Running head: COPING WITH NOISE

Coping with Noise and Misunderstanding:

Group Representatives Fare Worse Than Individuals Because They Lack Benign Partner Impressions

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Abstract

Research on interindividual-intergroup discontinuity has illuminated distinct patterns of cognition, motivation, and behavior in interindividual versus intergroup contexts. However, it has examined these processes in laboratory environments with perfect transparency, whereas real-life interactions are often characterized by noise (i.e., misperceptions and unintended errors). This research compared interindividual and intergroup interactions in the presence or absence of noise. In a laboratory experiment, participants played 35 rounds of a dyadic give-some dilemma, in which they acted as individuals or group representatives. Noise was manipulated, such that players’ intentions either were perfectly translated into behavior, or could deviate from their intentions in certain rounds (resulting in less cooperative behavior). Noise was more detrimental to cooperation in intergroup contexts than in interindividual contexts, because (a) participants who formed benign impressions of their interaction partner coped better with noise and (b) participants were less likely to form such benign impressions in intergroup than interindividual interactions.

Coping with Noise and Misunderstanding:

Group Representatives Fare Worse Than Individuals Because They Lack Benign Partner Impressions

 In politics, in collective bargaining, in the international community: interactions between groups fundamentally shape our lives. For this reason, it is important to understand such interactions, and to determine what benefits and risks they may entail for our collective welfare. A considerable body of research has revealed that, relative to interactions between isolated individuals, intergroup interactions are more competitive, aggressive, and intractable – a phenomenon called interindividual-intergroup discontinuity (Insko & Schopler, 1998; Wildschut, Pinter, Vevea, Insko, & Schopler, 2003). An important limitation of this research program, however, is that it has studied interindividual and intergroup interactions in laboratory contexts with perfect transparency, where persons’ decisions match their intentions. In real life, however, social interactions are often characterized by misperceptions and unintended errors or *noise*, such that people’s actions may produce different outcomes, or may be perceived differently than they intended (Axelrod & Dion, 1988; Bendor, Kramer, & Stout, 1991; Kollock, 1993; Van Lange, Ouwerkerk, & Tazelaar, 2002). Indeed, such noise may be particularly prominent in intergroup interactions, which may often be characterized by differences in norms, customs, and language that are conductive to misunderstanding. It is therefore important to gain insight into the difference between interindividual and intergroup interactions in noisy environments.

Our key objective was to examine the impact of noise in interindividual and intergroup settings. We did so by comparing interactions between individuals and between group representatives: individuals who have been appointed to make decisions on behalf of their group (Reinders Folmer, Klapwijk, De Cremer, & Van Lange, 2012; also see Aaldering, Greer, Van Kleef, & De Dreu, 2013; Milinski, Hilbe, Semmann, Sommerfeld, & Marotzke, 2016; Pinter et al., 2007). In everyday life, groups often interact through group representatives (i.e., through their leaders, representatives or delegates; Adams, 1976). Hence, by studying interactions between group representatives, we increased mundane realism. Furthermore, dyadic interactions between group representatives resemble closely dyadic interactions between isolated individuals, thus providing a stringent test of the difference between interindividual and intergroup interactions as a function of noise. We examine these processes in a social dilemma where noise is either present or absent.

**The Impact of Noise in Interindividual and Intergroup Settings**

Social life is noisy, that is, characterized by frequent mistakes and misunderstandings. How does such noise affect interindividual and intergroup interactions? For interindividual contexts, extant research suggests that noise undermines cooperation. Both experimental studies and simulations have examined how interindividual interactions may be affected by the intermittent occurrence of disruptions that cause the actual outcomes of people’s decisions for others to be less beneficial than was intended (i.e., negative noise), more beneficial (positive noise), or both in alternation (neutral noise; see Tazelaar, van Lange, & Ouwerkerk, 2004; Van Lange et al., 2002). Their results showed that such disruptions can have a pivotal impact on how such interactions unfold. In particular, instances of negative noise can undermine interindividual cooperation (Axelrod & Dion, 1988; Kollock, 1993; Van Lange et al., 2002) because noise creates uncertainty regarding the cooperative intentions of interdependent others, and thereby undermines trust and impressions of benign intent (Klapwijk & Van Lange, 2009; Tazelaar et al., 2004; Van Lange et al., 2002). Negative noise can thereby evoke harmful cycles of noncooperation (i.e., echo effect, see Axelrod, 1984) and inhibit the generous behaviors that are necessary to rebuild cooperation (i.e., returning more cooperation than you receive, see Axelrod & Dion, 1988; Klapwijk & Van Lange, 2009; Kollock, 1993).

How does noise affect intergroup interactions? We hypothesized that noise would be more harmful in intergroup than interindividual interactions and, hence, would accentuate the discontinuity effect. The rationale for this prediction is twofold. First, extant research in interpersonal settings indicates that benign impressions are crucial for overcoming noise, as they enable people to give each other the benefit of the doubt when faced with harmful behaviors that in fact result from noise (Bendor et al., 1991; Tazelaar et al., 2004; Van Lange et al., 2002). In this way, benign impressions enable one to maintain cooperative and generous behaviors in context of noise, and thereby to overcome its disruptive impact. Second, whereas impressions of other individuals are generally benign and trusting (Van Lange & Kuhlman, 1994; also see Murnighan, Malhotra, & Weber, 2004), impressions of other groups and their members are decidedly unfavorable (Insko, Schopler, Hoyle, Dardis, & Graetz, 1990; Schopler et al., 1993; Reinders Folmer et al., 2012; Wildschut, Insko, & Pinter, 2004). Groups, then, lack the benign partner impressions that can help individuals to overcome noise.

