Current Psychology (2021) 40:6014–6028
https://doi.org/10.1007/s12144-019-00509-1

On the role of vocal emotions in social decision-making

Jonathan A. Caballero[1,2] · Marina Menez Díaz[1]

Published online: 18 November 2019

Abstract
Emotional expressions constitute valuable information for decision-making in social interaction contexts. However, the range of emotions that have been studied is limited. The present study addresses the effects of a wider range of emotional expressions using a methodology modeling interdependent decision-making in social contexts, the Assurance Dilemma. Joy, sadness, anger, fear, disgust and emotionally neutral vocal expressions were presented to 46 participants taking part in the Assurance Dilemma, obtaining behavioral and judgment data on cooperation behavior. For each emotion, predictions based on theoretical accounts and research on emotion induction in decision-making contexts were advanced; joy, sadness and fear were predicted to increase cooperation while anger and disgust to decrease it, as compared to neutral expressions. Results show that emotional expressions reliably affected cooperation, although not always according to the predictions: except for joy, all emotions decreased cooperation. Judgment measures provide further insight into the decision-making process. When collected before participants experienced feedback in the interactions, judgment measures show that participants hold a priori expectations on others' likely behaviors depending on the emotional expression they display and are willing to use them to guide their decision-making process. This data aligns more closely with predictions. However, after experiencing outcomes, expectations are revised and converge with the behavioral patterns observed in the actual interactions. Results are discussed in terms of how emotional expressions are used for guiding expectations and taking decisions in social interaction contexts and the role that experience plays in this process. Limitations are pointed out directions for future research suggested.

Keywords Social decision-making · Vocal emotional expressions · Basic emotions · Cooperation behavior · Social interaction

Introduction

Making decisions in everyday life is a complex process that requires taking into account the particularities of the situation at hand as well as our goals and objectives to delineate a suitable course of action and attain those goals. In social situations, this process acquires an additional layer of complexity, as the outcomes we experience not only depend on our own behavior but also on the behavior of others with whom we interact. As the converse is also true, those situations are said to be interdependent: outcomes for the involved parties depend simultaneously on each individual's behavior and on the behavior of others taking part in the interaction.

This type of situations had been extensively studied using social dilemmas (Kollock 1998; Van Lange et al. 2013). In short, they represent interaction situations in which individual rationality (understood as acting out of self-interest and holding the assumption that other individuals also act in this way) leads to everyone involved to be worse off. In contrast, if the involved parties cooperate with one another, their outcomes are much better – but this requires taking a risk and sometimes acting in a way that may be interpreted as irrational from an individual point of view.

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s12144-019-00509-1) contains supplementary material, which is available to authorized users.

✉ Jonathan A. Caballero
j.caballero.m@comunidad.unam.mx

Marina Menez Díaz
menez@unam.mx

[1] Facultad de Psicología, Cubículo 124, Edificio D., Universidad Nacional Autónoma de México, Avenida Universidad 3004, Copilco Universidad, 04510 Coyoacán CDMX, Mexico

[2] Present address: Neuropragmatics and Emotion Lab, School of Communication Sciences and Disorders, Faculty of Medicine, McGill University, 2001 McGill College, 8th floor, Montreal H3A 1G1, QC, Canada

An example of such a situation is the Assurance Dilemma[1] (Kollock 1998; Kugler et al. 2012; Murnighan and Wang 2016), which is best understood using an example (adapted from Kugler et al. 2012, exp. 2). Imagine a context where you are paired with another (unknown) participant for a betting task and given the following instructions: "In this task, you will decide whether cooperating or betraying the other participant. If you decide to betray you will receive $10 regardless of the choice of the other participant. If you decide to cooperate, your payoff will depend on the decision of the other participant. If the other participant also choses to cooperate, both of you will receive $20. If the other participant decides to betray, you will receive $0 (and the other participant will receive $10). The other participant is facing exactly the same decision". The situation is summarized as a payoff matrix in Table 1.

Note that in the Assurance Dilemma, while it is better for both parties to cooperate with one another, because the decision of the other participant is unknown, cooperating represents a risk (hence the name of the dilemma, as one should be willing to cooperate insofar as one is assured that the other party also will). Moreover, note that this means that one is better-off doing the same as the other party does, i.e. if the other party cooperates, cooperating leads to a better outcome ($20) than betraying ($10), while if the other party betrays, one is better-off betraying ($10), than cooperating ($0). In other words, an important characteristic of the Assurance Dilemma is that the payoff structure incentivizes participants to decide the same as they expect the other party to decide (Murnighan and Wang 2016).

The use of social dilemmas in studying variables that influence decisions to cooperate has uncovered a wide range of variables that affects them, including those related to the structure of the situation (i.e. payoff matrices, one-shot vs iterated playing, whether communication is allowed, etc.), and those related to the role that psychological variables play in it (i.e. framing effects, group identity, personality traits, among others, Kollock 1998; Murnighan and Wang 2016; Van Lange et al. 2013). A key aspect for the purposes of the present study is that, because in these situations the outcomes are interdependent, any information about the possible behavior of others involved in the interaction is highly valuable, as it allows agents to orient their decision-making process.

In this regard, an ubiquitous cue of others' likely behavior in everyday life is exemplified by emotional expressions. This is the case because according to various theoretical approaches a fundamental function of emotional expressions is to communicate underlying behavioral intentions (Andersen and Guerrero 1998; Andrew 1963; Keltner and Haidt 1999; Keltner and Kring 1998; Shariff and Tracy 2011; Van Kleef et al. 2010). The general argument is engrained in an evolutive perspective and can be formulated as follows.

[1] Also known as *Stag Hunt* dilemma (c.f. Skyrms 2003)

Table 1 Example of a payoff Matrix representing the Assurance Dilemma

		Player 2	
		Cooperate	Betray
Player 1	Cooperate	$20/$20	$0/$10
	Betray	$10/$0	$10/$10

Number pairs represent the consequences for the Player 1 and 2 depending on the combination of decisions (Cooperate or Betray). In each pair, the first number of the pair represents the consequence for Player 1 and the second number the consequence for the Player 2 for that specific combination of decisions

As emotions play an important role in directing behavior in adaptive ways by producing coordinated physiological and motivational responses that have been useful during the evolutionary history (Abe and Izard 1999; Frijda 1988; Frijda et al. 1989; Izard 1997; Levenson 1999) and because they are also associated with specific and distinct types of emotional expressions (Ekman 1994; Izard 1994; Russell 1994; Sauter et al. 2010); in interaction contexts, emotional expressions allow observers to quickly (or even automatically) identify which emotion the counterpart is experiencing and thus to predict their likely courses of action, which allows observers to react in adaptive ways (Alguacil et al. 2015; Andersen and Guerrero 1998; Keltner and Haidt 1999; Shariff and Tracy 2011).

The Role of Emotional Expressions in Social Dilemmas

While not abundant, some studies have addressed the role of emotional expressions in guiding behavior in social dilemmas. A common finding has been that anger expressions decrease cooperation (Caballero and Menez, 2017; Caballero et al. 2018; Tortosa et al. 2013a, b) and that joy expressions increase it (Krumhuber et al. 2007; Scharlemann et al. 2001; Tortosa et al. 2013a).

Note, however, that some studies have not found effects of joy using behavioral measures of cooperation, although their results still suggest that participants expect increased cooperation from partners displaying joy. In this regard, Tortosa et al. (2013b) report that, as compared to neutral expressions, joy expressions fail to increase cooperation, while anger expressions decrease it in a repeated-interaction context where – unbeknown to the participants – the cooperation probabilities associated to the different emotional expressions is random. In contrast, when pairing the different emotional expressions with objectively different probabilities of cooperation, people readily take them into account only when they are consistent with their expectations (i.e. joy paired with a high cooperation

probability and anger with a low cooperation probability), as revealed by them rapidly changing their behavior to cooperate with partners displaying joy and defecting when the partners display anger. In contrast, participants have a very difficult time to overcome their expectations when the emotions are paired with the cooperation probabilities in the opposite way: they take a long time to consistently cooperate with participants displaying anger and defect when they display joy (even if it is the optimal pattern as per the contingencies); a pattern that mirrors previous research using non-social decision making paradigms (Averbeck and Duchaine 2009). More recently, Caballero and Menez (2017) showed that, as compared to neutral expressions, joy expressions failed to increase cooperation while anger expressions readily decreased it. However, participants expected that opponents displaying joy would be more cooperative (as captured by judgment measures), and this expectation remained unchanged after experiencing the feedback received in the interactions.

Note that, from a complementary perspective, some studies have found that experiencing emotions (as opposed to observing others' emotional expressions) also influences cooperation behavior. In this regard, it has been found that experiencing anger and disgust tend to decrease cooperation while experiencing fear tends to increase it (Chapman et al. 2009; Kugler et al. 2012; Nelissen et al. 2011). This is in line with the argument of the role of emotions in regulating behavioral tendencies as a result of the underlying physiological and motivational processes (note, however, that it can be conceived as relatively automatic). From the decision-making perspective that we address in the current study, though, it is more relevant to address whether people who are exposed to the emotional expressions of others use this information strategically to guide their behavior in social decision-making contexts.

