# Does betrayal aversion really guide trust decisions towards strangers?

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Abstract

Trust is a double-edged sword. When warranted it leads to positive and rewarding interactions. When not, it leads to disappointment and anger. Therefore, it has been argued that people will display "betrayal aversion" in trust situations (i.e., avoid trusting to avoid betrayal). Yet, people also feel tense and uneasy when they signal distrust to another person and thus show signs of "principled trustfulness" (i.e., choosing to trust others although being skeptical of their trustworthiness). These two theoretical orientations imply directly opposite influences on trust behavior. Thus, we conducted two laboratory studies (with a total of 841 participants) with binary trust games (implying a risk of being betrayed) and extended lottery games (implying no such risk). In both studies we varied the payoff structures of both games. Further, we made sure that the average perceived likelihood of winning or losing money when choosing the risky option was identical in both games, as was the distribution of these likelihoods. Neither study showed any sign of betrayal aversion. Rather, participants were more willing to risk their money in the trust game than they were to invest their money in a lottery, supporting the principled trustfulness view. We discuss possible explanations why, unlike previous studies, we did not find any indication of betrayal aversion.

*Keywords*: trust, risk, principled trustfulness, betrayal aversion

Does betrayal aversion really guide trust decisions?

Trust is essential for nearly all kinds of interactions in which people engage. Trust helps individuals to increase their income (Stavrova & Ehlebracht, 2016), friendships to endure and marriages to thrive (Simpson, 2007), companies to achieve success (Mayer, Davis, & Schoorman, 1995; Williamson, 1993), and countries to prosper (Knack & Keefer, 1997; Zak & Knack, 2001). However, trust is always a double-edged sword. Extending trust may be honored, but it may also be exploited.

In the last few decades, both psychologists and economists have used the so-called trust game to investigate trust behavior in the laboratory (Berg, Dickhaut, & McCabe, 1995; Johnson & Mislin, 2011; Snijders & Keren, 1999). In the binary version of this paradigm, Persons A (the trustors) get a certain amount of money that they can either keep for sure or send to another Person B (the trustees). If Persons A hand over their money, Persons B get a multitude of the initial endowment of Persons A and then have to decide how to split the money. They can either divide the money evenly between both players or keep most (or all) of the money for themselves. The specific payoff structures vary between different studies but they are consistent with regard to one crucial aspect: if Persons B turn out to be trustworthy, it pays off for Persons A to be trustful. If, however, Persons B turn out to be untrustworthy, Persons A are getting less money than if they had kept their initial endowment. Although the paradigm of the trust game might seem somewhat artificial at first glance, it encapsulates the very essence of trust: making oneself vulnerable to the trustworthiness of another person (Rousseau et al., 1998; Thielmann & Hilbig, 2016). In the trust game as in real life, trust is always a decision under uncertainty (Gambetta, 1988).

But, how do people deal with such uncertainties when making decisions to trust or not to trust another person? More specifically, are they *as willing*, are they *less willing* or are they *more willing* to choose the risky option in a trust game compared to non-social risks like taking part in a lottery? Interestingly, so far, the empirical evidence regarding this question is rather mixed. We therefore summarize the state of the literature and then report two studies that aimed to clarify the reasons for the contradictory results found in previous research.

## Trust as an ordinary decision

From a purely economic perspective, decisions to trust should follow the same rules as all other decisions under uncertainty (Berg et al., 1995; Coleman, 1990). Self-interested Persons B should never reciprocate the trust of Person A. As everybody knows that Persons B will act selfishly, Persons A should definitely keep their money for themselves and show no trust (Fehr & Schmidt, 2006).

Yet, there are rational choice models of trust that allow for trustworthiness on the side of Person B (Coleman, 1990; Hardin, 2002). In these models, when deciding which alternative to choose in a trust game, Persons A as rational actors will reflect on their potential losses and profits, estimate the likelihood of Person B to reciprocate their trust, and will then choose the alternative with the highest subjective expected utility. Take for example a trust game with an initial endowment of $ 5 for Person A, a chance to earn $ 10 if Person B proves to be trustworthy and an outcome of $ 0 for Person A if Person B keeps all the money for themselves. Technically, such a payoff structure equals the payoff structure of an ordinary coin-flip (with the rule "double or nothing"). If Persons A estimate the number of trustworthy Persons B to be higher than 50 % *and* they would be willing to go for a coin-flip (i.e., a 50 % chance to double their money), they should take the risky option in the trust game. If, however, Persons A estimate the number of trustworthy Persons B to be lower than 50 % *and* they are not willing to go for a coin-flip they should neither be willing to choose the risky option in the trust game.

Thus, according to the rational actor model, trust decisions will not be different from non-social decisions and will solely be based on expected outcomes and actors' level of risk avoidance (Coleman, 1990). There is indeed evidence that speaks for the validity of such a model. Trust decisions are consistently influenced by expectations of Persons B's trustworthiness (Evans & Krueger, 2014), by the incentives for Persons B to reciprocate Persons A's trust or not (Snijders & Keren, 1999), and by the payoff structure (i.e., the incentives to trust) of Person A (Evans & Krueger, 2016). However, it has repeatedly been shown that behavior in trust games is also rather unrelated to a person's general risk attitude (Ashraf, Bohnet, & Piankov, 2006; Kanagaretnam, Mestelman, Nainar, & Shehata, 2009) or their risk-proneness on a behavioral level as regards non-social risks like participating in a lottery (Eckel & Wilson, 2004; Houser, Schunk, & Winter, 2010).