**The Present Research**

To investigate the role of noise in interindividual and intergroup relations, we used a dyadic social dilemma task. Social dilemmas present a conflict between protagonists’ immediate self-interest and longer-term collective interests (Van Lange, Joireman, Parks, & Van Dijk, 2013). In situations like these, protagonists choose between noncooperative decisions (which benefit their immediate self-interest, but are harmful for the collective interest) or cooperative decisions (which benefit the collective interest, but are disadvantageous for their immediate self-interest). Social dilemmas are suitable for our present purposes because they provide an environment in which the discontinuity effect emerges (see Schopler et al., 2001) and in which the disruptive impact of noise can be studied (Van Lange et al., 2002; Tazelaar et al., 2004). Participants played an iterated social dilemma, situated in an interaction between either two individual players, or two group representatives (Pinter et al., 2007; Reinders Folmer et al., 2012). In designated rounds, we manipulated the presence (vs. absence) of noise by altering the decisions of either player to be less cooperative than they intended. In line with previous research, we focused on negative (rather than positive) noise because it is arguably more prevalent in the real world and has more harmful and disruptive consequences in social relationships (Van Lange et al., 2002; Tazelaar et al., 2004).

In this setting, we aimed to test the following hypotheses:

*Hypothesis 1*: Levels of cooperation will be lower in interactions between representatives than in interactions between individuals.

*Hypothesis 2*: Levels of cooperation will be lower in interactions where noise is present than in interactions where noise is absent.

*Hypothesis 3*: Differences in levels of cooperation between representatives and individuals will be greater in interactions where noise is present than in interactions where noise is absent.

*Hypothesis 4*: Partner impressions will be less benign in interactions between representatives than in interactions between individuals.

*Hypothesis 5*: Differences in levels of cooperation between representatives and individuals in interactions where noise is present will be mediated by differences between representatives and individuals in partner benign impressions.

**Method**

**Participants and Design**

 Participants were 294 students at VU University Amsterdam (103 men, 191 women; *M*age=20.52, *SD*=2.91). They were recruited through flyers at the university dining halls, and randomly assigned to conditions in a 2 (interaction type: individual vs. representative) × 2 (negative noise: present vs. absent) design.1 In light of prior evidence for gender effects in the context of interindividual-intergroup discontinuity (i.e., female groups responding more competitively than male groups when conflict of interest is severe; Schopler et al., 2001), we included gender as an additional predictor.

**Procedure**

 Up to 15 participants attended each experimental session. They were seated in individual cubicles containing a computer, on which the entire experiment was conducted.

**Manipulation of interaction type.** In order to examine interactions between group representatives, a context was required in which two meaningful groups could be distinguished, on whose behalf the participants could interact. To do so, we presented the study as a collaborative research project between VU University Amsterdam and the University of Amsterdam (cf. Reinders Folmer et al., 2012). In the representative condition, participants were told that students were attending the experimental session at either institution, and would be combined into a VU-team and a UvA-team. They learned that for each team, a single group representative would be selected, and that these representatives would interact dyadically on their team’s behalf, with the outcomes of their interaction determining the rewards of all the members of their team. A rigged lottery procedure ensured that participants were always assigned to the role of group representative. In the individual condition (where no intergroup context is required) no groups were distinguished, and participants would interact dyadically with another participant, with the outcomes of their interaction determining their rewards. The rewards that could be obtained in the task were vouchers for a postexperimental raffle, in which a 15 euro ($17) book certificate could be won by the participant (individual condition) or all team members (representative condition; see Van Lange et al., 2002).2

**The social dilemma task**. The task was a dyadic, iterated, gradual give-some social dilemma adopted from previous noise research (Van Lange et al., 2002; Tazelaar et al., 2004). We selected this paradigm rather than the binary social dilemma task that is typically employed in discontinuity research (e.g., Insko et al., 1998; Schopler et al., 2001) because it allows gradual increases and decreases in level of cooperation, which makes it suitable for representing the impact of noise, and affords the generous strategies that are necessary to overcome it (Klapwijk & Van Lange, 2009).