The Present Study

The main objective of the present experiment is to extend research on the effects of emotional expressions and test whether they constitute an important variable to guide decision-making in social interaction contexts. Specifically, we aim to address the effects of joy, sadness, anger, fear, and disgust on cooperation behavior. Those emotions were selected as there is extensive evidence of the human capability to adequately recognize them and because there is consensus on their status as basic emotions (Ekman 1992; Juslin and Laukka 2003; Pell et al. 2009; Scherer et al. 2001), which allows formulating specific predictions based on theoretical accounts and previous empirical research. We use the Assurance Dilemma as its payoff structure incentivizes participants to do the same as they expect the partner to do, as elaborated earlier. Therefore, given that emotional expressions are expected to provide a cue of the possible behavior of the partner, this methodology naturally provides an incentive for participants to use information about others' emotional expressions to guide their decision-making process.

The predicted patterns of results are as follows: Anger expressions will decrease cooperation, as it is a negative emotion for which decreases in cooperation have been reported using behavioral measures, and because it is known to decrease perceptions of trustworthiness and cooperativeness; moreover is widely regarded as a signal of threat and impending aggression (Caballero and Menez 2017; Caballero et al. 2018; Berkowitz and Harmon-Jones 2004; Canary et al. 1998; Stouten and de Cremer 2010; Tortosa et al. 2013a, b; Van Doorn et al. 2012). Joy expressions will increase cooperation as some previous results have found behavioral effects and as expressions of joy are known to increase perceptions of trustworthiness and cooperativeness; moreover it is widely regarding as signaling of openness to social contact, disposition to provide help, and to promote trust (Caballero and Menez 2017; Caballero et al. 2018 ; Eckel and Wilson 2003; Fischer and Mansted 2008; Izard 1991; Krumhuber et al. 2007; Scharlemann et al. 2001; Stouten and de Cremer 2010; Tortosa et al. 2013a; Van Doorn et al. 2012). Sadness is predicted to increase cooperation, as it has been proposed that sadness expressions signal helplessness and the need for social support and that they promote empathy and helping behavior in observers (Bandstra et al. 2011; Eisenberg et al. 1989; Fischer and Mansted 2008; Gray et al. 2011; Izard 1991; Oren 2009; Reed and DeScioli 2017; Van Kleef 2009; Vigil 2009). Fear is predicted to increase cooperation as this emotion is thought to promote search for social support, and its expressions may promote observers' helping behavior by signaling an affiliative, non-threatening disposition and inviting approach; and because in induction experiments it has been shown to increase cooperation (Fischer and Mansted 2008; Hammer and Marsh 2015; Izard 1991; Kugler et al. 2012; Marsh et al. 2005; Nelissen et al. 2011; Niedenthal et al. 2006; Tracy 2014). Disgust, lastly, is predicted to decrease cooperation as its function is promoting avoidance, withdrawal, and rejection; and because it has been shown that experiencing disgust decreases behavioral cooperation (Chapman et al. 2009; Rozin et al. 2008).

Following previous reports showing that participants' expectations of the possible behaviors of people expressing specific emotions allow revealing patterns that behavioral measures may miss and provide subtler insights in the decision-making process (Caballero and Menez 2017; Averbeck and Duchaine 2009; Tortosa et al. 2013b). We included judgment measures in the present study in addition to the behavioral cooperation measure.

A secondary objective of the study is to extend research to the vocal modality, as most studies addressing the role of emotional expressions on decision-making have prioritized the role of visual cues (facial expressions) of emotion

(Averbeck and Duchaine 2009; Krumhuber et al. 2007; Scharlemann et al. 2001; Tortosa et al. 2013a, b, c.f. Eckel and Wilson 2003; Reed et al. 2012). However, theoretical accounts predict that expressions of basic emotions in any modality (e.g. facial, vocal, body movement, etc.) should produce the same effects (Hawk et al. 2009) as they would communicate the same underlying behavioral intentions and social information (Andersen and Guerrero 1998; Keltner and Haidt 1999; Shariff and Tracy 2011). A pattern of results that recent research starts to support (i.e. Caballero and Menez 2017, described above), but that requires further testing.

In summary, this study aims to extend the study of how decision-making processes are influenced by others' emotional expressions to a wider set of basic emotions than previously addressed, and to increase the generalizability of results by using a different modality of expressions (vocal expressions of emotion) than most previous work has addressed (facial emotions).

Method

Participants

Forty-six undergraduate students (mean age = 19.33; SD = 1.9; 38 female), native Spanish speakers without hearing or language disabilities participated for course credit in a voluntarily opt-in fashion. A sample size calculation to ensure a statistical power of at least 0.8 (ß = 0.2) assuming $\alpha = 0.05$ and a medium-size effect ($\eta^2 = 0.06$) was performed on G*Power (Faul et al. 2007), and revealed that at least 44 participants should be included in the study. Note that the effect sizes in previous reports using similar designs are much higher ($\eta^2 > 0.3$ Caballero and Menez 2017; Krumhuber et al. 2007; Tortosa et al. 2013b). Therefore, the η^2 value used for calculating the sample size can be considered conservative. Note that the actual observed power after conducting the experiment was >.98 in all cases and the observed effect sizes much higher than 0.3, as will be reported in the results section.

Stimuli

Short recordings of the phrase "Let's play" ("Vamos a jugar" in Spanish), said with joy, sadness, anger, fear, disgust or a neutral tone of voice (to be used as a baseline), were used. Twenty recordings were included for each emotion; accordingly, a total of 120 stimuli were used in the experiment (6 Emotions × 20 recordings). Stimuli with the highest recognition levels among a pool of previously validated recordings were selected for the present experiment. Specifically, the recordings included for the present study were correctly recognized at 4.13 times chance level (S.D. 0.62) in two validation procedures (described in Caballero and Menez 2017, and the Annex provided in the Online Resource 1). They were roughly balanced in the gender of the encoder (59% of male-produced recordings).

Apparatus

Participants were individually tested in a quiet room. Stimuli were presented using professional earphones (Shure SRH940) at a comfortable volume for the participant. The stimuli presentation and response recording were controlled by Psychtoolbox for Matlab (Brainard 1997; Pelli 1997).

Procedure

Upon arrival at the laboratory, participants' data were recorded, participants were made aware that all personal information would remain confidential, and that they had the right to withdraw from the procedure at any time without penalty (which no participant did). Immediately after, the experiment began and instructions for the Assurance Dilemma were introduced at length, with examples of possible outcomes. Instructions were followed by three practice trials, after which any doubts or questions were answered, ensuring a correct comprehension of the task. Afterward, an experimental game block and a judgment block were presented according to a counterbalanced design, where each participant was randomly assigned to a task order group: the judgment block first and the game block later (Judgment-Game group) or the opposite task order (Game-Judgment group). Each of the 120 stimuli was presented once in each block in a randomized order, with the restriction of avoiding the consecutive presentation of the same emotion more than twice in a row. Accordingly, 120 trials were presented in each block (6 emotions × 20 recordings).

Experimental Game Block

In the experimental game block (hereafter just referred to as game block), the Assurance Dilemma, depicted as a bets situation was presented. The possible choices were cooperate ("cooperar") and betray ("traicionar"). The payoff matrix is shown in Table 2.

Table 2 Payoff Matrix of the Assurance Dilemma

		Partner	
		Cooperate	Betray
Participant	Cooperate	$300/$300	$0/$100
	Betray	$100/$0	$100/$100

The table shows the payoff matrix for the Assurance Dilemma as used in the current study. The first number of the pair represents the outcome for the Participant and the second number the outcome for the Partner (represented by the recordings of emotional expressions) given the combination of decisions taken. The $ sign represents Mexican pesos

Participants were informed that they would play a single turn against each partner (represented by the recordings), that at the beginning of every turn, they would listen to a short recording of a "phrase said by the partner", and that the situation involved a series of bets in which the participants' and partner's payoffs depended on their joint decisions, as illustrated in the payoff matrix. They were also informed that the partners' behavior would mimic the patterns observed in real people and that the objective of the game was to maximize their hypothetical benefits. They were also told that because the patterns of behavior of the partners would mimic those of real players, they should play as they would do if interacting with real people.

Nevertheless, the probability of cooperation of each simulated partner was fixed at 0.5 regardless of the emotion. Thus, the emotional expressions provided no information about the outcome probability. Participants were unaware of this manipulation during the experiment but were debriefed at the end. Note that explicitly stating that the partners' behavioral patterns are simulated or letting them interact with computer-generated avatars does not impede detecting effects of emotional expressions (Caballero and Menez 2017; Caballero et al. 2018; de Melo et al. 2014; Melo et al. 2009; Tortosa et al. 2013b). Each trial started with a recording of a vocal emotion. Afterwards, the payoff matrix was presented on the screen and the participant decided whether to cooperate or betray. Lastly, feedback appeared displaying the participant's and the partner's decisions in the trial and the monetary outcomes they received based on their joint decisions. The upper half of Fig. 1 provides a diagrammatic description of the sequence of the events in trials of the Game block.