**Distrust as betrayal aversion**

More generally, one might argue that such a putatively rational approach leaves out the essentially social nature of trust: If someone loses money in a coin-flip, there is nobody to be angry about, but if someone loses their money in a trust game, they have been fooled by another person. To avoid the experience of being a "sucker", people might demand a higher chance of winning for taking the risky decision in a trust game as compared to a situation where such a risk does not exist. This phenomenon has been called "betrayal aversion" by economists (e.g., Aimone & Houser, 2012; Bohnet & Zeckhauser, 2004) (or "exploitation aversion", Fehr, Fischbacher, & Kosfeld, 2005), and "sugrophobia" (i.e., the fear of being a sucker) by psychologists (Vohs, Baumeister, & Chin, 2007).

There is evidence that people are betrayal averse in that they try to avoid making themselves vulnerable to the questionable trustworthiness of a Person B. The first authors to demonstrate such a betrayal aversion empirically were Bohnet and Zeckhauser (2004). In their study, participants got an endowment of $ 10 they could either keep for sure or hand over to Person B. In the latter case, Persons B had a total of $ 30 at their disposal that they could either split evenly (i.e., $ 15 for both players) or of which they could keep $ 22 for themselves and only give $ 8 to Person A. In the position of Person A, participants had to indicate what percentage of Persons B at least had to be trustworthy for them to choose the risky option. In a control condition, participants had the chance to take part in a lottery with the same payoff structure and they had to indicate the minimum chance of winning necessary for them to choose that gamble. As it turned out, the "minimum acceptable probability" was higher in the trust game than in the lottery (54 % versus 37 %), so people seemed to demand a premium to trust. Bohnet, Greig, Herrmann, and Zeckhauser (2008) were able to show this phenomenon for six different countries.

Especially among economists, the concept of betrayal aversion has become quite ubiquitous as an explanation for (dis-)trust behavior following Bohnet's and Zeckhauser's work (see, e.g., Butler & Miller, 2017; Cubitt, Gächter, & Quercia, 2017; Fehr, 2009). For example, Fehr (2009) states: "Betrayal aversion as documented in the work of Bohnet and coauthors seems to play a particularly important role in trusting behavior" (p. 236f.). Its growing popularity altered the traditional economic view of decision-making under risk which did not distinguish between different sources of risk. But the idea of betrayal aversion has gained momentum among

psychologists, too. For example, in their review on trust, Thielmann and Hilbig (2015) conceptualize betrayal sensitivity as one of three core components of trust behavior alongside risk attitudes and trustworthiness expectations.

Effron and Miller (2011) provided support for Bohnet's and Zeckhauser's results: Using a similar paradigm, they showed that people anticipate and indeed experience more self-blame when being exploited by another person as compared to losing in a lottery, and that anticipated self-blame mediated the effect of paradigm (trust game versus lottery) on participants' "minimum acceptable probability". Further, in a number of studies, Aimone and Houser (2011, 2012, 2013) claim to have shown the phenomenon of betrayal aversion using a different experimental paradigm. Their change in design had the purpose of overcoming a number of weaknesses of the MAP design. One example is the difficulty of disentangling betrayal aversion and loss aversion: If a player expects a high trustworthiness rate, it might feel like a loss to indicate a MAP that falls below this rate (Aimone & Houser, 2012). Other weaknesses are

> "… potential confounds including disutility from loss of control, assessment costs associated with calculating trustworthiness, costs of making incorrect assessments, costs from placing trustees in a potentially undesirable decision situation, and disutility from earning money due to other people's kindness as factors that could lead to differences between treatments" (p. 573).

Furthermore – as will be made clear throughout the following paragraphs – asking people for their prerequisite to *participate* in a trust game might only provide very limited information on how they would behave were they already *placed* in such a situation (Fetchenhauer & Dunning, 2012).

In the design Aimone and Houser (2012) opted for, their participants played an ordinary trust game in one condition (the know condition). In another condition (the don't know condition), participants were told that they would not be coupled with a specific Person B. Instead, winning or losing would be decided by the random draw of a computer with their chance of winning being based on the number of trustworthy Persons B in the know condition. Thus, from a purely mathematical perspective, both conditions were identical. Yet, as Aimone and Houser argue, only in the know condition do participants face the danger of being personally betrayed. In line with their hypothesis, more participants chose the risky option in the don't

know condition than in the know condition (Aimone & Houser, 2011, 2012). Aimone, Houser, and Weber (2014) replicated this finding and additionally gathered fMRI data showing a heightened activation of the anterior insular cortex in the know condition as compared to the don't know condition, indicating heightened negative arousal.

**Trust as principled behavior**

Yet, as mentioned above, there is also evidence for what has been called "principled trustfulness" by Fetchenhauer and Dunning (e.g., 2012). Why should something like this exist? When not trusting another person, one is sending a rather negative signal: "I am keeping my money because I think you are not trustworthy." People might try to avoid this signal, as in social life we often act out of politeness rather than out of honesty (DePaulo & Bell, 1996; Lerman, 2006). We will never be told by a date that we are ugly, we will never tell a friend that their clothes make them look fat. Distrust might be another example for something we experience but do not want to signal to another person. Maybe this tendency is so hard-wired that it influences participants' behavior even in anonymous one-shot interactions in a behavioral economics lab.