Participants received an endowment of 10 grey coins at the start of every round. Their counterpart received an endowment of 10 blue coins. We explained that the value of these coins differed for both players. The participant’s grey coins were worth 50 cent each to him/herself, but were worth 100 cents each to the other player. Likewise, the other player’s blue coins were worth 50 cent each to him/herself, but 100 cents to the participant. In the task, players would be able to donate coins to each other. Although giving away coins is detrimental to one’s individual outcome, it is highly beneficial for the recipient, as these coins are twice as valuable to the opposing player. As such, players can collectively earn more by donating coins to each other (i.e., collective rationality). Individually, however, players can earn more by keeping their coins while receiving coins from the opposing player (i.e., individual rationality). Therefore, this situation is a social dilemma, in which donations represent a continuous measure of cooperation (with a contribution of zero coins reflecting minimal cooperation and a contribution of ten coins reflecting maximal cooperation; see Van Lange et al., 2002).3

Participants played 35 rounds of the social dilemma task (the actual number was unknown to them). In each round, both players simultaneously decided how many coins to give to the other, after which their decisions and outcomes were revealed. Although participants believed they were interacting with another player, we simulated their counterpart using a preprogrammed tit-for-tat strategy. Tit-for-tat is often considered a “default” strategy in interaction research and players frequently employ reciprocal strategies in social dilemmas (e.g., Parks, Sanna, & Posey, 2003; Tazelaar et al., 2004). As such, this strategy is suitable for simulating an opposing player.

 **Manipulation of noise.** Following the instructions to the social dilemma task, we introduced the noise manipulation. In the no-noise condition, we did not mention noise and participants’ decisions always reflected their intended level of cooperation. In the noise condition, participants received additional instructions that explained that players’ decisions in the task could be affected by noise. Specifically, participants in the noise condition learned that we were interested in how people make decisions in “situations in which the actual decision(s) by both persons may now and then have different results than they actually intended” (cf. Tazelaar et al, 2004; Van Lange et al., 2002). Accordingly, they learned that the computer would change their decisions or those of their counterpart in some rounds of the interaction, so that the player in question would donate more or fewer coins than he/she had actually intended (in fact, only negative noise occurred, cf. Tazelaar et al, 2004; Van Lange et al., 2002). Such changes potentially could occur in any round of the interaction, and while the player whose donation was changed would be informed of this, its recipient would not. Therefore, during the task, participants in the noise condition could not determine if the number of coins they received from the opposing player reflected an intentional choice or a change by the computer, nor would their counterpart be able to make this distinction in the participant’s own donations.4

 The social dilemma task comprised 35 rounds and we administered noise on every fourth round (i.e., a noise frequency of 25%), with instances alternating between the two players (i.e., affecting the participant’s decision in round 4, their counterpart’s decision in round 8, etc.). When noise occurred, three coins were subtracted from the number of coins that the player had intended to contribute (i.e., negative noise) – an intensity that was unlikely to go by unnoticed.5 As noted, a warning was displayed whenever the participant’s decision had been affected by noise, but participants received no warning when decisions of their counterpart had been affected. Upon completion of the task, we administered a postexperimental questionnaire assessing participants’ impressions of their counterpart.

**Measuring impressions of benign intent.** We assessed participants’ impressions of their partner’s benign intent with ten items (cf. Tazelaar et al., 2004). Participants indicated to what extent their partner was “generous,” “nice,” “forgiving,” “kind,” “noble,” “selfish,” “greedy,” “competitive,” “stingy,” and “vengeful” (1 = *not at all*, 7 = *very much*, negative items reverse-coded, α=.78). Furthermore, we assessed perceptions of the partner’s specific interaction goals, in which these global impressions are rooted (Kelley & Thibaut, 1978). We employed 15 items (cf. Tazelaar et al., 2004) to measure perceptions of each of the following interaction goals: maximizing joint outcomes (MaxJoint, e.g “the other person [representative] wanted to get the most outcomes for the both of us [both of our teams]”, α=.90); minimizing the difference between each party’s outcomes (MinDiff, e.g., “the other person [representative] wanted to minimize the differences in outcomes between me and him/her [my team and his/her team]”, α=.78); maximizing the participant’s outcomes (MaxOther, e.g., “the other person [representative] wanted me [my team] to get the highest outcomes”, α=.68); maximizing the relative advantage over the other party’s outcomes (MaxRel, e.g., “the other person [representative] wanted to get higher outcomes than me [my team]”, α=.81); and maximizing outcomes for oneself (MaxOwn, e.g., “the other person [representative] wanted to get the highest possible outcomes for him/herself ”, α=.70).

Upon completion of the questionnaire, participants were debriefed, thanked, and received either course credit or monetary payment of 7 euro ($8).

Results

**Cooperation**

 We present relevant means and standard deviations in Table 1.

 ***Round 1.*** To understand participants’ cooperative behavior (i.e., intended number of coins donated to the other player) independently of the influence of partner strategy and noise, decisions in the first round (which were made before participants had encountered noise or the partner strategy) were analyzed separately in a 2 (interaction type) × 2 (noise) × 2 (gender) Analysis of Covariance (ANCOVA). Participants’ self-reported experience with decision-making tasks involving coins (0 = *no*, 1 = *yes*) was included as a covariate in this analysis, to control for possible learning effects due to previous experience with the social dilemma task in other studies in our laboratory. The analysis indicated only main effects for interaction type, *F*(1, 285)=3.82, *p*=.052, η2=.012, for gender, *F*(1, 285)=6.05, *p*=.009, η2=.021, and for experience, *F*(1, 285)=22.10, *p*<.001, η2=.067. Consistent with Hypothesis 1, representatives displayed marginally lower initial cooperation than individuals (i.e., a discontinuity effect). Additionally, women (*M*=4.94, *SD*=3.01) displayed significantly lower initial cooperation than men (*M*=5.83, *SD*=3.23). Finally, participants with no prior experience of the social dilemma task (*M*=4.48, *SD*=2.84) displayed lower initial cooperation than participants with prior experience (*M*=6.18, *SD*=3.17).