Judgment Block

At the beginning of the judgment block, participants were asked to imagine that they were about to play with the player, and were informed that they will provide cooperation probability judgements without engaging in interactions, any questions about the procedure were clarified by the experimenter. The lower half of Fig. 1 diagrammatically illustrates the sequence of events in the trials of the Judgment block. In this block, each trial started by presenting a recording. Right after, participants were asked to provide a judgment on the expected cooperation probability of the partner using a 7-point Likert scale. Specifically, the following question appeared on the screen: "From 1 to 7, How likely is this partner to betray or cooperate?" along with the numbers 1 to 7 and the tags "I'm totally sure that this partner would betray", "This partner is equally likely to cooperate or betray" and "I'm totally sure that this partner would cooperate" accompanying the numbers 1, 4, and 7, respectively. This question was included to obtain a measure of how much participants' expected the partners to cooperate (hereafter we refer to this measure as expectation).

After their response, a new question appeared on the screen: "From 1 to 7, How willing would you be to betray or cooperate if you were to play with this partner?" along with the numbers 1 to 7 with the tags "I'm totally sure that I would betray", "I would be equally likely to betray or cooperate" and "I'm totally sure that I would cooperate" accompanying the numbers 1, 4, and 7, respectively. This question tackled at the participants' intention to cooperate with that partner (hereafter we refer to this measure as intention). Note that this measure is different from the behavioral measure obtained in the Game Block in such it is graded (7-point scale) as opposed to discrete (forced choice of cooperation versus betrayal). Note also that because both judgment measures were elicited by asking the participants to imagine that they would hypothetically play with those partners but without engaging in the interaction, no feedback was presented in this block. Furthermore, note that because of the counterbalanced order of presentation of the Game and Judgment blocks, judgments measures in the Judgment-Game order group provide insight into participants'

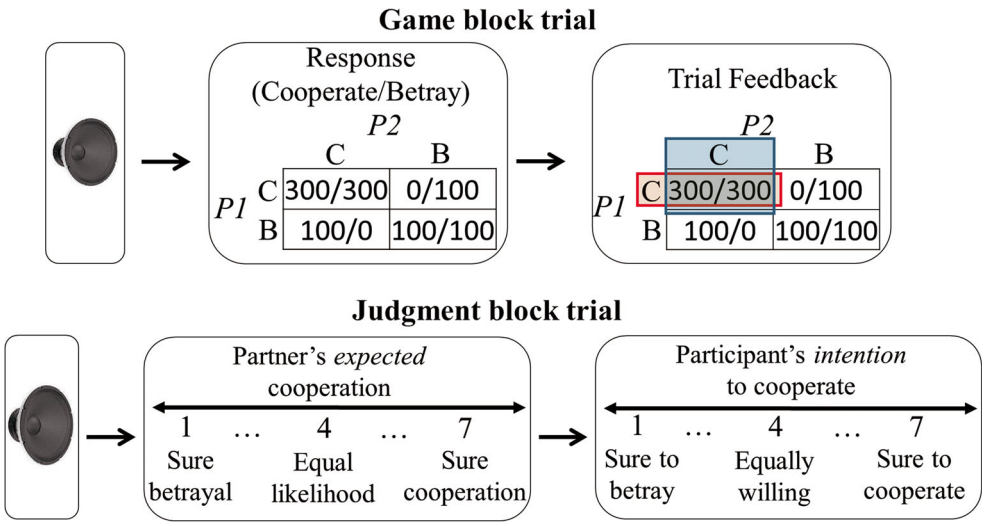

Fig. 1 Sequence of events in the trials of the Game and Judgment blocks. In the upper half, P1 and P2 denote the Participant and the Partner, respectively; and C and B denote Cooperate and Betray, respectively

a priori expectations and intentions, while judgments of participants in the Game-Judgment order group reflect how those measures change as a function of the feedback received during the Game block.

Results

Cooperation Behavior

From each participant's responses to the game block, we calculated the proportion of turns in which they cooperated out of the 20 times that stimuli depicting each emotion were presented. Because of this, we obtained 6 data points per participant: each data point representing the cooperation proportion observed for the participant when interacting with partners expressing each of the 6 emotions included in the design (joy, sadness, anger, fear, disgust, and neutral expressions). The resulting cooperation proportions were analyzed using a factorial ANOVA including the within-subjects factor "emotion" and the between-subjects factor "task order". The analysis revealed a main effect of emotion ($F(5,220) = 45.74$, $p < .001$, partial $\eta^2 = 0.51$), and no e main effect of task-order ($F(1,44) = 1.16$, $p = .29$, partial $\eta^2 = 0.03$), nor an interaction of task-order with emotion ($F(5,220) = 1.9$, $p = .1$, partial $\eta^2 = 0.04$).

To compare each emotion versus neutral expressions, individual t-tests for related samples were conducted for the pairs formed between neutral expressions and each of the individual emotions, using a Bonferroni correction. Results revealed no differences in cooperation towards partners displaying joy and neutral expressions ($t(45) = -1.78$, $p = 0.08$). In contrast, cooperation behavior was lower towards partners displaying sadness, anger, fear, and disgust as compared to those displaying neutral expressions (for all tests, $t(45) > 3$, $p < 0.001$).

As the probability of cooperation of the partners was fixed at 0.5 (chance level) regardless of the emotion displayed, we tested whether the participants' cooperation proportions simply aligned to this pattern or whether they differed from chance. For each emotion, we compared the cooperation proportions with a value of 0.5 for this end. Results revealed that cooperation proportions for Joy and Neutral expressions were significantly above chance (t's > 5, p's < 0.001); in contrast, cooperation proportions for Anger, Fear and Disgust were significantly below chance (t's < −3, p's < 0.005). The cooperation proportion for Sadness was no different from chance ($t = -.035$, $p = .97$).

In summary, analyses revealed that 1) all emotional expressions but joy led to lower levels of cooperation than neutral expressions, and 2) cooperation for all emotional expressions, except for sadness, differed from chance (See Fig. 2).

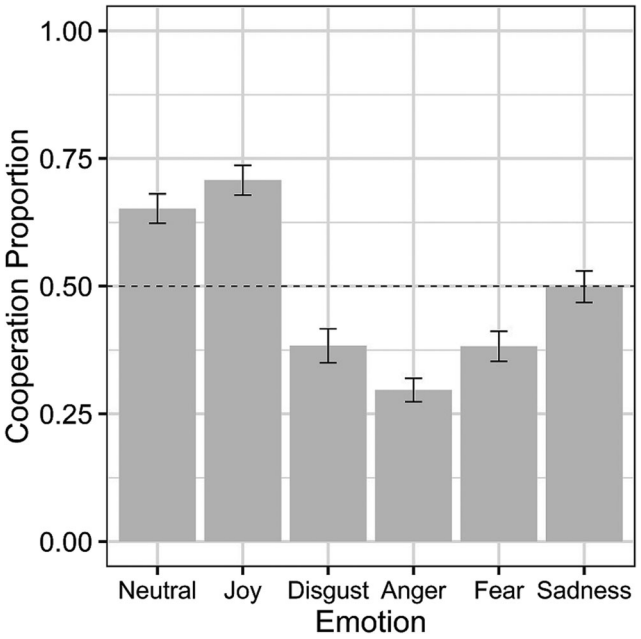

Fig. 2 Cooperation Proportions for each emotional expression. The dotted line signals the chance level. Error bars show standard errors

Expectations

For each participant and emotion, we obtained the mean rating of the scale addressing the participants' expectations of the partners' behavior (How likely is this partner to betray or cooperate?). The obtained measures were analyzed using the same approach as before. We identified a main effect of emotion ($F(5,220) = 52.6$, $p < .001$, partial $\eta^2 = 0.54$), and no main effect of task-order ($F(1,44) = 0.7$, $p = .4$, partial $\eta^2 = 0.02$). As the interaction of emotion and task order was significant ($F(5,220) = 2.85$, $p < .05$, partial $\eta^2 = 0.06$), we present the results separated by task order. Figure 3 summarizes results for this judgment measure.