Indeed, there is empirical evidence for this phenomenon. In a large number of studies, it has been shown that a majority of people is willing to take risks in trust games that they would never take in a (non-social) lottery (for an overview, see Dunning, Schlösser & Fetchenhauer, 2019). For example, Fetchenhauer and Dunning (2009) compared participants' willingness to choose the risky option between a trust game and a lottery (sharing the same payoff structure). Based on their own estimates of Persons B's trustworthiness and their level of risk aversion revealed in the lottery paradigm, only 30.2 % of Persons A should have handed over their money to Person B. Yet, more than twice as many participants (64.4 %) actually chose the risky option in the trust game. In another study, participants were either told that they could flip a coin with the chances of doubling their endowment being 46 % or that they could play a trust game with chances of 46 % to be coupled with a trustworthy Person B (Fetchenhauer & Dunning, 2012). Only a minority of 29 % went for the risky option in the coin-flip, but a full 54 % of participants decided to trust although the expected value of the risky option in this paradigm was lower than keeping one's $5.

Follow-up studies showed that this high willingness to act trustfully is governed by moral emotions (especially the emotions of feeling tense, stressed, and guilty at the idea of keeping the initial endowment) (Schlösser, Dunning, & Fetchenhauer, 2013; Schlösser, Fetchenhauer, & Dunning, 2016) and by the feeling that one should (although one may not necessarily want to) hand over the money to Person B (e.g., Dunning, Anderson, Schlösser, Ehlebracht, & Fetchenhauer, 2014). Note, that in all of these studies participants interacted with each other for actual money and under conditions of full anonymity.

**How to explain the contradictions?**

To summarize, there is empirical evidence for both betrayal aversion (i.e., avoiding the risky option in trust games if possible) and principled trustfulness (i.e., avoiding to signal one's distrust to Person B). How can these diametrically opposed results be reconciled?

There are a couple of factors to note. First, the studies took place in different labs with different participants and with different instructions. Thus, the present studies aimed to directly compare different paradigms within the same samples.

Second, in studies finding principled trustfulness, participants were placed in concrete trust games with respective specific interaction partners which led, as Fetchenhauer and Dunning (e.g., 2012) argue, participants to feel obliged to hand over their money to Person B. Such immediate emotions felt at the cusp of making a decision frequently drive behavior (Loewenstein, Weber, Hsee, & Welch, 2001; Schlösser et al., 2013). However, to indicate a "minimum acceptable probability" of approaching a trustworthy Person B (as participants did in, e.g., Bohnet & Zeckhauser, 2004, and Effron & Miller, 2011) might rather feel like a hypothetical choice, one still under construction, in which such feelings of moral obligations do not evolve. Indeed, Fetchenhauer and Dunning (2009) showed that trust rates went up when participants had to make actual and not only hypothetical decisions (see also Holm & Nystedt, 2008).

Third, the results of Aimone and Houser (2012) might not be very robust. Cell sizes are rather low (less than 30 participants per condition) and a study conceptualizing "betrayal aversion" as a personality measure revealed that only 44.6 % of all participants could be classified as "betrayal averse", 23.2 % as "betrayal neutral", and 32.1 % even as "betrayal

seekers" (Aimone, Ball, & King-Casas, 2015). This is hard to reconcile with the claim that people in general are less willing to take social than non-social risks.

Fourth, the instructions used by Aimone and Houser were rather technically and complexly worded and might have been misunderstood by some participants. In a pretest we measured whether participants understood the paradigm of the don't know condition. To do so, we used the original instructions of Aimone, Houser, and Weber (2014), and asked 8 control questions incentivizing valid answers by giving participants € 10 in case they got all answers right. Only 7 out of 31 participants (23 %) were able to answer all control questions correctly (Götmann, 2014).

Fifth, while in those studies demonstrating betrayal aversion Persons B got the same initial endowment as Persons A, this was not the case in the studies by Fetchenhauer and Dunning (e.g., 2009, 2012). Thus, one could argue that what they have called "principled trustfulness" might just be an example of inequality aversion (i.e., Persons A did not want Person B to leave the lab empty-handed). Therefore, in the present studies, Persons A and Persons B got the same amount of money in case Persons A decided to keep their initial endowment (note, however, that in Schlösser, Mensching, Dunning, & Fetchenhauer, 2015, Persons A revealed "principled trustfulness" even when they had to play with their own, personal money).

Sixth, the payoff structure was different. In all studies of Fetchenhauer and Dunning a symmetrical payoff structure was used. Persons A could either lose or double their initial endowment when choosing the risky option. In all studies showing betrayal aversion, the payoff structures were asymmetrical (cf. Aimone & Houser, 2011, 2012, 2013; Bohnet et al., 2008; Bohnet & Zeckhauser, 2004; Effron & Miller, 2011). In the specific studies of Aimone and Houser, participants could increase their initial endowment by 200 % in case they were coupled with a trustworthy Person B (i.e., making $30 out of $10) but, even when being coupled with an untrustworthy Person B, they did not lose all their endowment but kept $ 2 out of their initial $10. It has to be mentioned that the labs finding betrayal aversion and principled trustfulness tend to treat their respective specific payoff structure as quite arbitrary and – at least implicitly – hold that their results will not depend on it. In the present studies we therefore applied the payoff structure used by Aimone and Houser as well as the payoff structure used by Fetchenhauer and Dunning and compared them directly with each other.