 ***Rounds 2-35.***Participants’ cooperative behavior in the remaining 34 rounds of the social dilemma task was averaged into a single index of cooperation. This cooperation index was entered as dependent variable in a 2 (interaction type) × 2 (noise) × 2 (gender) ANCOVA, with prior experience as a covariate.6 In line with Hypothesis 2, the analysis revealed a significant main effect of noise, *F*(1, 285)=4.92, *p*=.027, η2=.015, indicating that cooperation was lower in the noise condition than in the no noise condition. Furthermore, the analysis indicated a significant main effect of experience, *F*(1, 285)=21.01, *p*<.001, η2=.065, indicating participants with no prior task experience (*M*=5.15, *SD*=2.40) cooperated less than those with prior experience (*M*=6.48, *SD*=2.72). The main effect of interaction type was not significant, *F*(1, 285)=0.84, *p*=.360, η2=.003, nor was the effect of gender, *F*(1, 285)=1.94, *p*=.164, η2=.006. As such, the initial differences in cooperation between representatives and individuals in Round 1 did not culminate in significant differences between their subsequent cooperation levels; thereby, this interval did not provide support for Hypothesis 1.

Crucially, the analysis revealed a marginally significant Interaction Type × Noise interaction effect, *F*(1, 285)=3.62, *p=*.058, η2=.011. Planned follow-up tests of simple effects indicated that, in the representative condition, noise (vs. no noise) significantly reduced cooperation, *F*(1, 285)=8.45, *p*=.004, η2=.026. In the individual condition, however, noise had no significant effect on cooperation, *F*(1, 285)=0.05, *p*=.827, η2=.000. Looked at from a different angle, cooperation between representatives was significantly lower than between individuals (i.e., a discontinuity effect) in the noise condition, *F*(1, 285)=3.93, *p*=.048, η2=.012. In the no noise condition, however, cooperation between individuals did not differ significantly from cooperation between representatives, *F*(1, 285)=0.50, *p*=.481, η2=.002. The absence of a significant discontinuity effect in this condition may seem surprising, but in fact is consistent with prior research (Insko et al. 1998; Wildschut et al., 2003), which indicates that when individuals and groups interact with a tit-for-tat strategy (as in the present experiment) in the absence of noise, the discontinuity effect is reduced and rendered non-significant (we return to this point in the Discussion). In sum, these results indicate that instances of noise were particularly detrimental in intergroup (compared to interpersonal) contexts, and thereby inflated the discontinuity effect – a finding that supports Hypothesis 3.

**Impressions of Benign Intent**

 We analyzed participants’ impressions of their partner’s global benign intent and of his/her specific interaction goals in 2 (interaction type) × 2 (noise) × 2 (gender) ANCOVAs (with prior experience as covariate). We present relevant means in Table 1. For global impressions of benign intent, the results revealed a significant main effect of interaction type only, *F*(1, 285)=3.93, *p*=.048, η2=.013. In line with Hypothesis 4, individuals reported more benign partner impressions than did representatives. For the specific interaction goals, we obtained significant main effects of interaction type on MinDiff, *F*(1, 285)=4.39, *p*=.037, η2=.015, MaxOther, *F*(1, 285)=5.83, *p*=.016, η2=.020, MaxRel, *F*(1, 285)=4.77, *p*=.030, η2=.016, and MaxOwn, *F*(1, 285)=13.46, *p*<.001, η2=.043, but not on MaxJoint, *F*(1, 285)=1.87, *p*=.173, η2=.006. Individuals (compared to representatives) attributed to their partner greater concern for minimizing differences and maximizing their (i.e., the participant’s) outcomes, and lesser concern for maximizing relative advantage and own outcomes.7

**Conditional Process Analyses**

Compared with individuals, representatives displayed less favorable impressions of their partner’s benign intent, and attributed to him/her less other-regarding (i.e., MinDiff and MaxOther), and more self-regarding (i.e., MaxOwn and MaxRel) interaction goals. We examined whether these potential mediating mechanisms explained why the discontinuity effect was more pronounced when noise was present (compared to absent). Specifically, we tested a “direct effect and second stage moderation model” (Edwards & Lambert, 2007). This model specifies that the moderator (noise) affects the magnitude of the mediators’ (benign impressions, perceived interaction goals) partial association with the outcome (cooperation), and that this occurs in conjunction with a main effect of the independent variable (interaction type) on the mediators (Figure 1). This model is appropriate because interaction type influenced the potential mediators irrespective of noise, but influenced cooperation only in the noise condition. We therefore tested the mediated effects of interaction type on cooperation, conditional upon noise.