Judgment-Game Order

When the judgment block preceded the game block, the emotion factor was significant ($F(5,110) = 29.21$, $p < 0.001$, partial $\eta^2 = 0.57$), implying that emotions significantly impacted a priori expectations. Comparing each emotion versus neutral expressions we found that participants expected partners displaying joy to be more cooperative than those displaying neutral expressions ($t(22) = 7.82$, $p < 0.001$); moreover, participants expected that partners displaying anger or disgust would be less cooperative than those displaying neutral expressions (t's < −3, p's < 0.001). The expectations for partners displaying sadness and fear were not different than for those displaying neutral expressions (Sadness: $t = -1$, $p = 0.33$; Fear: $t = -.68$, $p = .5$). We used one-sample t-tests (Bonferroni-corrected for 6 multiple comparisons; adjusted alpha = .0083) to compare versus chance level (corresponding

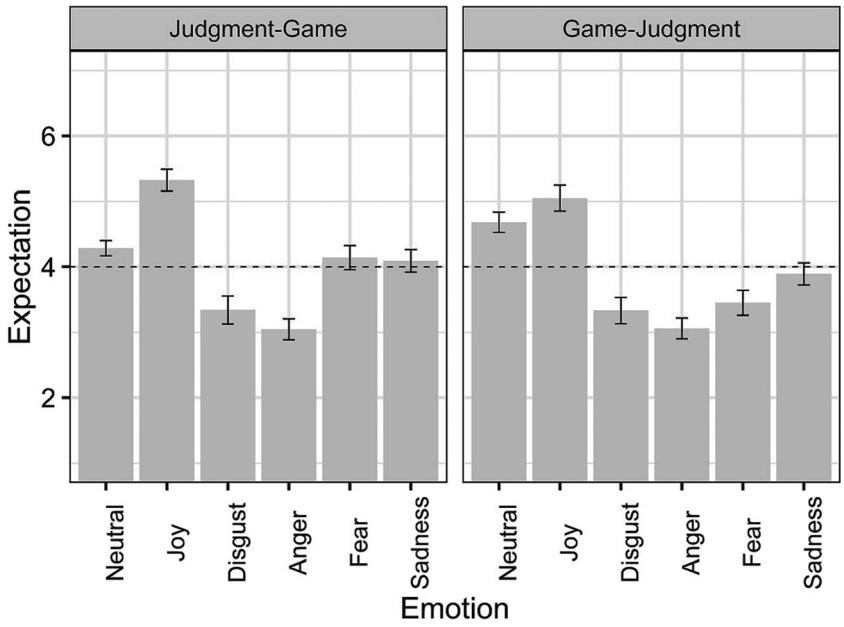

Fig. 3 Participants' expectations of the partners' cooperation probability as a function of the emotional expression, divided by task-order groups. The dotted line indicates chance level. Error bars show standard errors

to the 4 response in the scale, which was accompanied by the label This partner is equally likely to cooperate or betray). We found that participants expected partners displaying Joy to be more cooperative than chance ($t = 8$; $p < 0.001$); partners displaying Anger and Disgust to be less cooperative than chance ($t's < -3$, $p's < 0.008$); and partners displaying Neutral, Sadness or Fear to be equally likely to cooperate or betray, i.e. no different from chance (Sadness: $t = 0.53$, $p = 0.6$; Fear: $t = .76$, $p = .45$; Neutral: $t = 2.45$, $p = 0.023$).

Game-Judgment Order

When the game block preceded the judgment block, the emotion factor was also significant ($F(5,110) = 26.37$, $p < 0.001$, partial $\eta^2 = 0.55$), implying that after having experienced outcomes in the experimental game, expectations were still affected by emotional expressions. Comparing each emotion versus neutral expressions, we found that participants expected partners displaying sadness, anger, fear or disgust to be less cooperative than partners displaying neutral expressions ($t's < -3$, $p's < 0.005$). The expectations for partners displaying joy and neutral expressions revealed no differences ($t = 1.54$, $p = .14$). Note that this pattern of results mirrors the one observed for the behavioral measure.

Comparing versus chance level (adjusted alpha = 0.0083), we found that participants expected partners displaying joy and neutral expressions to be more cooperative than chance ($t's > 4$, $p's < .001$). In contrast, they expected partners displaying anger, fear or disgust to be less likely to cooperate than chance (Anger: $t = -5.9$, $p < 0.001$; Fear: $t = -2.9$, $p = 0.00828$; Disgust: $t = -3.36$, $p = 0.0028$). The expectations for partners displaying sadness did not differ from chance ($t = -.64$; $p = 0.53$).

Between-Group Comparisons

To test whether expectations of participants in the Judgment-Game group (a priori expectations) differed from those of participants in the Game-Judgment group (expectations after having experienced feedback in the Game block), for each emotion we tested for differences between the Judgment-Game and Game-Judgment groups. No significant differences across groups were found for Joy, Sadness, Anger and Disgust (all $t's < 1.5$, all $p's > .2$). And while the analysis would have revealed a significant difference for fear expressions ($t(44) = -2.61$, $p < 0.05$; participants in the Game-Judgment order had lower expectations of cooperation than those in the Judgment-Game order for this emotion) and for neutral expressions ($t(44) = 2.05$, $p < 0.05$, participants in the Game-Judgment group had higher expectations of cooperation than participants in the Judgment-Game group) using conventional significance thresholds, the Bonferroni adjustment for multiple comparisons precludes to interpret them as reaching significance.

Intention to Cooperate

For each participant and emotion, we obtained the mean rating of the scale addressing the participant's intention to cooperate (How willing would you be to betray or cooperate if you were to play with this partner?). Data were analyzed using the same approach as above. A main effect of emotion ($F(5,220) = 54.49$, $p < .001$, partial $\eta^2 = 0.55$), and no main effect of task-order ($F(1,44) = 3.1$, $p = .09$, partial $\eta^2 = 0.07$) were detected. However, as the interaction of emotion and task-order was significant ($F(5,220) = 2.9$, $p < .05$, partial $\eta^2 = 0.06$), we present the results separately for each task-order.

Judgment-Game Order

The effect of the emotion factor was significant ($F(5,110) = 30.29$, $p < 0.001$, partial $\eta^2 = 0.58$). Comparing each emotion versus neutral expressions, we found that participants intended to cooperate more with partners displaying joy than with those displaying neutral expressions ($t(22) = 3.63$, $p < 0.005$); moreover, participants were less inclined to cooperate with partners displaying anger, fear or disgust than with those displaying neutral expressions (t's < −3, p's < 0.005). The participants were equally willing to cooperate with partners displaying sadness than with those displaying neutral expressions ($t = -2.19$, $p = 0.039$, nonsignificant as per the Bonferroni adjustment). Comparing versus chance level (corresponding to the 4 response accompanied by the label I would be equally likely to betray or cooperate); we found that participants' intention to cooperate with partners displaying Joy or Neutral expressions was significantly above chance (t's > 3, p's < 0.0083); that participants' intention to cooperate with partners displaying Anger and Disgust was significantly below chance (t's > 3, p's < 0.005); and that participants' intentions to cooperate with partners displaying Sadness or Fear were no different from chance (Sadness: $t = 0.2$, $p = 0.98$; Fear: $t = -.93$, $p = .36$).

Game-Judgment Order

When the game block preceded the judgment block, the emotion factor was also significant ($F(5,110) = 27.45$, $p < 0.001$, partial $\eta^2 = 0.56$), implying that participants' intention to cooperate was still influenced by the emotional expressions of the partners after experiencing the game feedback (even though they actually were not predictive of outcomes).

Comparing each emotion versus neutral expressions (using Bonferroni-corrected t-tests for related samples), we found that participants were less willing to cooperate with partners displaying sadness, anger, fear or disgust than with partners displaying neutral expressions (t's < −5, p's < 0.001). The intentions to cooperate with partners displaying joy and neutral expressions did not differ ($t = .16$, $p = .87$). Comparing versus chance (adjusted alpha = 0.0083), we found that participants' intentions to cooperate with partners displaying anger, fear or disgust were significantly below chance (t's < −4, p's < 0.001). In contrast, participants' intention to cooperate with partners displaying Neutral expressions was higher than chance ($t = 3.15$, $p < 0.005$). Participants' intentions to cooperate with partners displaying Joy or Sadness expressions were no different from chance (Joy: $t = 2.74$, $p = .01$; Sadness: $t = -.2.75$, $p = .01$).

Between-Group Comparisons

To test whether the intentions to cooperate of participants that had not been exposed to feedback (Judgment-Game order) differed from those of participants who already had experienced the outcomes of the game (Game-Judgment order), for each emotion, we tested for differences between those two groups. We only detected a significant difference in the intention to cooperate for fear expressions: participants in the Game-Judgment order were less willing to cooperate with partners displaying fear than participants in the Judgment-Game order ($t(44) = -3.11$, $p < 0.005$), the rest of the emotions revealed no significant differences (all t's < 2, all p's > .05). Figure 4 displays the intention results.

Relationship Between Variables

Since, as described in the introduction, in the Assurance Dilemma the best possible decision is to do the same as one expects the partner to do, and since the dependent variables were planned to tackle all the steps of the process (i.e. the Expectation of the partners' behavior given the emotion they showed, the Intention of the participants to cooperate given the game structure and the participants' goals, and the behavioral measure of Cooperation itself), we calculated the Pearson product-moment correlation coefficients between the dependent variables. All variables correlated with each other (all p's < 0.001). Table 3 summarizes the correlations between the variables and Fig. 5 provides a visual summary of the interrelations between them.

Discussion

The main objective of the study was extending research on the effects of emotional expressions on social decision-making addressing a wider set of basic emotions, and a secondary objective was extending research and make it more generalizable by using vocal expressions of emotions. To test whether this was the case we addressed cooperation in the context of the Assurance Dilemma using behavioral and judgment measures. Results show, overall, that the different emotions reliably affected cooperation, as captured by the effects of the emotion manipulation on the different dependent measures. This supports the notion that emotional expressions influence others' behavior, and provide evidence that this occurs using vocal emotions, extending previous research, based mainly in visual representation of emotions (facial stimuli).

