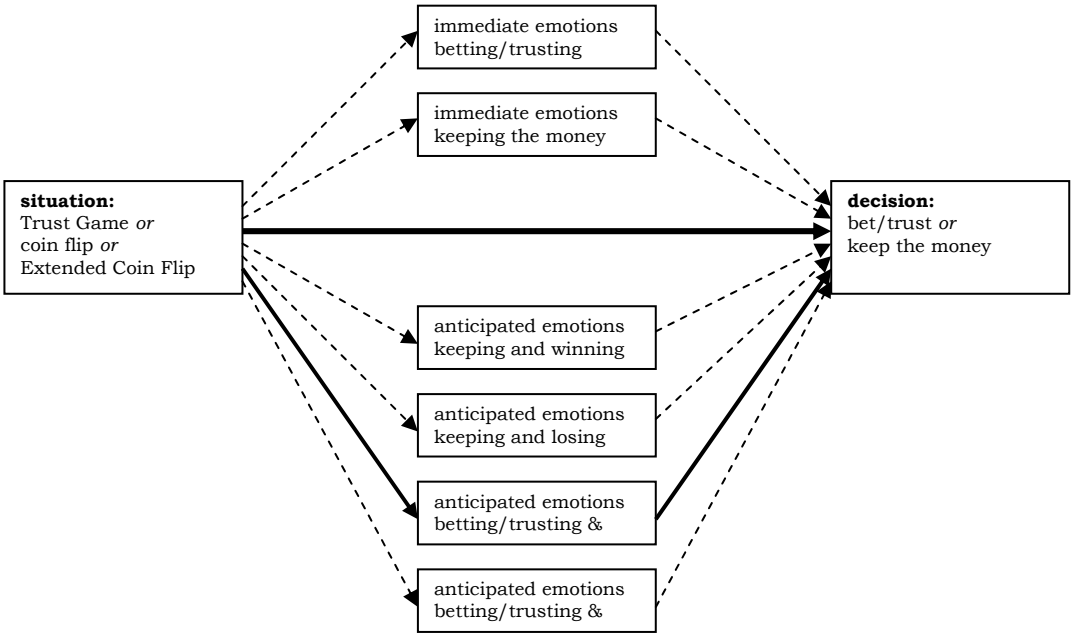


Figure 6: Study 5: Mediation I: How emotions mediate the effect of a changed situation (Trust Game, Extended Coin Flip, Coin Flip) to changes in behavior

A multinomial regression with the experimental condition as a predictor and the memberships to the clustered emotional states as the dependent variable shows a significant influence of the anticipated emotional state in the situation of take the risk and win (Nagelkerke's R^2 =.14, p<.001; ϕ=.36, p<.001). This relation is the strongest compared to all five other measured emotional scenarios. That these anticipated emotional states, connected to the situation of *trust/bet & win,* significantly influence the decision was already shown before with the regression in Model 4, Table 9 (p.101). To constitute mediation now, it has to be shown that the direct effect from changing objective probabilities on the decisions is significantly reduced when the mediators, in form of relevant emotional states, are added simultaneously. By controlling for the non-normality distribution of the indirect effect a bootstrap test with 5000 re-samples (Baron and Kenny, 1986; Kenny, 2008; Preacher and Hayes, 2008a, 2004) reveals that this is indeed the case for the mentioned cluster-membership in the mentioned anticipated scenario (with a 5% probability to err). The effect size, measured as *index of mediation*

(Preacher and Hayes, 2008b), yielded an effect of .169 (lower level 95% confidence interval = .032; upper level 95 % confidence interval = .333). Following MacKinnon and Dwyer (1993) and Sobel (1982), the specific indirect effect size measured as the proportion of the total effect that is mediated yielded 22.4%. Note that in the applied model such a specific indirect effect could be found only along the described anticipated emotions, but not with any of the immediate emotions[8]. This mediation was transported by the emotional states in that scenario which had the strongest specific connection to the experimental condition, as well as to the decision over *all* conditions.

Mediation Model II. A different picture is drawn when reducing the independent variation of the experimental condition to a binary world of either playing the simple coin flip or the Trust Game (Figure 7, p.112). Our findings indicate that the situation of an Extended Coin Flip was more similar to a Trust Game regarding the behavioral outcome. It was also the situation with the most interdependencies for immediate with anticipated emotional states, which was also true for the interdependencies within the two immediate and four anticipated scenarios. This is why another mediation analysis that didn't consider this special experimental condition was conducted.