First, we assessed whether the moderator (noise) affected the magnitude of the mediators’ (global benign impressions, perceived interaction goals) associations with the outcome (cooperation) by testing, for each mediator, the Noise × Mediator interaction. This tested whether global benign impressions and perceived interaction goals were stronger predictors of cooperation when noise was present (compared to absent). We found significant interaction effects between noise and, respectively, MinDiff and MaxRel. Results further revealed marginal interactions between noise and, respectively, Benign Impressions and MaxOwn (Table 2, A × C). Global benign impressions and partners’ greater (compared to lesser) perceived concern for minimizing differences in outcomes predicted increased cooperation in the noise condition (Benign Impressions: *F* (1,277) = 17.39, *p* < .001, η2=.051; MinDiff: *F* (1,277) = 35.03, *p* < .001, η2=.094), but these associations were not significant in the no noise condition (Benign Impressions: *F* (1,277) = 2.24, *p* = .136, η2=.006; MinDiff: *F* (1,277) = 1.61, *p* = .205, η2=.004). Partners’ greater (compared to lesser) perceived concern for maximizing own outcomes and relative advantage in outcomes, conversely, predicted decreased cooperation in the noise condition (MaxOwn: *F* (1,277) = 7.13, *p* = .008, η2=.021; MaxRel: Noise: *F* (1,277) = 8.67, *p* = .004, η2=.026), but did not in the no noise condition (MaxOwn: *F* (1,277) = 0.00, *p* = .977, η2=.000; MaxRel: No noise: *F* (1,277) = 0.05, *p* = .822, η2=.000). Furthermore, the previously significant Noise × Interaction Type interaction on cooperation (Table 2, A × B) became non-significant or marginal when we controlled for the interaction between noise and, respectively, Benign Impressions, MaxRel, MinDiff, and MaxOwn.

Next, we used the PROCESS macro to test the conditional process model shown in Figure 1 (model 15; 10,000 resamples; Hayes, 2013). The mediator was, in turn, Benign Impressions, MinDiff, MaxOwn, or MaxRel. PROCESS calculates bootstrap confidence intervals (CIs) for the indirect effect (denoted as *ab*) of interaction type on cooperation via each of the mediators, conditional upon noise. In the noise condition, this indirect effect was significant (i.e., the 95% CI did not include 0) for Benign Impressions (*ab*=-.09, *SE*=.05, 95% CI=-.21/-.01), MinDiff (*ab*=-.16, *SE*=.08, 95% CI=-.33/-.02), MaxOwn (*ab*=-.10, *SE*=.06, 95% CI=-.24/-.02), and MaxRel (*ab*=-.09, *SE*=.05, 95% CI=-.21/-.01). In the no noise condition, this indirect effect was not significant for Benign Impressions (*ab*=-.03, *SE*=.03, 95% CI=-.13/.01), MinDiff (*ab*=-.04, *SE*=.03, 95% CI=-.14/.01), MaxOwn (*ab*=-.00, *SE*=.05, 95% CI=-.11/.11), or MaxRel (*ab*=.01, *SE*=.03, 95% CI=-.03/.08). When the four mediators were entered simultaneously as parallel mediators, the indirect effect in the noise condition remained significant only for MinDiff (*ab*=-.17, *SE*=.09, 95% CI=-.36/-.03), and was not significant for Benign Impressions (*ab*=-.02, *SE*=.02, 95% CI=-.11/.04), MaxOwn (*ab*=-.00, *SE*=.05, 95% CI=-.10/.09), or MaxRel (*ab*=.04, *SE*=.04, 95% CI=-.01/.15). In the no-noise condition, the indirect effect was not significant for Benign Impressions (*ab*=-.02, *SE*=.04, 95% CI=-.12/.03), MinDiff (*ab*=-.06, *SE*=.05, 95% CI=-.20/.01), MaxOwn (*ab*=.00, *SE*=.07, 95% CI=-.13/.15), or MaxRel (*ab*=.05, *SE*=.05, 95% CI=-.01/.19).

In sum, in line with Hypothesis 5, the discontinuity effect in the noise condition was mediated by benign impressions of the partner, and by perceptions of the partner’s concern for maximizing own outcomes, relative advantage in outcomes, and (particularly) minimizing differences in outcomes. These results are consistent with the idea that (a) benign partner impressions help to cope with the detrimental effects of noise on cooperation and (b) group representatives (compared to individuals) are less likely to form such benign partner impressions, and thereby are less able to overcome the deleterious effects of noise. Accordingly, the discontinuity effect is accentuated when noise is present (compared to absent).

**Discussion**

We examined the impact of unintended errors, or noise, in interindividual and intergroup contexts. Specifically, we sought to understand whether intergroup interactions are more or less vulnerable to instances of noise than interindividual interactions, and thereby to determine if noise accentuates the discontinuity effect. To this end, we compared social dilemma interactions between group representatives with interactions between isolated individuals in the presence or absence of noise. Noise exerted particularly detrimental effects on cooperation between group representatives, and had no significant impact on cooperation between individuals. Thereby, cooperation between representatives was considerably lower than between individuals in the presence of noise, while reaching a level equivalent to individuals when noise was absent (in line with previous evidence involving tit-for-tat strategies, see Insko et al., 1998; Wildschut et al., 2003). Accordingly, these findings suggest that the presence (vs absence) of noise accentuated the discontinuity effect. These findings provide important insight into how interindividual-intergroup discontinuity may unfold in realistic, noisy environments, and show that these environments are less conductive to intergroup cooperation than the non-noisy environments in which this contrast has previously been studied. This offers important insights into the origins and potential resolution of intergroup conflict. We discuss these contributions next.