Note however, that the patterns of results did not fully conform to our predictions, which were based on an evolutionary framework. In what follows, we first address the patterns of behavioral results. Later, we summarize the patterns of results of the judgment measures and discuss how they can

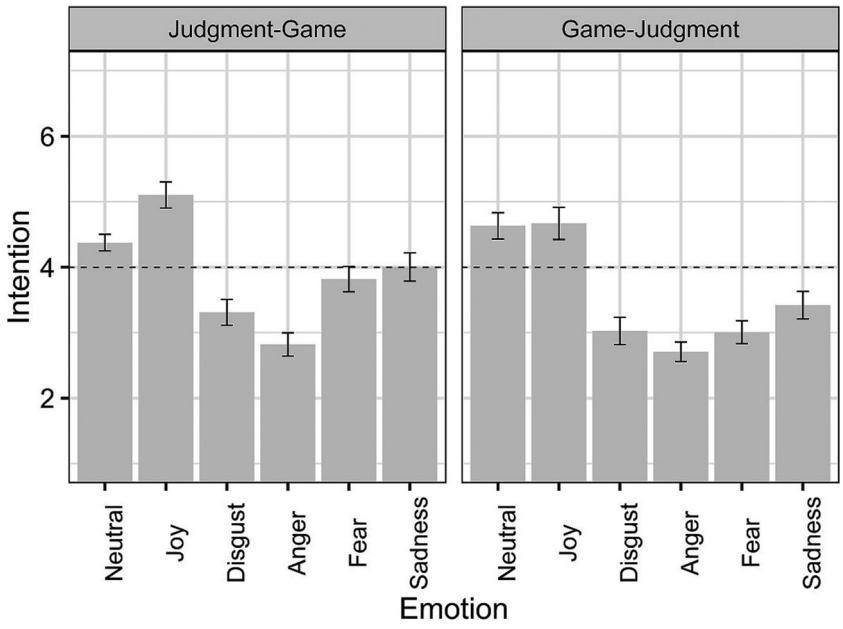

Fig. 4 Participants' intentions to cooperate with the partners as a function of the emotional expression they observed, divided by task-order groups. The dotted line indicates chance level. Error bars show standard errors

inform our understanding of the role of emotional expressions in social decision-making. Afterwards we discuss limitations and suggest future directions for research in the area.

Cooperation Behavior

To test whether participants' decisions to cooperate are influenced by emotional expressions of others', we compared the cooperation proportion towards partners displaying expressions of joy, sadness, anger, fear and disgust with that observed towards partners displaying neutral expressions. Results showed that, except for joy, all emotional expressions led to lower cooperation levels than neutral expressions, supporting the idea that emotional expressions constitute valuable information in social decision-making contexts. This pattern of decreased cooperation aligns with the predicted patterns in the case of anger and disgust and is consistent with previous research on the role of those emotions in social interaction (Caballero and Menez 2017; Berkowitz and Harmon-Jones 2004; Canary et al. 1998; Chapman et al. 2009; Rozin et al. 2008; Tortosa et al. 2013b; Van Doorn et al. 2012).

Table 3 Pearson product-moment correlation coefficients matrix for dependent variables

Measure	Cooperation	Expectation	Intention
Cooperation	1	0.67*	0.72*
Expectation		1	0.89*
Intention			1

*denotes $p < .001$

However, the effect was in the opposite direction of the predictions in the case of fear and sadness. Specifically, we predicted that sadness would increase cooperation; as its evolutionary social function has been conceptualized as promoting empathy and help from observers and constituting a signal of helplessness and the need for social support (Bandstra et al. 2011; Eisenberg et al. 1989; Fischer and Mansted 2008; Gray et al. 2011; Izard 1991; Oren 2009; Reed and DeScioli 2017; Van Kleef 2009; Vigil 2009). Along similar lines, because it has been proposed that experiencing fear promotes search for social support and that expressing it would signal an affiliative and non-threatening disposition – as well as based on findings of increased cooperation in fear induction studies – we predicted that fear expressions would increase cooperation (Fischer and Mansted 2008; Hammer and Marsh 2015; Izard 1991; Kugler et al. 2012; Marsh et al. 2005; Nelissen et al. 2011; Niedenthal et al. 2006; Tracy 2014). A possible explanation for the observed pattern of results is that expressions of sadness and fear may promote competing motives in observers: offering help, but also avoiding interaction. Following this idea, those emotions, in addition to constituting cues of a need for social support (motivating others to help), also constitute cues of a diminished social desirability (demotivating others to approach), and the second motivation tends to triumph in contexts that require direct social interaction (Hauser et al. 2014). Determining whether this was the case in the present experiment is not possible using current data, but it constitutes an area of opportunity for future studies.

To test whether the participants' cooperation behavior simply aligned to the contingencies they experienced, we compared cooperation proportions vs the chance level (which was the partners' objective probability of cooperation regardless of the emotional expression they displayed, as per our

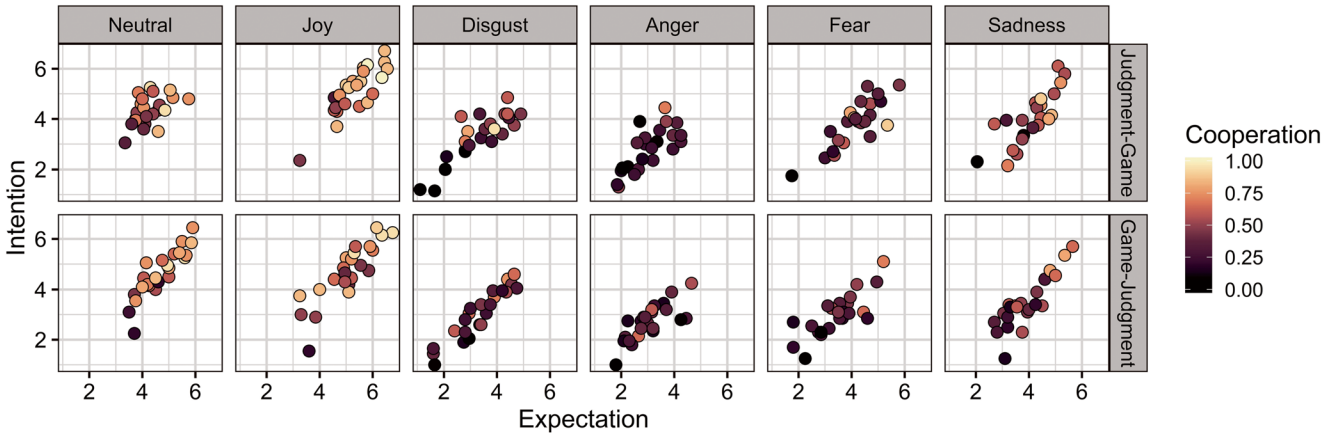

Fig. 5 Visual summary of interrelations between variables. Each panel shows the scatterplots of the Judgment measures (Expectation and Intention) divided for each emotion for the two block-order groups. The color scale presents the cooperation proportion (behavioral measure)

experimental design). On the great scheme of things, results allow rejecting that this was the case. Except for sadness, all emotional expressions led to cooperation levels which differed from chance: neutral and joy expressions led to above-chance cooperation levels while anger, fear, and disgust led to below-chance cooperation levels.

One of the reasons that sadness may not have showed differences from chance level while the rest of the emotions did differ is that, while it has been proposed that sadness expressions constitute a signal of vulnerability and increased need for social connection and support (Gray et al. 2011; Oren 2009; Reed and DeScioli 2017), such support usually comes from people in close relationships and from those who can benefit from providing help, rather than from strangers (Hauser et al. 2014; Vigil 2009). In contrast, strangers may not always provide support to people expressing sadness (Hauser et al. 2014) and expressing this emotion may even invite aggression under certain circumstances (Vigil 2009). Because we used a context of short interactions with strangers in the current study, we may not have been able to observe the predicted effects of increased cooperation (nor a decrease, for that matter) towards partners expressing sadness. Future studies could manipulate the social context in which the interaction takes place to explore the effects of sadness (and the other emotions) under different circumstances. It may be possible, for example, that in a context where a form of aggression leads to better outcomes and helping leads to losing resources, the expressions of sadness – while still signaling vulnerability – increase observers' aggression rather than inviting help and support.

Judgment Measures

For its structure, in the Assurance Dilemma, the best possible decision is to do the same as one expects the partner to do and thus any information that allows predicting the partners' behavioral intentions is highly valuable. If this was the case in the context of the present experiment, we could expect that emotional expressions would, first, influence what our participants expected the partners to do as a function of the emotions they displayed. Moreover, if this constitutes relevant information for their decision-making process, it should also affect their subsequent intention to cooperate with them, even when asked about it in a hypothetical scenario. That's to say, when participants are asked how likely they would be to cooperate with a given partner without being required to engage in the interaction. This is analogous to a situation in which only the information about the interdependent structure of the situation with its associated outcomes as well as the observed emotional expressions are available to take a decision, but direct experience dealing with the situation is lacking.

We used judgment measures to tackle those two steps. Note that, in contrast with the behavioral measure (unaffected by the task-order manipulation), we found order effects for both judgment measures.