An open clustering process grouping the emotional states excluding the Extended Coin Flip leads to a regression Model analogous to Model 4 in Table 9 (p.101), using emotional states and the experimental condition as predictors. This approach was not used from the beginning because we had the idea to run the clustering process over all three conditions hoping to filter out distinctive emotional patters which then predict behavior – which worked out successfully. But obviously the situation of an Extended Coin Flip was unique since, for the participants, it seemed to be very clear how

[8] These tests were conducted with the latest available scripts by Preacher & Hayes (2004, 2008) and were confirmed with Mplus software Version 5.2 (Muthén, L.K. and Muthén, B.O. (1998-2007)

they should feel depending on the scenarios. However, running the regression analysis just for the situation of the simple coin flip and the Trust Game would have resulted in insignificant coefficients of emotional influences in Models similar to Model 1-3 due to the small sample size of *n*=123.

In a complete Model, including immediate and anticipated emotional states as well as the experimental manipulation (simple coin flip and Trust Game), the anticipated scenarios, in the case of *bet/trust & win* and *bet/trust & lose,* and the immediate emotions, regarding to *bet/trust,* were found to significantly influence the decision. Hence, a mediation model was calculated, showing that the above-mentioned emotional states partially mediated the influence that the different situations had on the decision.

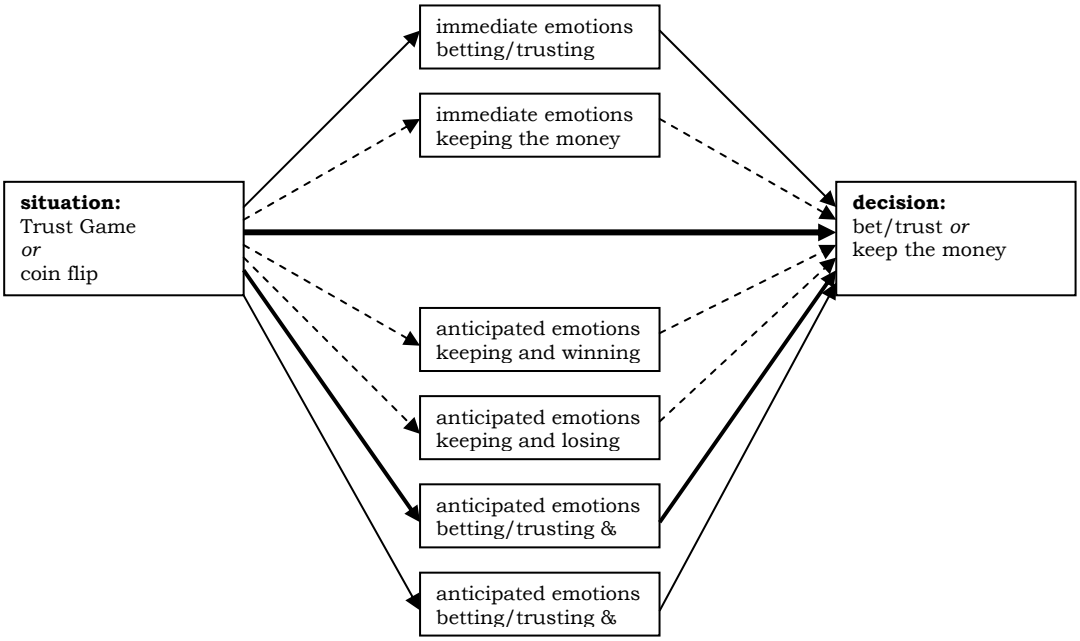


Figure 7: Study 5: Mediation II: How emotions mediate the effect of a changed situation (Trust Game, Coin Flip) to changes in behavior

Using the described method, the specific indirect effects gain mediation as follows: For the emotional states within the anticipated scenario of *bet/trust & win*, the effect size measured as *index of mediation* (Preacher and Hayes, 2008b) yielded an effect of .417 (lower level 94% confidence interval = .092; upper level 94 %

confidence interval = .681). Hence the specific indirect effect size, measured as the proportion of the total effect that is mediated, yielded 57.7 %. The emotional states anticipated for scenario of *bet/trust & lose* indirectly transported the effects of the experimental variation on the decision with an index of mediation of .326 (lower level 94% confidence interval = .048; upper level 94 % confidence interval = .610). Accordingly, the specific indirect effect size, measured as the proportion of the total effect that is mediated, is 45.1%.

Additionally, the immediate emotions regarding to *bet/trust* yielded an index of mediation of .179 (lower level 94% confidence interval = .009; upper level 94 % confidence interval = .43)[9]. So, the specific indirect effect size, measured as the proportion of the total effect that is mediated, gains 27.7%. This clearly shows that when the somehow exotic Extended Coin Flip is left out of the mediation analysis, differences in the immediate emotional states regarding to *bet/trust* specifically contribute to the decision within the situation of a simple lottery (coin flip) and a situation of trust.