**The Impact of Noise in Intergroup Contexts**

We demonstrated that in intergroup contexts, people lack the benign partner impressions that are necessary to overcome the harmful impact of noise. Specifically, previous research has indicated that impressions of benign intent are crucial for maintaining cooperation in noisy environments (Bendor et al., 1991; Tazelaar et al., 2004; Van Lange et al., 2002). Benign impression enable partners to give each other the benefit of the doubt, and maintain cooperation, despite suffering poor outcomes (in fact due to noise). Our findings revealed that intergroup interactions (compared with interindividual interactions) are characterized by substantially less benign partner impressions, and that these negative impressions explained representatives’ distinct vulnerability to noise. That is, when faced with harmful outcomes that in fact result from noise, representatives’ negative partner impressions obstruct the trusting interpretations and generous behaviors that are necessary to overcome noise (see Axelrod & Dion, 1988; Klapwijk & Van Lange, 2009; Kollock, 1993). In contrast, individuals’ positive partner impressions facilitated trust and generosity, thereby limiting the deleterious effect of noise.

When noise was absent, however, representatives achieved high levels of cooperation, equivalent to individuals – even though their initial cooperation levels had been lower (see Round 1 results). This finding is in line with previous research, which suggests that the discontinuity effect can be reduced when intergroup interactions are conduced through representatives rather than by entire groups (Pinter et al., 2007). For the purpose of reducing the competitiveness of intergroup interactions, such findings seem encouraging. However, it is important to note that representatives’ high cooperation levels in absence of noise were not accompanied by more favorable partner impressions – which remained as unfavorable as in noisy interactions. This pattern of results can be explained by the observation that partner impressions had a weaker association with cooperation when noise was absent (compared to present; Table 2, A × C). The finding that partner impressions were less strongly related to cooperation between representatives when noise was absent (compared to present) is in line with previous research indicating that cooperation can emerge in the absence of trust (Haesevoets, Van Hiel, Reinders Folmer, & De Cremer, 2014). Haesevoets et al. proposed that individuals may cooperate for pragmatic reasons to achieve economic benefits, even when they have unfavorable impressions of their partner (Chua, Ingram, & Morris, 2008). In intergroup interactions, group representatives may be inclined to display such pragmatic cooperation (see Pinter et al., 2007; also see Milinski et al., 2016); however, the present findings suggest that in interactions between group representatives, such pragmatic cooperation is undermined by noise.

Another reason for the absence of a significant discontinuity effect in the no-noise condition may relate to our implementation of a tit-for-tat strategy to simulate the interaction partner. Prior research shows that the discontinuity effect is reduced or even eliminated when participants interacted with a partner who followed a tit-for-tat strategy (Insko et al., 1998; Wildschut et al., 2003). In the absence of noise, tit-for-tat may reduce intergroup competition because it (a) always reciprocates cooperation and therefore increase trust in the partner and (b) always reciprocates competition and therefore discourages attempt to exploit the partner. The present research shows that the positive effect of tit-for-tat on intergroup cooperation may be undermined by noise, presumably because noise disrupts the otherwise strictly contingent nature of tit-for-tat.

**Broader Implications**

The concept of noise has been largely absent from the literature on intergroup relations. This is surprising because, in everyday life, intergroup interactions are often characterized by differences in norms, culture, and ideology, which may increase the likelihood of misunderstanding (Choi & Nisbett, 1998; Gelfand & Christakopoulou, 1999; Morris & Peng, 1994). The present research provides evidence that noise is particularly harmful in intergroup settings and accentuates the discontinuity effect. Indeed, past research may have underestimated the competitiveness of intergroup relations: in environments without noise, the competitive impressions and interaction goals that characterize intergroup interactions may be less detrimental to cooperation. The present research thus underlines the importance of considering noise in future theorizing and research on intergroup relations.

In addition, our findings also shed light on how to reduce the discontinuity effect by increasing intergroup cooperation. Prior perspectives have proposed a range of initiatives to increase intergroup cooperation, including reciprocal strategies and the pursuit of long-term goals (Cohen & Insko, 2008). As the present findings suggest, such strategies may be compromised by instances of noise. We propose that generosity, or returning greater cooperativeness than that received from one’s counterpart, is necessary to counter the negative impact of noise (Klapwijk & Van Lange, 2009). The question of how to promote such generosity in context of competitive groups is an important challenge for future research. One promising idea is based on prior evidence that representatives who received sufficient autonomy to conduct the group’s interactions at their own discretion, without fears of being penalized by their constituents, employed more cooperative strategies to maximize long-term gain and collective interests (Pinter et al., 2007; also see Milinski et al., 2016). This orientation would seem more conducive to the generous strategies that are necessary to overcome noise. For these reasons, we suggest that autonomous (i.e., unaccountable) representatives may hold the key to overcoming the impact of noise, and enhancing cooperation in intergroup contexts.

**Coda**

Although intergroup interactions may be particularly prone to noise in everyday life, little is known about the impact of unintended errors on decision making in intergroup contexts. The present research addressed this by comparing interindividual and intergroup interactions in social dilemma environments with or without noise. Results indicated that noise was more detrimental to intergroup than interindividual cooperation and, hence, accentuated the discontinuity effect. In light of the far-reaching implications of intergroup interactions (in politics, collective bargaining, and international relations), the present research underscores the importance of considering noise in theorizing about intergroup conflict and in initiatives to resolve it.