Results demonstrate that emotional expressions influenced participants' expectations and intentions even when they have not experienced interaction outcomes: In the Judgment-Game group, participants expected partners displaying joy to be more cooperative and partners displaying anger or disgust to be less cooperative than those displaying neutral expressions (and also when comparing vs chance level), in line with our predictions. It is noteworthy that the expectations for partners displaying neutral, sadness and fear expressions showed no differences among themselves nor did they differ from chance in this group. While not conforming with the predictions (sadness and fear expressions were expected to increase cooperation), results suggest that participants do not consider those emotions to constitute signals of a diminished probability of cooperation a priori.

The pattern of results was closely mirrored in the case of the participants' intention to cooperate with a small exception: their intention to cooperate with partners displaying Neutral

expressions was higher than chance (mirroring behavioral results). This is in line with previous research showing that people cooperate more than could be expected based on decision models that assume "rational" decisions to cooperate (Cooper et al. 1996; Dawes and Thaler 1988; Dunning et al. 2014). This can be interpreted as implying that even if participants expected partners displaying Neutral expressions to be equally likely to cooperate or betray, they nevertheless have a higher-than-chance cooperative intention. This default high disposition to cooperate may help explain the lack of differences between joy and neutral expressions: if people already behave cooperatively towards people displaying neutral expressions, there may be little room for joy expressions to further increase cooperation. Taken together, results show that emotional expressions can drive effects on the participants' expectations and intentions to cooperate in the absence of experience taking part in actual interactions.

Comparing the patterns of results of the Game-Judgment group with those of the Judgment-Game group suggest that the a priori expectations and intentions described above are revised after experiencing the game outcomes (c.f. Averbeck and Duchaine 2009; Tortosa et al. 2013b for evidence on the integration of feedback to tasks involving emotional expressions). This can be illustrated by the differences in patterns of results before the game occurred (Judgement-Game group) and after it occurred (Game-judgment group). It is important to highlight that those revisions in judgments depending on exposure to outcomes led the patterns of results of both measures (expectation and intention) to fully align with the behavioral results (c.f. Caballero and Menez 2017). In other words, the three dependent variables showed the same pattern of results in the case of participants who took part in the game before providing the judgment measures: decreased cooperation towards partners displaying sadness, anger, fear and disgust expressions as compared to neutral expressions; and no differences between joy and neutral expressions (in contrast with the a priori judgments, were differences between joy and neutral expressions were reliably found for both measures).

Limitations and Future Directions

To interpret results, especially when interested in their implications for decision-making in real life scenarios, it is important to bear in mind the artificial nature of the experiment. The methodological decisions taken give rise to limitations and point to areas of opportunity for future research. This is because while social dilemmas and other behavioral economic games allow capturing important features of social interaction, they do not capture all of them. For their nature, they constrain and simplify interactions by instantiating specific contexts and rules that govern them. This allows for experimental control but may limit the generalizability of results (Murnighan and Wang 2016).

In the present experiment, the probability of cooperation was fixed at 0.5 regardless of the emotional expressions. However, this is unlikely to reflect what happens in real life, as the very function of emotions as conceived theoretically is to motivate different behaviors (Frijda et al. 1989; Izard 1997; Levenson 1999) and as emotional induction experiments have found that experiencing emotions lead to differing behavioral tendencies in experimental games (Chapman et al. 2009; Kugler et al. 2012; Nelissen et al. 2011). Future experiments could associate different probabilities of cooperation with each emotion making them consistent with expectations (something that judgment data of the current study can help inform) or in inconsistent ways to assess how the incongruency (and the degree of it) between expected and experienced outcomes is resolved and how decision-making evolves over time. It is worth to note that addressing this may require experimental designs including a considerable number of trials. In the present experiment, even after more than 100 trials, participants expectations did not match the actual contingencies, and previous experiments using social and nonsocial decision-making methodologies provide evidence of the difficulty to revise expectations associated to emotional expressions despite contradictory evidence (Averbeck and Duchaine 2009; Tortosa et al. 2013b).

To the extent that participants a priori expectations for specific emotional expressions match actual behavioral tendencies of people experiencing those emotions, they would be beneficial to guide decision-making. Nevertheless, determining this will require to have more evidence of the effects of emotions in specific social-interaction scenarios (which is currently scarce). Moreover, as subtle differences in the structure of experimental games can influence the behavior of the involved parties (Kollock 1998; Murnighan and Wang 2016; Van Lange et al. 2013), the exact same task structure should be used to assess behavior the of participants to whom emotions are induced and that of participants exposed to emotional expressions. All in all, it seems that people are drawn to use this information spontaneously (Andrade and Ho 2007) and theoretical accounts consider that such a tendency exists precisely because it has been advantageous throughout the phylogenetic history (Shariff and Tracy 2011).

Another point of consideration is that participants were aware that they were not interacting with real people. They were informed that the partners' responses would be controlled by the computer mimicking patterns occurring in real people. This decision was taken because the other methodological decisions we implemented (mainly the need for several trials for each emotion to compute cooperation proportions, the use of perceptually valid emotional expressions, and the counterbalanced design) made unfeasible to let participants believe they were interacting with more than 100 real partners

during the experiment. It also made other approaches, such as the use of confederates, hard to implement. Note, however, that the approach we used did not preclude us to find experimental effects, as it has not precluded previous studies in the area to find them (de Melo et al. 2014; Tortosa et al. 2013a, b). Future studies could benefit of using face to face interaction experiments measuring spontaneous emotional expressions (Reed et al. 2012) or confederates displaying target emotions (Hauser et al. 2014) to address the issue and compare results. Ultimately, a synergy between approaches may prove fruitful for a better understanding of the role of emotional expressions in social interaction.

Note that in the present experiment the monetary consequences did not translate to real life payments. While it is possible that a more concrete use of incentives (giving money contingent on the results) may affect the outcomes of decision-making experiments, there is no consensus on whether this is the case, with some research pointing that it does (Xu et al. 2016) and other pointing that it does not (Locey et al. 2011). Whether it affects experimental outcomes or not, and if so, to which extent, can be addressed in future research by specifically comparing the use of hypothetical and real monetary incentives.

On another subject, note that our sample consisted mainly of females. While the focus of our research was not on sex differences, this may limit the generalizability of results for males. Note, however, that we theoretically expect the same effects of emotional expressions regardless of the sex of the listeners (Shariff and Tracy 2011), and that most previous research on the subject has not found sex differences. There is some evidence that females tend to have an advantage in recognizing others' emotional expressions and perceiving them as more intense than men do, but it is not clear whether this is the case in all situations and across all emotions, as somefindings qualify this tendency by showing a male advantage for recognizing emotions such asanger and some studies fail to show any advantage for females (Biele and Grabowska 2006; Kret and De Gelder 2012). Moreover, most research on the area is based on facial stimuli. In the contexts of vocal expression of emotions, some researchers have pointed out gender differences in brain patterns related to emotional processing, but no differences at the behavioral level (Besson et al. 2002; Schirmer et al. 2002). Evidence for a female advantage in recognition of emotional vocal expressions is, at most, scarce (Szymanowski et al. 2007) and research comparing healthy males and females in vocal emotion recognition tasks has not found differences (Campellone and Kring 2013; Ramos-Loyo et al. 2012). Although the study was not designed to test effects of sex, as a complementary analysis we tested for effects of sex in cooperation behavior and did not find main effects nor interactions involving this variable. However, the low number of males (8) makes difficult to draw conclusions on the subject and so we decided not to elaborate on the matter. This constitutes, however, a potential area worth of exploring in future research.

Another consideration is that the present experiment cannot fully discard the possibility that it is the valence of emotions – instead of their proposed evolutionary social functions – what drove the effects of the different emotional expressions. Joy, the only positive emotion included in the experiment, led to the highest levels of cooperation (although not different from Neutral expressions), while Anger, Fear, Disgust and Sadness expressions led to reductions of cooperation (as compared with the Neutral emotional expressions). As in the present study we did not obtain perceptual measures of emotional dimensions such as valence (as they were out of the scope of interest) it is not possible to address whether they could explain the results. This being the case, approaches to the study of emotions that consider them in terms of dimensions such as valence (how pleasurable or not, i.e. positive or negative valence) and arousal (how much physiological activation is present, i.e. how intensely they are felt) instead of conceiving them as discrete entities may provide a useful framework to address the effects of emotional expressions on observers' behavior (Harmon-Jones et al. 2017; Rubin and Talarico 2009; Scherer 2000), and so, future studies may address this issue by including such measures to address whether they could constitute an appropriate predictor of emotional expressions' effects on listeners' behavior.

Likely, though, when it comes to social interaction, processes are much more complex than those involved in just perceiving emotions (i.e. classifying them in discrete categories, such as basic emotions; or assigning them different scores in affective dimensions such as valence and arousal), and may involve inferential processes and require taking contextual cues into account. In fact, several experiments (mostly within the framework of discrete, basic emotions) provide evidence that manipulations of the context in which emotions occur can influence or even reverse the effects of specific emotions, examples of such manipulations are providing information on the events that preceded a given emotional expression (de Melo et al. 2014), or presenting emotional expressions along with linguistic messages, be it in the form of facial expressions paired with written messages (Reed et al. 2014; Stouten and de Cremer 2010), or on stimuli conveying simultaneously the linguistic message and emotional information through emotionally inflected speech (Caballero et al. 2018). This last point also illustrates one of the advantages of using vocal emotional expressions as stimuli, as they allow the simultaneous manipulation of semantic variables along with emotional information in naturalistic and flexible way.