3.5. General Discussion

This analysis aimed to show that the perceived emotional content in a situation of trust differs from that perceived in a simple lottery and a lottery extended by possible benefits for another person and that this difference accounts for the different risk rates within the different conditions.

The variation of the situation did influence participants' willingness to take a risk. The risk rates within clustered emotional states for immediate and anticipated scenarios varied. Additionally, it is possible to demonstrate from this data that different emotional

[9] The sum of the indirect effects measured as proportions of proportion of the total effect mediated gains more than 100% because of interrelations of the mediators among each other.

states are dominant within different anticipated and immediate scenarios depending on the framing of the decision problem, and the variation of the occurrence of these states are connected to the decision made.

A regression analysis showed that immediate emotions connected to taking the risk affected the decision. Taking anticipated emotions into account revealed that their influence was weaker than immediate emotions. A regression controlling for the effect of the farming of the decision showed a different picture: The strongest mediator surviving the variation of all three experimental settings was the anticipated emotional state in the case of *bet/trust & win*. However, it should be noted that this mediation is caused by the significant *additional* emotional effect of our emotional measures, above and beyond that strong direct effect carried by the variation of the situation itself. An important role was also played by the effect of *bet/trust & lose*. The effect of *bet/trust & win* was driven by its prominent role in the situation of trust. Contrarily, the effect of *bet/trust & lose* was important within the Extended Coin Flip but less important in the simple coin flip.

Additionally, the immediate emotions connected to take the risk had a significant effect on the decision as well. These effects were driven by their prominent role on the decision within the situation of the Extended and the simple coin flip.

Unfortunately, due to limited sample size, not all possible interaction effects were controlled for within the binary regression analysis. However, an analysis of these interaction effects on a bivariate level revealed that interdependencies of immediate with anticipated emotional states vary heavily for the three different situations: the most occur for the simple coin flip, less for the extended and not at all for the Trust Game. This shows that especially the immediate emotions connected to a situation of trust

cannot be seen as reflections of emotional anticipations regarding the outcomes.

Furthermore, interdependencies of the emotional cluster-memberships among the four anticipated scenarios were the weakest for the Trust Game but the strongest for the Extended Coin Flip. The interdependencies among both immediate scenarios to *keep* the money or *bet/trust* was prominent for the simple coin flip and the Extended Coin Flip but not for the Trust Game. This again shows that immediate emotions, especially in situation of trust, cannot be said to follow a simple on/off structure.

Reducing the complexity of the design by analyzing a mediation model, which contrasts only the situation of a simple coin flip with the Trust Game, reveals that effects of the situation on the decision are carried by specific indirect effects of the anticipated scenario of *bet/trust & win*, *bet/trust & lose* and the immediate emotional state connected to take the risk. Thus, immediate emotions differ between a simple lottery and a situation of trust and this difference affects the decision.

3.5.1. Trust Driven by Anticipations?

Contrary to former findings (Schlösser, 2006) this study could not show that immediate emotions play a crucial role for the decision to trust an anonymous person. Immediate emotions did play a role for the simple lottery and a lottery with social dependencies. It seems that in the setting given in the study on hands, participants' decision to trust was driven by the warm glow of the anticipated feeling to have done the right thing – that they trust, and this risky choice is rewarded. The feeling connected to the largest share taking the risk was '*competent*'.

Unfortunately the effects of emotions could not be shown for every one of the three different experimental conditions. This was due to the small sample size combined with the number of predictors

leading to the boarders of the stability of a regression analysis. This is the reason why our regression analysis focused only on emotional effects *beyond* the situation.

The exclusive patterns of emotional interactions occurring within the other socially risky decision (Extended Coin Flip) showed that participants had a very clear idea how they would feel and how they felt with their decision. The contrary was true for the Trust Game.

A reason for this structure of findings might be that the experimenters introduced the experiment as a challenge of financial decision-making aloud[10]. This might have had an impact on the perception of the Trust Game, changing it into an investment situation. Perhaps this was why anticipated emotional states mattered most here.

The Extended Coin Flip framing might not be as sensitive to such an influence because here Person B never had an active role. Person B never decided to act trustworthy but is just the lucky one when the gambler loses.

Even when the outcomes of both situations are structurally the same, it could be that participants frame the role of Person B being an active one only in the Trust Game, even if the chances of win and loss are similar for both framings. In that sense, an Extended Coin Flip is the simpler social situation. Hence, this situation might not as easily influenced by the assertion that it is about financial decision making because in any case it is more like a lottery where another person profits from the gambler's bad luck.