References

Aaldering, H., Greer, L. L., van Kleef, G. A., & De Dreu, C. K. (2013). Interest

(mis)alignments in representative negotiations: Do pro-social agents fuel or reduce inter-group conflict? *Organizational Behavior and Human Decision Processes, 120*, 240–250. doi: 10.1016/j.obhdp.2012.06.001.

Adams, J. S. (1976). The structure and dynamics of behaviour in organization boundary roles. In M. D. Dunnette (Ed.) *Handbook of industrial and organizational psychology* (pp. 1175-1199). Chicago: Rand McNally.

Axelrod, R. (1984). *The evolution of cooperation.* New York: Basic Books.

Axelrod, R., & Dion, D. (1988). The further evolution of cooperation. *Science, 242*, 1385- 1390. doi: 10.1126/science.242.4884.1385.

Bendor, J., Kramer, R.M., & Stout, S. (1991). When in doubt… Cooperation in a noisy prisoner’s dilemma. *Journal of Conflict Resolution, 35*, 691-719. doi:

10.1177/0022002791035004007.

Choi, I., & Nisbett, R.E. (1998). Situational salience and cultural differences in the correspondence bias and actor-observer bias. *Personality and Social Psychology Bulletin, 24*, 949-960. doi: 10.1177/0146167298249003.

Chua, R. Y. J., Ingram, P., & Morris, M. W. (2008). From the head and the heart: Locating cognition- and affect-based trust in managers’ professional networks. *Academy of Management Journal, 51,* 436-452. doi: 10.5465/AMJ.2008.32625956.

Cohen, T.R., & Insko, C.A. (2008). War and Peace: Possible approaches to reducing intergroup conflict. *Perspectives on Psychological Science, 3*, 87-93. doi: 10.1111/j.1745-6916.2008.00066.x.

Edwards, J. R., & Lambert, L. S. (2007). Methods for integrating moderation and mediation: A general analytical framework using moderated path analysis. *Psychological Methods, 12,* 1-22. doi: 10.1037/1082-989X.12.1.1.

Gelfand, M.J., & Christakopoulou, S. (1999). Culture and negotiator cognition: Judgment accuracy and negotiation processes in individualistic and collectivistic cultures. *Organizational Behavior and Human Decision Processes, 79*, 248-269. doi:

10.1006/obhd.1999.2845.

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis. A regression-based approach.* New York, NY: Guilford.

Haesevoets, T., Van Hiel, A., Reinders Folmer, C., & De Cremer, D. (2014). What money can't buy: The psychology of financial overcompensation. *Journal of Economic Psychology, 42,* 83–95. doi: 10.1016/j.joep.2014.02.001.

Insko, C.A., Schopler, J., Hoyle, R.H., Dardis, G.J., & Graetz, K.A. (1990). Individual-group

discontinuity as a function of fear and greed. *Journal of Personality and Social Psychology, 58*, 68-79. doi: 10.1037/0022-3514.58.1.68.

Insko, C.A., & Schopler, J. (1998). Differential distrust of groups and individuals. In C. Sedikides, J. Schopler, & C. A. Insko (Eds.), *Intergroup Cognition and Intergroup Behavior* (pp. 75-107). Mahwah: Lawrence Erlbaum Associates.

Insko, C. A., Schopler, J., Pemberton, M. B., Wieselquist, J., McIlraith, S. A., Currey, D. P.,

& Gaertner, L. (1998). Long-term outcome maximization and the reduction of interindividual–intergroup discontinuity. *Journal of Personality and Social Psychology, 75,* 695–710. doi: 10.1037/0022-3514.75.3.695.

Kelley, H.H., & Thibaut, J. (1978). *Interpersonal relations: A theory of interdependence*. New York: Wiley.

Klapwijk, A., & Van Lange, P.A.M. (2009). Promoting cooperation and trust in “noisy”

situations: The power of generosity. *Journal of Personality and Social Psychology, 96*, 83–103. doi: 10.1037/a0012823.

Kollock, P. (1993). “An eye for an eye leaves everyone blind”: cooperation and accounting systems. *American Sociological Review, 53*, 768-786. doi: 10.2307/2095950.

Milinski, M., Hilbe, C., Semmann, D., Sommerfeld, R., & Marotzke, J. (2016). Humans

choose representatives who enforce cooperation in social dilemmas through extortion. *Nature Communications, 7*: 11915. doi:10.1038/ncomms10915.

Morris, M.W., & Peng, K. (1994). Culture and cause: American and Chinese attributions for social and physical events. *Journal of Personality and Social Psychology, 67*, 949- 971. doi: 10.1037/0022-3514.67.6.949.

Parks, C.D., Sanna, L.J., & Posey, D.C. (2003). Retrospection in social dilemmas: How thinking about the past affects future cooperation. *Journal of Personality and Social Psychology, 84*, 988-996. doi: 10.1037/0022-3514.84.5.988.