Seventh, the contrast condition to the ordinary trust game differed. Whereas both labs played ordinary trust games they differed with regard to the conditions that served as a contrast (the don't know condition in the studies by Aimone and Houser, lotteries in the studies by Fetchenhauer and Dunning). To give both approaches a fair chance, we decided to use so-called extended lottery games with the same payoff structures as the respective trust games in the present studies. In the extended lottery game paradigm, Person A can either keep their initial endowment, in which case another Person (Person B) also gets the same amount of money, or Persons A can stake their money in a lottery. In case Persons A win that gamble, both players earn an amount of money that is higher than the initial endowment. In case Persons A lose that gamble, Persons A get nothing (or very little money), while Persons B get much more. Thus, the extended lottery game resembles the trust game, as in both paradigms Persons A interact with a Person B. In both paradigms, by choosing the risky option, Persons A can "enlarge the pie". But only in the trust game is Person A dependent on the trustworthiness of Person B. Thus, following the reasoning of Aimone and Houser, participants should be more risk-taking in the extended lottery game than in the trust game because in the extended lottery game they run no risk of being betrayed. Following the reasoning of Fetchenhauer and Dunning, participants should be more risk-taking in the trust game than in the extended lottery game because only in the trust game do they have to avoid to question the morality (i.e, trustworthiness) of Person B.

Eighth, both approaches differed in the way they elicited and measured risk estimates in the situations that were used as a contrast to the trust-game. In the present studies we largely followed the paradigm of Aimone and Houser in that chances to win when choosing the risky option were dependent on the percentage of trustworthy Persons B across all conditions.

## Study 1

The main aim of Study 1 was to investigate whether participants would be more or less risk-taking in a trust game as compared to an extended lottery game. Further, we wanted to test whether the contradicting results of past studies were due to the different payoff structures of Fetchenhauer and Dunning on the one hand and Aimone and Houser on the other hand. Thus, in the *symmetrical payoff condition* participants got €5 (about $6) that they could keep for themselves or hand over to Person B. If Persons A sent the money to Person B the initial €5 was quadrupled to an amount of €20. In case Person B divided the money equally, Persons A earned

a total of €10, in case Persons B kept all the money for themselves, Persons A went home without anything. Note that such symmetrical payoff structures are widely used in trust game studies. In the *asymmetrical payoff condition* we followed the lead of Aimone and Houser. As in the other condition, participants got €5 that they could keep for themselves or hand over to Person B. If Persons A sent the money to Person B the initial €5 was multiplied by a factor of 6 to a total of €30. In case Person B divided the money equally, Persons A earned a total of €15, in the other case Persons B kept €28 for themselves, giving €2 to Person A. Thus, in the symmetrical payoff condition the scheme was "double or nothing", whereas in the asymmetrical payoff condition Persons A could potentially earn three-times their initial endowment and in the worst case would only lose 60 % of it (€3 out of €5).

Hence, we employed a 2 x 2 between-subjects design, the first factor being the payoff structure of the games (symmetrical versus asymmetrical payoff structure) and the second factor being the kind of game (trust game versus extended lottery game). Given previous research, we expected that participants' behavior would also be influenced by the likelihood of approaching a trustworthy Person B in the trust game and, by the likelihood of winning the lottery in the extended lottery game, respectively. Therefore, we employed the following yoking procedure: We asked every participant in the trust game condition to estimate the percentage of trustworthy Persons B. The next participants in the extended lottery condition were given the estimate of the previous participants as their fixed probability of winning the lottery. By this we made sure that the average, but also the distribution, of the probabilities of winning and losing when taking the risky option were identical in both paradigms.

## Methods

### Participants

308 Persons A were recruited on the campus of the University of Cologne, Germany. They were between 17 and 38 years old ($M$ = 22.70, $SD$ = 3.35), studying a large variety of programs. The sample contained 154 (50.0 %) female and 153 (49.7 %) male subjects. One participant chose to be identified as neither male nor female.

The corresponding 308 Persons B were recruited in large lectures of the Faculty of Management, Economics and Social Sciences of the University of Cologne, and they predominantly studied business administration or social sciences. They were between 18 and 74

years old ($M$ = 23.03, $SD$ = 9.02), 167 (54.2 %) of them were female, 141 (45.8 %) were male (we did not find any gender differences in the present study).

**Procedure**

**Persons A.** Participants in the role of Person A were seated in front of one of eight computers (separated by opaque dividers) as they entered the laboratory. After seeing a welcome screen with general information on the study, they generated a code word that enabled them to receive their payoff anonymously after they completed the study. Depending on the condition they had been randomly assigned to beforehand, they then read a description of either the trust game or the extended lottery game, either with asymmetrical payoffs or with symmetrical payoffs. Several questions were asked in order to test if Persons A understood the situation.

After that, participants in the trust game condition were asked to estimate the percentage of Persons B who would give half of their money to Person A and the corresponding percentage who would keep everything for themselves.

For the extended lottery game condition, we used the aforementioned "yoking" procedure: Every probability estimated by a participant in the trust game was subsequently used as a fixed communicated probability in the extended lottery game. For example, if a trust game participant in the symmetrical payoff condition estimated that 30 % of Persons B would choose option 2, i.e. give € 10 back, then later on an extended lottery game participant in the symmetrical payoff condition was informed that in this game, if the risky option was chosen, the chance of receiving € 10 was 30 %.