3.5.2. Are Immediate Emotions Tautological?

One might argue that the demonstrated effects of immediate emotions are just an artifact of tautology: Once people decide to bet they will surely indicate compatible emotional states when asked

[10] I would like to thank Jan Bruch and Alexander Schneider for collecting the data.

about those states after they have made their decision. But, the participants were asked to indicate their emotions for both possible alternatives of betting or keeping the money, immediately *before* they had to make their final decision.

The independence of emotional cluster memberships for both immediate scenarios was confirmed the most for the Trust Game. However, there was evidence for a pattern of cross-over group interrelationship for the clusters in both other experimental scenarios. Especially the findings of independence in the Trust Game reflect the existing diversity of immediate emotions especially in that situation, indicating that positive emotions in the situation of keeping the money do not automatically determine the existence of bad emotions when trusting – and vice versa. But also for the Extended Coin Flip and the simple coin flip, the interrelation was similarly far from perfect.

Consequently, an approach to capture different distinct emotional states seems to be advisable, because people experience such distinctive states, which affect the decision to bet/trust in a sophisticated manner. It is not a dichotomous on/off structure of mutually exclusive binary good or bad emotions which determine the decision to choose the risky option. Such complex states are found not only for immediate emotions but also for anticipated emotions.

Furthermore, we could show that relevant immediate emotions are not just reflections of the anticipated emotions. Hence, immediate emotions contribute uniquely to the prediction of actual behavior.

3.5.3. Immediacy

Between the two sessions conducted there was a gap of one week. One might argue that this gap is too long, so that effects of hyperbolic discounting (Green, Fry, and Myerson, 1994; McClure, Laibson, Loewenstein, Cohen, 2004) in the first session may arise. For the case of the Trust Game this objection actually strengthens our

argument further, confirming that the situation of trust differs from other risky decisions: the time-lag announced places a stress on trust as an inter-temporal uncertainty, and therefore the effect of time-discounting should lower trust rates. Even given this long waiting time before the revealing of the consequences, participants in the Trust Game showed high rates of trust compared to those in the simple coin flip.

Differences in trust rates between the three experimental conditions can not be explained by such time-discounting effects because in all situations the time-lag was held constant with one week tie until the outcomes were revealed.

3.5.4. The Conception of Trust in the Trust Game

The *discrete* structure of the trust game played in this study is a variant of a game called The Investment Game (Berg et al., 1995), which uses divisible *continuous* amounts to measure the extent of trust and trustworthiness in the form of amounts sent (one trustor sending €4 of €5 shows more trust than another trustor sending €2 of €5, and analogue for the trustee's trustworthiness).

The *discrete* variant of the game establishes a situation in the experiment which is closer to real-life trust decisions. Pilutla, Malhotra, and Murninghan (2003) showed that trustors only had the chance to obtain a final outcome close to, or slightly exceeding, their endowment if they decided to send the entire (or nearly entire) amount: only a full contribution is seen as a signal of trust, which produces an obligation for the trustee to show *full* trustworthiness in the form of giving back the amount sent by Person A (reciprocating) or – more often – equalizing outcomes (a reward). So a game played with discrete amounts is more real from both players' perspectives: The trustor does not have an opportunity to reduce his risk by reducing his trust in the trustee. Only two options are relevant: to trust or to distrust. There is, after all, no half lunch (or trust) for either of them. Discrete games have already been examined by,

amongst others, Eckel and Wilson (2001), Snijders and Keren (2001) and Fetchenhauer and Dunning (2005).

Still, the question remains as to whether this design, based on a monetary decision, is able to represent a real-life trust decision. The divisible character of money and learned rules of handling it might trigger higher cognitive involvement, so that System 2 reasoning processes are involved that might be less involved in real trust situations. Due to the indivisible character of trust, our findings might be confirmed even more strongly when playing a trust game with goods rather than money. At this point, the trust game would leave its origin of the Investment Game and step into the arena of indivisible goods, as real trust also does. This might happen experimentally with a design where knowledge is the object of trust, making participants depending on each other's specific knowledge in a quiz or in an examination. The supposition going along with the previous argument is that participants in such situations show even higher rates of trust.

3.5.5. Neuro-Economics

Different findings in Neuro-Economics (McClure, Laibson, Loewenstein, Cohen, 2004; Sanfey, Rilling, Aroson, Nystrom, Cohen, 2003) and advanced comments on these (Camerer, 2003; Greene et al., 2004; Sanfey, Loewenstein, McClure, Cohen, 2006; Fehr et al., 2005) lead in a direction that might be able to explain these somewhat ambiguous findings. On the one hand the present study found that only anticipated emotions mediate the effect of the changed framing of the situation on the actual decision when all three experimental conditions were considered. Furthermore, it was possible to demonstrate that immediate emotions in the situation of giving the money affected the decision. An explanation for this might be given by the perspective of an underlying dual-process model, as was theoretically proposed by Loewenstein and O'Donoghue (2005). The two different classes of processes find their expression in the

grade of stimulant of different brain areas during decision processes: deliberative System-2 processes and affective System-1 processes are mediated by a third area, detecting the conflict between goal-based reasoning and emotions or basic motivations.