Conclusions

The present study extends research on the effects of emotional expressions in driving decision-making in social interaction contexts. We provide evidence that joy, anger, sadness, fear, and disgust affect expectations of others' behavior, intentions to behave, and actual behavioral outcomes. We also provide evidence that the direction of behavioral patterns is not in line with predictions based in evolutionary accounts of emotion and that experiencing outcomes allows revising expectations but at the same time fail to make them conform to objective probabilities in the short term. Future research on the area can help to illuminate how decision-makers integrate information on the emotional state of others to guide their decisions using more complex social contexts.

Acknowledgments The experiment described in this paper is part of the first author's doctoral dissertation under the supervision of the second author. The authors acknowledge the support received through a Ph.D. Scholarship (CONACYT, # 280423) awarded to Jonathan Caballero and the UNAM-DGAPA PAPIIT RN305412 grant awarded to Marina Menez Díaz. The authors want to thank Dr. Marc D. Pell for useful comments on a previous version of this article and Alexandra Topilova for support with English revision.

Compliance with Ethical Standards

Conflict of Interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

Ethical Approval No research ethics committee existed in the institution at the time of conducting the research. However, the procedures were conducted in accordance with the 1964 Helsinki declaration or comparable ethical standards and following APA's ethical principles (including but not limited to acknowledging participants the purpose and expected duration of the study, that their personal data would remain confidential, and informing them of the right to withdraw from the study at any moment with no penalty, as well as debriefing them).

Informed Consent Informed consent was obtained from all individual participants included in the study.

Reference

Abe, J. A. A., & Izard. (1999). The developmental functions of emotions: An analysis in terms of differential emotions theory. *Cognition & Emotion, 13*(5), 523–549. https://doi.org/10.1080/026999399379177.

Alguacil, S., Tudela, P., & Ruz, M. (2015). Ignoring facial emotion expressions does not eliminate their influence on cooperation decisions. *Psicológica: International Journal of Methodology and Experimental Psychology, 36*(2), 309–335.

Andersen, & Guerrero, L. K. (1998). Principles of communication and emotion in social interaction. *Handbook of Communication and Emotion: Research, Theory, Applications, and Contexts*, (pp. 49–96). https://doi.org/10.1016/B978-012057770-5/50005-9.

Andrade, E. B., & Ho, T. H. (2007). How is the boss's mood today? I want a raise. *Psychological Science, 18*(8), 668–671. https://doi.org/10.1111/j.1467-9280.2007.01956.x.

Andrew, R. J. (1963). Evolution of facial expression. *Science, 142*(3595), 1034–1041. https://doi.org/10.1126/science.142.3595.1034.

Averbeck, B. B., & Duchaine, B. (2009). Integration of social and utilitarian factors in decision making. *Emotion, 9*(5), 599–608.

Bandstra, N. F., Chambers, C. T., McGrath, P. J., & Moore, C. (2011). The behavioural expression of empathy to others' pain versus others' sadness in young children. *Pain, 152*(5), 1074–1082. https://doi.org/10.1016/j.pain.2011.01.024.

Berkowitz, L., & Harmon-Jones, E. (2004). Toward an understanding of the determinants of anger. Emotion (Washington, D.C.), 4(2), 107–30. doi: https://doi.org/10.1037/1528-3542.4.2.107.

Besson, M., Magne, C., & Schön, D. (2002). Emotional prosody: Sex differences in sensitivity to speech melody. *Trends in Cognitive Sciences*. https://doi.org/10.1016/S1364-6613(02)01975-7.

Biele, C., & Grabowska, A. (2006). Sex differences in perception of emotion intensity in dynamic and static facial expressions. *Experimental Brain Research, 171*(1), 1–6. https://doi.org/10.1007/s00221-005-0254-0.

Brainard, D. (1997). The psychophysics toolbox. *Spatial Vision, 10*, 443–446.

Caballero, J. A., & Menez, M. (2017). Vocal Emotion Expressions Effects on Cooperation Behavior. *Psicológica: International Journal of Methodology and Experimental Psychology, 38*(1), 1–24.

Caballero, J. A., Díaz, M. M., Arias-trejo, N., Rodriguez, F. L., & Pell, M. D. (2018). How to do things with(out) words ? Analyzing the effects of vocal emotional expressions on cooperation behavior. In *9th International Conference on Speech Prosody 2018* (pp. 260–264). Poznan, Poland. https://doi.org/10.21437/SpeechProsody.2018-53.

Campellone, T., & Kring. (2013). Context and the perception of emotion in schizophrenia: Sex differences and relationships with functioning. *Schizophrenia Research, 149*(1–3), 192–193.

Canary, D., Spitzberg, B., & Semic, B. (1998). The experience and expression of anger in interpersonal settings. In P. Andersen & L. Guerrero (Eds.), *Handbook of communication and emotion: Research, theory, applications, and contexts*. San Diego: Academic Press.

Chapman, H., Kim, D., Susskind, J., & Anderson, A. (2009). In bad taste: Evidence for the oral origins of moral disgust. *Science, 23*, 1222–1226.

Cooper, R., DeJong, D., & Forsythe, R. (1996). Cooperation without reputation: Experimental evidence from prisoner's dilemma games. *Games and Economic Behavior, 12*, 187–218.

Dawes, R. M., & Thaler, R. H. (1988). Anomalies: Cooperation. *Journal of Economic Perspectives, 2*(3), 187–197. https://doi.org/10.1257/jep.2.3.187.

de Melo, C., Carnevale, P. J., Read, S. J., & Gratch, J. (2014). Reading people's minds from emotion expressions in interdependent decision making. *Journal of Personality and Social Psychology, 106*(1), 73–88. https://doi.org/10.1037/a0034251.

Dunning, D., Anderson, J. E., Schlösser, T., Ehlebracht, D., & Fetchenhauer, D. (2014). Trust at zero acquaintance: More a matter of respect than expectation of reward. *Journal of Personality and Social Psychology, 107*(1), 122–141. https://doi.org/10.1037/a0036673.

Eckel, C., & Wilson, R. (2003). The human face of game theory: Trust and reciprocity in sequential games. In E. Ostrom & J. Walker (Eds.), *Trust & reciprocity* (pp. 245–274). Nueva York: Russel Sage Foundation.

Eisenberg, N., Fabes, R. A., Miller, P. A., Fultz, J., Shell, R., Mathy, R. M., & Reno, R. R. (1989). Relation of sympathy and personal distress to prosocial behavior: A multimethod study. *Journal of Personality and Social Psychology, 57*(1), 55–66. https://doi.org/10.1037/0022-3514.57.1.55.

Ekman, P. (1992). An argument for basic emotions. *Cognition & Emotion, 6*(3), 169–200. https://doi.org/10.1080/02699939208411068.

Ekman, P. (1994). Strong evidence for universals in facial expressions: A reply to Russell's mistaken critique. *Psychological Bulletin*, 268–287.

Faul, F., Erdfelder, E., Lang, A., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior Research Methods, 39*, 175–191.

Fischer, A. H., & Mansted, A. (2008). Social functions of emotion. In M. Lewis, J. Haviland-Jones, & L. Feldman Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 456–467). New York/London: The Guilford Press.

Frijda, N. H. (1988). The Laws of emotion. *American Psychologist, 43*(5), 349–358.

Frijda, N. H., Kuipers, P., & ter Schure, E. (1989). Relations among emotion, appraisal, and emotional action readiness. *Journal of Personality and Social Psychology, 57*(2), 212–228.

Gray, H., Ishii, K., & Ambady, N. (2011). Misery loves company: When sadness increases the desire for social connectedness. *Personality and Social Psychology Bulletin, 37*(11), 1438–1448.

Hammer, J. L., & Marsh, A. a. (2015). Why do fearful facial expressions elicit behavioral approach? Evidence from a combined approach-avoidance implicit association test. *Emotion, 15*(2), 223–231. https://doi.org/10.1037/emo0000054.

Harmon-Jones, E., Harmon-Jones, C., & Summerell, E. (2017). On the importance of both dimensional and discrete models of emotion. *Behavioral Sciences, 7*(4), 66. https://doi.org/10.3390/bs7040066.

Hauser, D. J., Preston, S. D., & Stansfield, R. B. (2014). Altruism in the wild: When affiliative motives to help positive people overtake empathic motives to help the distressed. *Journal of Experimental Psychology: General, 143*(3), 1295–1305. https://doi.org/10.1037/a0035464.

Hawk, S. T., Van Kleef, G. A., Fischer, A. H., & van Der Schalk, J. (2009). "Worth a thousand words": Absolute and relative decoding of nonlinguistic affect vocalizations. *Emotion, 9*(3), 293–305. https://doi.org/10.1037/a0015178.