The next screen informed participants that they had been allocated the role of Person A. They were informed that Person B was a randomly allocated person who studied at the University of Cologne (Germany), that Person B was not in the same room, that they would not get to know each other, and – in the trust game – that Person B had already taken a decision in case Person A would choose the risky option (earlier studies have shown that the order in which Person A and Person B are making their decision is irrelevant; see Schlösser et al., 2015). It was emphasized that the decision Persons A were about to take was about real money which they would receive anonymously immediately after the study in an envelope by an assistant in another room. Participants' understanding of their role was tested by three control questions.

After they had completed the study, participants' payoffs were determined. For trust game participants this meant that they were randomly matched with a Person B decision, for extended lottery game participants this meant that a random mechanism determined their payoffs based on the probability that had been communicated to them. Then, participants had to go to another room, state their code word and obtained their pay-offs.

**Persons B.** Participants in the role of Person B received print questionnaires which were structurally equivalent to the on-screen study Persons A completed. In the trust game condition, they made an actual decision for real money. In the extended lottery game, they were merely informed about their part in the game.

## Results

Of all Persons B in the trust game 72,1 % turned out to be trustworthy (i.e., they decided to split the money evenly between themselves and Person A). As in earlier studies Persons A were rather skeptical about Persons' B trustworthiness. The average estimate was close to an estimate of 50 % trustworthy Persons B, but the dispersion of these estimates was broad ($n = 154$, $M = 48.70$, $SD = 24.08$). The lowest estimate was 2 %, the highest 95 %.

Thus, participants significantly underestimated Persons B trustworthiness (one sample t-test: $t = -17.150$, $p < .001$).

Nonetheless, across all conditions, 78.9% of all participants chose to take the risky option, while 21.1% decided to keep their initial endowment.

First, we tested whether these decisions were influenced by the payoff conditions. Indeed, while 87.0 % of all participants took the risky option in the asymmetrical payoff condition, only 70.8 % did so in the symmetrical payoff condition ($\chi^2 = 12.19$, $p < 0.001$).

Next, we analyzed the influence of the kind of game on participants' decisions. Participants were more willing to take the risky option in the trust game (83.1 %) than in the extended lottery game (74.7 %). However, this difference was only marginally significant ($\chi^2 = 3.30$, $p = .069$, two-tailed).

Figure 1 shows the percentage of risky decisions across all four experimental conditions.

[INSERT FIGURE 1 HERE]

*Figure 1.* Risk-taking rates across conditions.

As expected, across conditions participants were the more willing to take the risky option the higher the (perceived) probability that such a decision would lead to a positive outcome ($r$ = .287; $p < .001$).

To analyze the influence of all three independent variables simultaneously we ran a binary logistic regression analysis using participants' decision as dependent variable and kind of game, payoff structure and expectations as independent variables. The results are shown in Table 1. As can be seen the multivariate analysis confirmed the results that were found on a bivariate level. Both expectations ($e^{\beta} = 1.036$, $p < .001$) and pay-off structure ($e^{\beta} = 3.22$, $p < .001$) had a highly significant influence on participants' decisions, while the influence of the type of game was only marginally significant ($e^{\beta} = 1.81$, $p = .053$, two-tailed). We further tested potential interactions between all three independent variables but did not find any significant result.

**Discussion**

Study 1 aimed to simultaneously test three different predictions on how participants deal with risks of betrayal in trust games as compared to risks that do not imply a potential betrayal. To summarize, we did find consistent evidence for some kind of rational decision making in that participants were more risk-taking in the asymmetrical payoff condition (in which lots was to gain and little was to lose) than in the symmetrical payoff condition and they were the more willing to take that risk the higher the (perceived) probability of a positive outcome.

We did not find any evidence for betrayal aversion. If the fear of being exploited makes people shy away from making themselves vulnerable in a trust game, rates of risk taking in the extended lottery game should have been higher than in the trust game, as fear of betrayal should not play a role in the extended lottery game. Yet, this is not what we found. To the contrary, we did find evidence for principled trustfulness as participants were more willing to hand over their money in the trust game than in the extended lottery game, although this effect was only marginally significant.

We used a yoking procedure to make sure that the average as well as the distribution of all probabilities to increase one's money when taking the risky option were identical in the trust game and the extended lottery game, respectively. However, they still differed in one important detail. For participants in the trust game, their decisions were based on a probability that they had

to estimate themselves and of which they knew that this probability could be fundamentally wrong. Participants in the extended lottery game were simply told the exact probability of drawing a win in case they went for that lottery. Thus, decisions in the trust game were decisions under uncertainty, whereas decisions in the extended lottery game were decisions under risk. However, it has often been shown that most participants are averse to ambiguities (i.e., they prefer known over unknown risks; Ellsberg, 1961). Recently, Evans and Krueger (2017) showed that participants reacted more to objectively given information about an interaction partner's trustworthiness than they acted on their own estimates of their interaction partner's trustworthiness. Thus, ambiguity aversion might have decreased the effects of principled trustfulness.

What is striking is the high degree of risk-taking across all four different conditions. While Aimone and Houser would have expected risk aversion in the trust game, Fetchenhauer and Dunning would have expected risk aversion in the expected lottery game. Yet, both predictions proved wrong. In each of the four conditions, of those estimating the chance of winning being between 40 % and 60 %, a vast majority of more than 80 % participants went for the risky option. Especially in the symmetrical payoff conditions this indicates a remarkably high degree of risk-seeking. It is not easy to explain this result.