Without drawing causal conclusion from these physiological findings one could think about the case where people behave against their feelings because they set a rational reason higher and suppress their intuition trough *willpower*. It could also be the case that people do follow their emotions but then post-rationalize their emotion-based decision.

Decision-making tasks are solved by combinations of processes resulting in a wide spectrum between the totally reason-based and rational on the one end and the totally affective at the other end. It might be argued that decisions of trust are more similar to easy personal moral dilemmas and therefore are typically solved by processes with higher emotional and less cognitive involvement (Green et al., 2004). In the situation of the trust game and other every-day situations of trust they easily might follow the social-intuitionists model (Haidt, 2001). But following a moral intuition might emotionally reflect two-fold: on the one hand in the fact that immediate emotions play the leading part (Schlösser, 2006), on the other hand by the warm glow of having done the right thing in case of a successfully act of rewarded trust which has to be distinguished from the happiness of a lucky gambler.

In situations of real risky decisions outside the laboratory, where stronger social dependencies may emerge, higher involvement of both types of processes is to be expected. This does not mean that rate of risk inevitably decrease. On the contrary, most of such high-cost decisions at least might be made from sentiment. The fact that the strength of intuitive emotions was found even in the artificial experimental situation should lead us to the conclusion that such processes might build the bridge for crossing the Rubicon in real

decisions when reasoning processes must find their borders. Thus, even in decision-making involving higher rational reasoning processes, the power of intuition might still be needed to finally make the decision. The structure of brain activity when chosing risky options with social dependencies remains an object for further neuro-economic research, as well as the relationship of trusting behavior to moral judgment.

3.5.6. Cultural differences

Compared to the results of Fetchenhauer and Dunning (in press) we find participants taking the bet in the Extended Coin Flip much more often (50% in Germany vs. 28% in the US). Behavior in the Trust Game is largely the same in the two countries (61% in Germany vs. 59.3% in the US), so the question arises, if such differences are explained by differences in the perception of the Extended Coin Flip situation. The descriptions of the situation were very the same. What does make a difference is the feature of the situation Person A focuses on: is it the bet or is it the dependency of Person B? One explanation might be the ease with which the dependency of Person B is suppressed or ignored. It is easy to escape from a moral dilemma here by arguing with chances: Person B is allotted to Person A so it's just luck for Person B to pick a pro-social Person A. This argument can be used to weaken the dependency of Person B. Or it could be the case that one group really thinks more in the line with the enlarge-the-pie logic among students. It might be the case that cultural influences underlie how this focus is placed. This question will be investigated in our future research.

3.5.7. Conclusion

A clear, direct effect of immediate and anticipated emotions on the actual decisions was found. This effect remains substantial, even when controlling for social dependencies of risky decisions: *Beyond* the effects captured by the framing of the situation, both types of

emotions play a crucial role for deciding to take risk a risk or not. The analysis of the emotional content perceived in the different experimental conditions reveals that for most people trust is not *just another bet*. Contrary to former findings the decision to trust was mainly driven by the emotional anticipations attached to the outcome that one trusted and that this act is rewarded by a trustworthy counterpart.

Nearly four hundred years ago, Pascal addressed dual-process modes of thinking in a passage that reads like an appeal to inquire about how reasoning is informed by emotions - and the other way around. He aimed for an approach beyond the separation of these two perspectives – a thing he called heart.

> *All our reasoning reduces itself to yielding to feeling.*
> But fancy is like, though contrary to, feeling, so that we cannot distinguish between these contraries. One person says that my feeling is fancy, another that his fancy is feeling. We should have a rule. Reason offers itself; but it is pliable in every sense; and thus there is no rule.
>
> *(Blaise Pascal, 1660)*

4. General Discussion and Preview

Overall our data show that even in very simple situations of deciding to take a manageable risk or not emotions attached to the outcomes do play a role. A fact which is not surprising to those who assume the decision-making process regarding risky options to follow a consequentialistic path.

But questioning this common approach the main finding emerged is that immediate emotions attached to the decision itself mostly do play the decisive role. Their impact on the decision could be found to act independent of anticipated emotions and changes in objective or subjective probabilities. Beside this independent influence they partly mediated the effects of changed objective chances on the decision. This finding contradicts the consequentialistic approach.