Izard, C. (1991). *The psychology of emotions*. New York: Plenum Press.

Izard. (1994). Innate and universal facial expressions: Evidence from developmental and cross-cultural research. *Psychological Bulletin, 115*(2), 288–299. https://doi.org/10.1037/0033-2909.115.2.288.

Izard. (1997). Differential emotions theory. In *Human emotions* (pp. 43–66). New York: Platinum Press.

Juslin, P. N., & Laukka, P. (2003). Communication of emotions in vocal expression and music performance: Different channels, same code? *Psychological Bulletin, 129*(5), 770–814.

Keltner, D., & Haidt, J. (1999). Social functions of emotions at four levels of analysis. *Cognition & Emotion, 13*(5), 505–521.

Keltner, D., & Kring, A. (1998). Emotion, social function, and psychopathology. *Review of General Psychology, 2*(3), 320–342. https://doi.org/10.1037/1089-2680.2.3.320.

Kollock, P. (1998). Social dilemmas: The anatomy of cooperation. *Annual Review of Sociology, 24*, 183–214.

Kret, M. E., & De Gelder, B. (2012). Sex differences in processing emotional signals of others. *Neuropsychologia*, 1–11. https://doi.org/10.1016/j.neuropsychologia.2011.12.022.

Krumhuber, E., Manstead, A., Cosker, D., Marshall, D., Rosin, P., & Kappas, A. (2007). Facial dynamics as indicators of trustworthiness and cooperative behavior. *Emotion, 7*(4), 730–735.

Kugler, T., Connolly, T., & Ordoñez, L. (2012). Emotion, decision, and risk: Betting on gambles versus betting on people. *Journal of Behavioral Decision Making, 25*(2), 123–134.

Levenson, R. W. (1999). The intrapersonal functions of emotion. *Cognition & Emotion, 13*(5), 481–504.

Locey, M. L., Jones, B. A., & Rachlin, H. (2011). Real and hypothetical rewards in self-control and social discounting. *Judgment Decision Making, 6*(6), 552–564.

Marsh, A. A., Ambady, N., & Kleck, R. E. (2005). The effects of fear and anger facial expressions on approach- and avoidance-related behaviors. *Emotion, 5*(1), 119–124. https://doi.org/10.1037/1528-3542.5.1.119.

Melo, C., Zheng, L., & Gratch, J. (2009). Expression of moral emotions in cooperating agents. *Intelligent Virtual Agents, 5773*, 301–307.

Murnighan, J. K., & Wang, L. (2016). The social world as an experimental game. *Organizational Behavior and Human Decision Processes, 136*, 80–94. https://doi.org/10.1016/j.obhdp.2016.02.003.

Nelissen, R. M. A., Leliveld, M. C., Van Dijk, E., & Zeelenberg, M. (2011). Fear and guilt in proposers: Using emotions to explain offers in ultimatum bargaining. *European Journal of Social Psychology, 41*(1), 78–85. https://doi.org/10.1002/ejsp.735.

Niedenthal, P., Krauth-Gruber, S., & Ric, F. (2006). *Psychology of emotion*. Nueva York: Psychology Press.

Oren, H. (2009). Emotional tears as biological signals. *Evolutionary Psychology, 7*(3), 363–370.

Pell, M. D., Paulmann, S., Dara, C., Alasseri, A., & Kotz, S. A. (2009). Factors in the recognition of vocally expressed emotions: A comparison of four languages. *Journal of Phonetics, 37*, 417–435.

Pelli, D. (1997). The VideoToolbox software for visual psychophysics: Transforming numbers into movies. *Spatial Vision, 10*, 437–442.

Ramos-Loyo, J., Mora-Reynoso, L., Sánchez-Loyo, L. M., & Medina-Hernández, V. (2012). Sex differences in facial, prosodic, and social context emotional recognition in early-onset schizophrenia. *Schizophrenia Research and Treatment, 2012*, 1–12. https://doi.org/10.1155/2012/584725.

Reed, L. I., & DeScioli, P. (2017). The communicative function of sad facial expressions. *Evolutionary Psychology, 15*(1), 1–9. https://doi.org/10.1177/1474704917700418.

Reed, L. I., Zeglen, K., & Schmidt, K. (2012). Facial expressions as honest signals of cooperative intent in a one-shot anonymous prisoner's dilemma game. *Evolution and Human Behavior, 33*, 200–209.

Reed, L. I., DeScioli, P., & Pinker, S. A. (2014). The commitment function of angry facial expressions. *Psychological Science, 25*(8), 1511–1517. https://doi.org/10.1177/0956797614531027.

Rozin, P., Haidt, J., & McCauley, C. (2008). Disgust. In H.-J. Lewis & Barret (Eds.), *Handbook of emotions* (3rd ed., pp. 757–776). New York/London: The Guilford Press.

Rubin, D. C., & Talarico, J. M. (2009). A comparison of dimensional models of emotion: Evidence from emotions, prototypical events, autobiographical memories, and words. *Memory, 17*(8), 802–808. https://doi.org/10.1080/09658210903130764.

Russell, J. A. (1994). Is there universal recognition of emotion from facial expression? A review of the cross-cultural studies. *Psychological Bulletin, 115*(1), 102–141. https://doi.org/10.1037/0033-2909.115.1.102.

Sauter, D. A., Eisner, F., Ekman, P., & Scott, S. K. (2010). Cross-cultural recognition of basic emotions through nonverbal emotional vocalizations. *Proceedings of the National Academy of Sciences of the United States of America, 107*(6), 2408–2412.

Scharlemann, J., Eckel, C., Kacelnik, A., & Wilson, R. (2001). The value of a smile: Game theory with a human face. *Journal of Economic Psychology, 22*(5), 617–640.

Scherer, K. R. (2000). Psychological models of emotions. In J. Borod (Ed.), *The neuropsychology of emotion* (pp. 137–162). Oxford/NewYork: Oxford University Press.

Scherer, K. R., Banse, R., & Wallbott, H. G. (2001). Emotion inferences from vocal expression correlate across languages and cultures. *Journal of CrossCultural Psychology, 32*(1), 76–92.

Schirmer, A., Kotz, S. A., & Friederici, A. D. (2002). Sex differentiates the role of emotional prosody during word processing. *Cognitive Brain Research, 14*, 228–233.

Shariff, A. F., & Tracy, J. L. (2011). What are emotion expressions for? *Current Directions in Psychological Science, 20*(6), 395–399. https://doi.org/10.1177/0963721411424739.

Skyrms, B. (2003). The stag hunt and the evolution of social structure. *The Stag Hunt and the Evolution of Social Structure*. https://doi.org/10.1017/CBO9781139165228.

Stouten, J., & de Cremer, D. (2010). "Seeing is believing": The effects of facial expressions of emotion and verbal communication in social dilemmas. *Journal of Behavioral Decision Making, 23*(3), 271–287.

Szymanowski, F., Szymanowski, F., Kotz, S., Schröder, C., Rotte, M., & Dengler, R. (2007). Gender differences in processing emotional prosody. *Clinical Neuropsychology, 118*(4), e102–e103.

Tortosa, M., Lupiáñez, J., & Ruz, M. (2013a). Race, emotion and trust: An ERP study. *Brain Research, 1494*, 44–55. https://doi.org/10.1016/j.brainres.2012.11.037.

Tortosa, M., Strizhko, T., Capizzi, M., & Ruz, M. (2013b). Interpersonal effects of emotion in a multi-round trust game. *Psicológica: International Journal of Methodology and Experimental Psychology, 34*(2), 179–198.

Tracy, J. L. (2014). An evolutionary approach to understanding distinct emotions. *Emotion Review, 6*(4), 308–312. https://doi.org/10.1177/1754073914534478.

Van Doorn, E. A., Heerdink, M. W., & Van Kleef, G. A. (2012). Emotion and the construal of social situations: Inferences of cooperation versus competition from expressions of anger, happiness, and disappointment. *Cognition & Emotion, 26*(3), 442–461. https://doi.org/10.1080/02699931.2011.648174.

Van Kleef, G. A. (2009). How emotions regulate social life: The emotions as social information (EASI) model. *Current Directions in Psychological Science, 18*(3), 184–188. https://doi.org/10.1111/j.1467-8721.2009.01633.x.

Van Kleef, G. A., De Dreu, C. K. W., & Manstead, A. S. R. (2010). An interpersonal approach to emotion in social decision making: The emotions as social information model. *Advances in Experimental Social Psychology, 42*, 45–96. https://doi.org/10.1016/S0065-2601(10)42002-X.

Van Lange, P., Joireman, J., Parks, C., & Dijk, E. (2013). The psychology of social dilemmas: A review. *Organizational Behavior and Human Decision Processes, 120*(2), 125–141.

Vigil, J. M. (2009). A socio-relational framework of sex differences in the expression of emotion. *The Behavioral and Brain Sciences, 32*(5), 375–390.

Xu, S., Pan, Y., Wang, Y., Spaeth, A. M., Qu, Z., & Rao, H. (2016). Real and hypothetical monetary rewards modulate risk taking in the brain. *Scientific Reports, 6*(29520), 1–7. https://doi.org/10.1038/srep29520.