## Study 2

Study 2 aimed to replicate and extent the results of Study 1. Again, we let participants play trust games and extended lottery games under different payoff conditions, but we slightly changed the set-up in the following way.

First, we used a within-subjects design and let all participants play both games consecutively (in random order). Before they made their decisions in either game we explained to them the paradigm of the trust game and let them estimate the number of trustworthy Persons B. Participants were told that in the trust game they would be randomly paired with a single Person B and that the likelihood of winning in the extended lottery game was equal to the percentage of trustworthy Persons B in the trust game. Thus, in both paradigms, participants made a decision under uncertainty with identical probabilities to win or lose – while in the between-subjects setup in Study 1, the trust game was a decision under uncertainty but the extended lottery game was a decision under risk.

Second, the study reported here took place after participants had taken part in another study that lasted about one hour and for which participants were paid € 10. They were told that when making their decision, they could either keep these € 10 or they could use this money to send it to Person B in the trust game or to take the risky option in the extended lottery game, respectively. As students had worked one hour to earn their endowment for the experiment, we expected participants to be less in a "gambling mode" than some of them might have been in Study 1. Note that this should work in favor of betrayal aversion, as it can be assumed that losing one's own income to an untrustworthy Person B feels even worse than losing money that one has gotten from the experimenter without having had to work for it.

## Methods

### Participants

223 participants took part in the study. As in Study 1, they were recruited on the campus of the University of Cologne, and again, a mix of disciplines was ensured. 122 subjects were female (54.7 %), 99 were male (44.4 %). Two subjects chose to classify themselves as neither female nor male (0.9 %) (we did not find any gender differences in the present study). Participants' age ranged from 17 to 45 years ($M$ = 21.45, $SD$ = 3.22).

### Procedure

After participants had completed an hour-long unrelated study, they received a new paper-and-pencil questionnaire. It informed them that they would have to make three decisions, one of which would be relevant to their payoff.

In the first half of the questionnaire, the trust game and the extended lottery game were explained to participants in fixed order. As compared to Study 1, absolute payoffs stated in the first two games were twice as high due to the higher initial endowment (which was €10 instead of €5). The factor by which the initial endowment was multiplied when Person A chose the risky option was identical to Study 1, so relative payoffs had not changed.

The extended lottery was verbally illustrated by an urn containing red and white balls: For example, in the symmetrical payoff condition, participants were told that if they chose to take part in the lottery and they drew a white ball, they would receive nothing and Person B would receive €40 – which equaled the outcome of being paired with an untrustworthy Person B in the trust game –, while if they drew a red ball, they and Person B would each receive €20 –

which equaled the outcome of being paired with a trustworthy Person B in the trust game. They were also told that the probabilities of drawing a red or a white ball equaled the probabilities of the respective outcome options in the trust game, i.e., were derived from Persons B's behavior in the trust game.

After each explanation of a decision situation, questions tested for participants' understanding. After the trust game, participants were furthermore asked for their expectations regarding the behavior of Persons B.

In the second half of the questionnaire, participants had to indicate their concrete decisions in random order for the trust game and the extended lottery game, then for the coin-flip. To make their decisions, they were allowed to re-read the situations and they were reminded that one of their decisions would be for real money, i.e., involving the €10 they received for the unrelated prior study. After the decisions, demographic data was collected and participants were thanked.

After their decisions in the trust game and the extended lottery game participants had also been asked to decide whether they would be willing to participate in a simple coinflip (and had been told that one of these decisions would be for actual money). At the end of the study the experimenter informed the participants that the decision made for real money would be that decision. If they had indicated to take part, the experimenter flipped a coin in front of them, determining their payoff; if they did not, the experimenter would hand them their €10.

## Results

Across both kinds of game and both payoff structures, 34.6 % of all participants decided to take the risky option.

For analyzing the data properly we applied a mixed multi-level regression model, taking care of the nested data structure as the decisions in the trust game and decisions in the extended lottery were elicited within one subject as repeated binary measurements. To take care of participants' idiosyncrasies consequently, a model was applied that considers random intercepts and random slopes across individuals regarding their repeated decisions, as this should account for potential correlations of the decisions elicited in the within-subject design. The results showed that the order in which the two decisions were taken had no effect on participants' behavior ($e^{\beta} = .78$, $p = .35$, 95% CI [.47, 1.31]; trust game first vs. extended lottery game first).

Importantly, these decisions were also independent from the different payoff structure ($e^{\beta}$ = 1.42, $p$ = .18, 95% CI [.85, 2.34]; asymmetrical vs. symmetrical). Furthermore, no interaction effect of these two factors was detected ($e^{\beta}$ = .69, $p$ = .49, 95% CI [.25, 1.96]).

However, it turned out that more participants chose the risky option in the trust game than in the extended lottery game (40.8 % versus 28.2 %; $e^{\beta}$ = 1.87, $p$ < .01, 95% CI [1.23, 2.85]; trust game vs. extended lottery game fixed effect under the control of the respective non-significant random slope effect and a significant random intercept term). Figure 2 shows the percentage of risky decisions across the two independent variables. As can be seen, in both payoff conditions more participants chose the risky option in the trust game as compared to the extended lottery game.