Especially the immediate emotions regarding to keeping the money were found to be very different comparing these captured within a framing of a decision to trust or the framing of a coin flip. Not controlling for the effect of the change in situation but for simultaneous influences of the anticipated emotions immediate emotions clearly ruled out the effects of anticipations (Model 3, Table 9, Chapter 3.4.3, p.101). A mediation analysis contrasting both situations revealed that the effects of framing the situation as a coin flip or trust on the decision partly was transported via immediate and anticipated emotions.

Due to small sample sizes the social and non-social situations in Chapter 3 could not be analyzed properly distinct from each other. As described before, other features of the study design may have led the results to differ from former results. Schlösser (2006) showed that in the situation of trust contrary to the data presented, here clearly immediate emotions affected the actual decision whereas the anticipated did not.

To investigate the question how these results can be so inconsistent with one another a future study will contrast the situation of a coin flip, an Extended Coin Flip, a Trust and a Dictator Game with sufficient sample sizes in each condition (*n*=200).

4.1. Trust and Moral Emotions

Due to the fact that Schlösser (2006) could also show that anticipations regarding emotions attached to the outcomes were strikingly exact – similar to the findings in Study 4 on hand - a mixed picture of emotional influences might show up in future studies. On the one hand immediate emotions might play a leading role, if anticipated emotions come into play it might be in the form of the anticipated warm glow of having done the right thing. Doing the right thing here is filled with the emotional content of feeling as a 'competent' person whose venture to expose herself vulnerable to the other person comes to a good end. This pay-off might be quite independent of the actual height of reward because the value of a warm glow is independent of a monetary payoff. This fits to results which show the large extend of independence of people's willingness to give away their money and the height of stakes in a very real trust setting (Johansson-Stenman, Mahmud, Martinsson, 2005).

This hypothesis would also fit to another finding of Fetchenhauer and Dunning (2009) who showed that the elasticity with which participants reacted to different chances was substantially lower when the situation was framed as a decision to risk compared to a simple lottery. The share of those who were willing to trust another anonymous person increased from 56% when the chance to meet a trustworthy person was set to 46% to a share of 70% when this chance was set to 80% (a step of 14 percentage points). The same step in winning chances caused a substantially stronger increase of the willingness to bet in a simple lottery. The share of persons betting their money with a 46% chance of winning

was 28%, but when the chances were set to 80%, 78% of the participants took the risk (a step of 50 percentage points). Hence, a change in the chances that taking a risk pays off, took substantially less effect on the decision to trust compared to the decision to bet.

The type of a trust situation might in that sense be akin to moral judgement in a sense that people feel the duty to trust another person because it is the right thing to do. In that respect it also might be more similar to the act of voting, which is bound to the value of being a good citizen which is a need of a good democracy. In this decision problem people share very pessimistic beliefs about the gains of that action but overwhelmingly tend to vote, similar to the pessimistic believes of others trustworthiness in trust situations. If the proneness to trust also is driven by something one might call values or norms, the question arises how these values can survive when only a minor share consciously believes in them but a larger share act against their beliefs and trust against all odds. Thus, somehow the knowledge about the efficiency of a successful act of trust and trustworthiness is shared unconsciously. But what is the source of the warm glow of such an exchange and the bad feelings connected to the decision not to trust another person? We found that emotions do play a role but we do not know how they arise.

The same is true for other moral actions like punishing unsocial behavior of a person adverse to another person without gaining personal advantage from that action. Such altruistic (or third-party) punishment happens even when the victim of the injustice act has drawbacks from that action. Individuals' proneness to punish in that sense has been shown to be connected to the personality trait of Justice Sensitivity from a beneficiaries' perspective: those who are more sensible to perceive injustice when passively profiting from an act of injustice against another person were more willing to punish (Lotz, Gresser, Schlösser, Baumert, Fetchenhauer, 2009). Hence

moral emotions which were more likely to occur for specific personality traits were partly responsible for the decision to punish.

4.2. Individual Differences

It is to question to what extend individual differences in the interplay of immediate emotions and anticipated emotions change the individual decision. It could be the case that stable personality traits influence the interaction of both types of emotions in a sense that the predictive power of either immediate or anticipated emotions varies systematically with personality. This then would separate those who decide more on an intuitive path from those elaborating more about possible outcomes more and put effort into finding reasons for their decision. First results show in a surprising way that this might be a reasonable hypothesis:

4.2.1. Personal Need for Structure

In Study 4 (Ellsberg-Paradox) the personality trait Personal Need for Structure was collected from the participants and its connections with the interplay of both types of emotions was analyzed. This analysis reveals that for the decision of participants who score *low* on the scale of Personal Need for Structure only anticipated emotional states were relevant (with a predictive power of Nagelkerke's R^2=.48). Only the anticipated emotional states in the case of winning with the ambiguous urn or losing with the unambiguous urn significantly affected their decision. Immediate emotions gained only very weak predictive power (Nagelkerke's R^2=.07). The difference between the subjective probabilities of winning with the ambiguous or the unambiguous urn played no crucial role for these participants.

On the contrary for those participants' decision scoring *high* on this personality trait was mostly affected by emotions regarding both immediate options, and only very weakly by the emotional content connected to the anticipated scenario of losing with the ambiguous

urn. Anticipated emotional states only accounted for a very weak predictive power of Nagelkerke's R^2 of .03, on the contrary immediate emotions with .31 and subjective probability with .35.

This eventually irritating result suggests that the measure of Personal Need for Structure captures the proneness to base the decision on the riskless perspective on choice: the decision to bet either on an ambiguous or on an unambiguous risk of participants with a *high* need for structure was strongly connected to the immediate emotions regarding the choice itself. These emotions serve as the close and reliable cue which directly structures the situation. In general, these results reveal that there are characteristics of personality which influence the way how emotions affect decisions.

4.2.2. Fear of Negative Evaluation

Effects of ambiguity-aversion seem to disappear when absolute secrecy of participant's decision is guaranteed (Trautmann, Vieider, Wakker, 2008). It could be hypothesized that the individual disposition to imagine an "other" or the implicit idea of that one has to account for his/hers decision change decisions systematically under risk and uncertainty. Those with a high salience of a watching instance might be those who extensively search for good reasons or early in the decision-making process begin to rationalize their intuition to go for one or the other option.

This might also be an interesting approach to inquire the phenomenon of trust. Maybe the individual differences in the salience of the decision to trust being evaluated or even only watched by others lead to different behavior. One could hypothesize what role this impartial spectator then might play: one that serves as a proxy of following a value based or moral judgment or one that serves as the rational wise economic decider? It could be the case that those applying the value-bound nature of the spectator on average tend more to trust an anonymous person than those striving for laud from an impartial homo economicus. Furthermore, if the first role is the

one applied to the decision to trust, reactions to changes in probability of potential trustees acting trustworthy should not be as strong as they would be when the second role is applied. Hence, differences in this elasticity might show up in a specific individual manner. Cultural differences are to be expected here, too.

4.3. Advances in Methods

4.3.1. Physiological Measures

To inquire the question deeper to what extent the measurements of the SAM are partly cognitively generated or biased answers, one possible way to go is to record immediate visceral affects by using physiological measures. Of course the SAM is an instrument which allows coming closer to spontaneous affective information but by far it is not perfect. Actually, up to now not much is known about how the answers people indicate on that matrix specifically deviate or go along with physiological measures (with exception of those mentioned before and Bradley and Lang, 2000). By giving specific stimuli it could be tested where islands of related but distinct emotions map and how they are bridged to other “emotional archipelagos” (or clouds of sense). In particular there might be found tipping points or other non-linear relations between dimensional changes on the stimuli and the answers on the SAM. This then could be taken as a hint how the response includes recombination, weighting and fitting of the three-dimensional information. As a by-product this would serve as further validation of the SAM.

Practically one could imagine studying decision making problems in the framework of the risk-as-feelings theory like we did before, but additionally measuring Skin Conductance Response (SCR), Pupil diameter (PD), and Peripheral Arterial Tone (PAT) when asking for the immediate emotions connected to the decision problem itself and all possible outcomes.

4.3.2. Clustering

Up to now little is known how much information is really lost when clustering individual emotional information to a larger group with averaged values on all three dimensions (valence, arousal, dominance). The cluster solutions found in the mentioned studies were always conducted with a 25% corridor of outlier-detection. This means that every individual combination deviating more than 25% of the averaged values on all three dimensions on any of the detected clusters was not used in the analysis. Due to the fact that these cases are rather rare (usually about 2%-5% of a sample) this did not spoil our results in a sense that we just used the participants fitting into a rather narrow emotional picture. And it might be a hint that a large majority perceives the detected and clustered emotional states quite uniformly. But of course this can not be assumed without deeper analysis. So on the one hand the clustering process shows its strength by reducing a massive stream of individual data but on the other hand of course this advantage is bought by loss of information.

But it should not be forgotten that this clustering also serves as an attempt to follow the theoretical idea that every emotion finds is distinctive place in the three dimensional space of valence, dominance and arousal.

4.4. Applying the Framework of Immediate and Anticipated Emotions

The approach of asking for the influence of emotions could be used to inquire the emotional nature of a series of well known phenomenons.