[INSERT FIGURE 2 HERE]

*Figure 2.* Risk-taking rates across game type and payoff structures.

Table 2 shows that behavior in both kinds of games was highly related. A majority of 52.3% kept their money in both paradigms, 21.5% took the risky option in both conditions. Only a small minority of 6.7% staked their money in the extended lottery game but kept their money in the trust game. Compared to that many more (19.3%) kept their money in the extended lottery game but sent their money in the trust game. As in Study 1, participants' decisions were influenced by their estimates about the percentage of trustworthy Persons B. However, the correlation between these estimates and behavior in the trust game ($r$ = .42; $p$ < .01) was stronger than the correlation between these estimates and behavior in the extended lottery game ($r$ = .16; $p$ < .01). A z-test revealed that this difference was highly significant ($z$ = 3.1; $p$ < .01). A multi-level analysis confirmed these findings under control of the nested repeated measure structure of the data (expectations of trustworthiness as a control: $e^{\beta}$ = 2.07, $p$ < .001, 95% CI [1.57, 2.71]; another model, testing for an interaction of expectations with decisions in trust game vs. extended lottery game: $e^{\beta}$ = 1.94, $p$ = .005, 95% CI [1.22, 3.09]).

To summarize, in Study 2 we found no evidence for betrayal aversion, but as the willingness to choose the risky option was substantially higher in the trust game as compared to the extended lottery game, there was clear evidence for principled trustfulness. This effect was

neither moderated by the different payoff structures that were applied nor by the order in which both games were played or the perceived likelihood to be paired with a trustworthy Person B. Estimates of the percentage of trustworthy Persons B influenced participants' decisions in both games but did so significantly more strongly in the trust game (although it had the same logical relevance for both decisions).

## General discussion

The aim of the present studies was to further investigate how decisions in trust situations differ from other situations in which taking a risky option does not imply making oneself vulnerable to the trustworthiness of another person. Thus, in both studies we contrasted participants' behavior in a trust game with the behavior in an extended lottery game. In both games, another Person B was involved, in both games, Persons A could "enlarge the pie" by choosing the risky option, in both games, payoff structures and probabilities to win or lose were identical, but only in the trust game Persons A ran the risk of having their trust betrayed by Person B.

We contrasted the payoff structures used by Aimone and Houser (2011), on the one side, and Fetchenhauer and Dunning (2009), on the other side, because both labs had asked participants for their concrete decisions in trust games in the past (unlike, e.g., Bohnet and Zeckhauser, 2004, who had asked for "minimum acceptable probabilities") but had obtained results pointing to opposing directions. Regarding the two games, theoretically, there were three potential outcomes of these studies: 1) Rates of risk-taking could have been equal in both games (indicating that trust decisions are not different from other risky decisions), 2) rates of risk-taking could have been lower in the trust game than in the extended lottery game (indicating betrayal aversion in Persons A), and 3) rates of risk-taking could have been higher in the trust game than in the extended lottery game (indicating principled trustfulness in Persons A).

The results we obtained across both studies partly differed and were partly identical. To start with the differences, first, it has to be noted that the willingness to choose the risky alternative significantly differed across both studies. Indeed, across all conditions risk-taking rates in Study 1 were more than twice as high as in Study 2 (78.9 % versus 34.6 %). Compared with other studies both by ourselves (e.g., Dunning et al., 2014; Fetchenhauer & Dunning, 2009) and by others (e.g., Aimone et al., 2014; Evans & Krueger, 2011), risk-taking in Study 2 was

inconspicuous but was surprisingly high in Study 1. Although it is difficult to prove any potential explanation for this result we would argue that it was likely due to the different general set-up of both studies. In Study 1 participants were invited to our lab and only played the trust game or the extended lottery game, respectively. They knew that they participated in a psychological study on "decision-making", which might have triggered motives to learn something about human behavior (i.e., about oneself and other people). Yet, insight into others' behavior was only possible if one chose the risky option. Therefore, it might have felt like an anticlimax to simply keep one's initial endowment and to never find out what would have happened had they decided for the risky, much more thrilling alternative.

In contrast to this, in Study 2 participants earned € 10 by filling in questionnaires for about one hour and we explicitly told them that is was this money they were given as endowment for the decisions they had to make in our study. Therefore, they might have been more hesitant to risk losing their money. In line with this reasoning, when asked whether they wanted to use their endowment to flip a coin (the decision which finally was made for real money), a vast majority of 86.4 % decided to decline and to keep their money. Thus, we would argue that the external validity of Study 2 may be regarded as higher than the external validity of Study 1, as in real life most people in most situations will not make their trust decisions just for the thrill of the situation.

This might also explain another difference between both studies, namely that the different payoff structures influenced participants' behavior in Study 1, but not in Study 2. It makes sense that one takes into consideration what is to lose and what is to win when being in a rather playful or gambling mode. Yet, in the more serious circumstances of Study 2 participants might have taken their decision based on internal principles rather than on external incentives. However, it has to be acknowledged that this explanation is rather post hoc as we did expect to find an influence of the payoff structure in both studies.