4.4.1. Manipulating immediate emotions.

Status-Quo effect. It is a well known finding that people tend stay with the default option of the situation (status-quo effect). Similar it is known that people tend to evaluate the value of a good higher when

they own it compared to the case when they want to have it (endowment effect; Kahnemann, Knetsch, Thaler, 1991).

It can be hypothesized that such effects occur due to emotions affecting the decision. For this reason we will conduct an experiment where participants obtain either an amount of $5 or a voucher for a lottery. Participants are allowed to change their endowment: those who received the $5 can use this money to buy them into a lottery where they get a 50% chance to win $10 (a coin flip). Losing in this lottery has the consequence to leave without any money. Those who received the voucher for the same lottery are allowed not to use it and instead change it into save $5.

We then will ask the participants to indicate their immediate emotions for either keeping or exchanging the endowment they received as well as for the anticipated emotions attached to all possible outcomes (taking the sure option and win, taking the sure option and lose, taking the lottery and win, taking the lottery and lose).

Depending on the kind of endowment the participants received in both experimental conditions (lottery voucher, save $5) most possible different rates of exchanging the endowment will occur. We hypothesize that these differences are mostly driven by the immediate emotions, not by those anticipated and only moderately by the subjective probability to win in the lottery.

Inter-Temporal Choice. It is a well known fact that people's wish to either accelerate or delay the realization of gains or losses heavily varies with the height of stakes and the point in time these events might occur (Loewenstein and Thaler, 1989). Such 'anomalies' might be also explainable by differences in the emotional content attached to the future outcomes and the emotions perceived for the immediate realization. This might explain such interesting patterns that teachers choose to delay their salary from 9 to 12 month (delayed reward) or the proneness to realize bad events now and not

pay much to avoid an electric shock now but much for avoiding it in the farer future. To find out about the role of emotions in this context, varying the emotional content is manipulated trough varying the time of realization and content of events (gains, losses, now, future, etc.).

The effect of cute pandas. One could think about directly manipulate the emotional content of the alternatives of a decision and observe how the perception of this content affects choice. An experiment could ask one group of participants to choose between a 50€ lottery and helping 1 or 2 pandas. Another group could be asked for choosing between a 50€ lottery and a 25% or 50% rebate on the next textbook they buy. If results would show that this manipulation of the emotions connected to the decision works in a sense that difference occurs regarding how often the lottery is chosen, the impact of immediate emotions on the decision would be confirmed further.

Misattribution. Further confirmation for the effects of immediate emotions could be shown when actively changing the emotional state in the moment the actual decision is going on would influence the decision. One could imagine to set participants under the impact of a fake “magnetic-field brain-distortion apparatus” and tell them that they will feel somehow (e.g., strange or nervous or fearful or aroused or emotionless or emotional). Then they would have to make simple risky decisions. In this way immediate emotions would be manipulated trough misattribution. An analysis would focus on the effects on the immediate emotions attached to the options as well as those attached to outcomes and to behavior. The problem of this approach is that immediate emotions connected to both alternatives would be manipulated, and not just to one alternative.

4.5. Preferences

It might be worth to think about the allowance of emotions in economic decision models, especially in the context of the relation of short to long term preferences. If one allows for endogenous preferences – meaning the environment constantly changing preferences – it is hard to conclude why this should just be true for the short term ones. A lifetime utility optimum is reached only if one assumes a well-informed actor that in the long run will move on an optimal path which gains higher personal welfare. Assuming short term preferences would result in erratic not-equilibrium realizations.

Our approach gives evidence for the impact of short term preferences by showing that in a lot and especially in (economic) risky choices immediate emotions do play a crucial role. Given this finding, it is to question how actors then should find their optimal long term utility path when their reasoning is pliable? Addiction behavior may serve as an extreme example, but this might also be true for economic behavior: Trusting your banking expert too much might lead to systematic over-investment in the market, your wish for being a proud house owner may let you forget about the real value and risk of such a good, etc. This idea then allows for declining paths by explaining non-rational, meaning non-consequentialistic choices.

On a broader level it might be to ask to what extend markets exist and function because of actors behaving imperfect compared to the homo economicus. Especially in these days of global crisis it is unfolded how crucial and essential the institution of trust is. And interestingly enough, it really seems to be a difficult task to reestablish trust because it seems to be quite independent of the amount of money pumped into the market. Maybe the reason for that phenomenon can simply be found in the fact that trust follows different rules as investment decisions. Or it reveals how often common investment decisions are decisions to trust.

Given the deciding role of emotions in risky decisions shown in this work, future economic decision-making approaches may draw attention to a fact which was already mentioned long time ago by Blaise Pascal.

> The heart has its reasons,
> which reason does not know.
>
> *(Blaise Pascal, 1660)*

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