Expectations played a role in both studies. The higher the perceived likelihood of winning, the more were participants willing to hand over their money to Person B. Although this might sound trivial, this finding indicates that decisions in our studies did have a rational and calculative element. Interestingly, in Study 2 expectations played a much bigger role in the trust game than in the extended lottery game (for similar results see Evans & Krueger, 2017). Maybe

in the extended lottery game the likelihood of winning was (nearly) ignored in a similar way as was the payoff structure and participants rather took a principled decision whether to gamble with the salary that they had gotten for one hour of filling in questionnaires. Furthermore, it might be the case that participants – knowing that they had to make an actual decision – adapted their estimates to make their decision appear more rational ("I am about to send my money to Person B thus, I believe that person will be trustworthy").

The main question of both studies was whether participants' behavior would indicate the presence of betrayal aversion or whether participants' behavior would rather indicate the presence of principled trustfulness. It should be noted that in psychology there are not many occasions at which two different lines of reasoning come up with two very specific and contradictory hypotheses.

In both studies, participants were more willing to choose the risky option in the trust game than in the extended lottery game. That is, we found consistent evidence for principled trustfulness but we did not find any evidence for betrayal aversion on a behavioral level. A pooled analysis across both studies revealed that the inverse variance weighted effect size of the game type (trust game vs. extended lottery game) gained an odds ratio of 1.85 ($p$ = .013). Furthermore, we did not find any evidence for this effect being moderated by the payoff structure or the order in which decisions were made. As mentioned before, we obtained very different rates of risk-taking in both studies but we found principled trustfulness in both of them.

Our initial expectation was that the different results of Aimone and Houser and Fetchenhauer and Dunning in the past would be due to the different payoff structures. Thus, we expected to find principled trustfulness in the symmetrical payoff structure and to find betrayal aversion in the asymmetrical payoff structure. Yet, in both studies there was no sign of such interaction effects.

How come that we were not able to replicate any of the results that speak for the existence of people reacting in line with the concept of betrayal aversion? First, as mentioned, the previous results of Aimone and Houser were based on rather small sample sizes: In Aimone and Houser (2011) and (2012), they had 26 participants in the know condition and 25 participants in the don't know condition. Also keep in mind that in a pretest, only 7 out of 31

participants were able to answer all control questions on the quite complex instructions used by Aimone and Houser correctly (Götmann, 2014).

Second, even within their own paradigm, studies only partly confirm the dominance of betrayal aversion as determining participants' decisions in trust games. For example, Aimone et al. (2015) conceptualized betrayal aversion as a personality measure and found that only 44.6 % of all participants could be classified as "betrayal averse". A similar result was obtained in the fMRI study by Aimone et al. (2014), in which participants made a total of 82 decisions (41 decisions in the know condition and 41 decisions in the don't know condition). Based on these decisions, less than a third (8 out of 30) participants could be classified as "betrayal averse" (i.e., they were significantly more risk-taking in the don't know condition than in the know condition).

It should be noted that the extended lottery game should have given the concept of betrayal aversion a very fair chance to show up in our data. In this paradigm, when taking the risky option and losing one's money, participants do not have to be angry about having been betrayed by Person B, and additionally they could feel a warm glow (Andreoni, 2016) that at least another person has earned some money.

In contrast, the present studies are very much in line with the results we obtained before. As mentioned above, in a number of studies we could show that participants are more willing to hand over their money to an anonymous Person B in a trust game than they are willing to gamble on a lottery with identical payoffs and identical probabilities of losing and winning (e.g., Dunning et al., 2014; Fetchenhauer & Dunning, 2009; 2012). Furthermore, we found evidence that in trust games people feel obliged to hand over their money to Person B (Dunning et al., 2014) and that they experience emotions of tenseness and uneasiness when thinking about keeping their money (Schlösser et al., 2016).

Taken together, we feel confident that in trust decisions principled trustfulness plays a more substantial role than betrayal aversion, at least in one-shot interactions. It would be worthwhile to investigate whether betrayal aversion would be able to predict participants' behavior in repeated trust games when participants might have made negative or ambivalent experiences with a specific interaction partner.

Furthermore, we think that betrayal aversion does indeed exist on an affective level. It can hardly be denied that it hurts when your trust is abused. Thus, people might shy away from

situations in which they make themselves vulnerable to the trustworthiness of another person. But to openly signal one's distrust to another person seems to feel even worse.

This might be functional both on an individual and on a societal level. Only when we make us vulnerable by trusting each other in the first place can we prove our trustworthiness (Fetchenhauer & Dunning, 2010). This is necessary for trust to fulfill its vital role in intimate relationships, friendships, organizations, and societies as a whole. Maybe much of the trust we observe in these institutions is not so much based on the optimistic expectation for trust to be rewarded but rather on the bad feelings associated with signaling one's distrust.

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Table 1

*Binary-Logistic Regression Testing the Effect of Expectations/Probabilities and Their Interaction with Type of Game on Risk-Taking*

| Variable | *B* | *SE* | *p* | $e^{\beta}$ |
|---|---|---|---|---|
| Constant | -0.006 | 0.835 | .010 | 0.369 |
| Type of Game | 0.594 | 0.306 | .053 | 1.811 |
| Payoff Structure | 1.170 | 0.317 | .000 | 3.220 |
| Expectations/ Probabilities | 0.035 | 0.007 | .000 | 1.036 |
| Nagelkerke $R^2$ .212 | | | | |

Table 2

*Percentages of Within-Subject Combinations of Risk-Taking Behavior*

| | Keep money in extended lottery game | Stake money in extended lottery game |
|---|---|---|
| Keep money in trust game | 52.3 | 6.7 |
| Send money in trust game | 19.3 | 21.5 |