Pinter, B., Insko, C.A., Wildschut, T., Kirchner, J.L., Montoya, R.M., Wolf, S.T. (2007). Reduction of interindividual-intergroup discontinuity: The role of leader accountability and proneness to guilt. *Journal of Personality and Social Psychology, 93*, 250-265. doi: 10.1037/0022-3514.93.2.250.

Reinders Folmer, C.P., Klapwijk, A., De Cremer, D., & Van Lange, P.A.M. (2012). One for

all: what representing a group may do to us. *Journal of Experimental Social Psychology, 48*, 1047-1056. doi: 10.1016/j.jesp.2012.04.009.

Schopler, J., Insko, C.A., Graetz, K.A., Drigotas, S., Smith, V.A., & Dahl, K. (1993). Individual-

group discontinuity: further evidence for mediation by fear and greed. *Personality and Social Psychology Bulletin, 19*, 419-431.

Schopler, J., Insko, C. A., Wieselquist, J., Pemberton, M. B., Witcher, B., Kozar, R.,

Roddenberry, C. & Wildschut, T. (2001). When groups are more competitive than

individuals: The domain of the discontinuity effect. *Journal of Personality* *and Social Psychology, 80,* 632–644. doi: 10.1177/0146167293194007.

Tazelaar, M.J.A., Van Lange, P.A.M., & Ouwerkerk, J.W. (2004). How to cope with “noise” in social dilemmas: the benefits of communication. *Journal of Personality*

*and Social Psychology, 87*, 845-859. doi: 10.1037/0022-3514.87.6.845.

Van Lange, P. A. M., Joireman, J., Parks, C. D., & Van Dijk, E. (2013).  The psychology of

social dilemmas:  A review.  Organizational Behavior and Human Decision Processes, 120, 125-141. doi: 10.1016/j.obhdp.2012.11.003.

Van Lange, P.A.M., & Kuhlman, D.M. (1994). Social value orientations and impressions of

a partner’s honesty and intelligence: a test of the might versus morality effect. *Journal of Personality and Social Psychology, 67*, 126-141. doi: 10.1037/0022-3514.67.1.126.

Van Lange, P.A.M., Ouwerkerk, J.W., & Tazelaar, M.J.A. (2002). How to overcome the detrimental effects of noise in social interaction: the benefits of generosity. *Journal of Personality and Social Psychology, 82*, 768-780. doi: 10.1037/0022-3514.82.5.768.

Wildschut, T., Insko, C.A., & Pinter, B. (2004). The perception of outgroup threat: Content

and activation of the outgroup schema. In V. Yzerbyt, C. M. Judd, & O. Corneille (Eds.), *The psychology of group perception* (pp. 335–359). Hillsdale, NJ: Erlbaum.

Wildschut, T., Pinter, B., Vevea, J. L., Insko, C.A., & Schopler, J. (2003). Beyond the group mind: A quantitative review of the interindividual-intergroup discontinuity effect. *Psychological Bulletin, 129*, 698-722. doi: 10.1037/0033-2909.129.5.698.

Footnotes

1 The original sample included two non-adult individuals (aged 14 and 10). In light of the study’s framing (i.e., in terms of rivaling universities), we excluded them from data analysis.

2 In fact, participants’ chances of winning in a postexperimental raffle were not contingent on task outcomes.

3 This paradigm is more suitable for examining coping with noise than the dichotomous decisions that have been used in some previous research (e.g., Axelrod & Dion, 1988; Kollock, 1993), as people can communicate intentions and goals more profoundly through in- and decreases of their gradual level of cooperation.

 4 We informed participants about the possibility of noise because they are unlikely to expect unintended errors in an experiment and, hence, would assume all of their partner’s decisions to be intentional.

 5 If participants intended to give no coins then an incidence of noise could reduce this no further and, hence, would go by unnoticed. However, previous research has indicated that typically a high percentage of noise comes through (over 90%, see Tazelaar et al., 2004; Van Lange et al., 2002). Here, of the eight instances of noise, on average 86.8% came through. This rate did not differ between interpersonal and intergroup interactions (*p*=.62).

6 A repeated measures ANCOVA on cooperation in rounds 2-34 indicated only a single significant interaction effect involving rounds and noise, *F*(18.31, 5219.88)=3.83, *p*<.001, η2=.013 (indicating a modest increase in cooperation in interactions without noise, and a gradual decline and slight recovery in noisy interactions). Accordingly, we only present the (more parsimonious) analysis on average cooperation here.

7 Additionally, the analyses revealed isolated effects involving gender, indicating that men attributed greater concern for maximizing own outcomes to their partner than women, *F*(1, 285)=5.72, *p*=.017, η2=.018; that women, but not men attributed greater concern for relative advantage to their partner in intergroup contexts than in interpersonal contexts, *F*(1, 285)=2.88, *p*=.091, η2=.009; and that women displayed more benign impressions than men in interactions without noise, but not in noisy interactions, *F*(1, 285)=3.61, *p*=.058, η2=.012.

Table 1. *Means and Standard Deviations (in Parentheses) for Mean Cooperation, Benign Impressions, and Impressions of Specific Interaction Goals as a Function of Noise (No Noise vs. Noise) and Interaction Type (Individuals vs. Representatives).*

|  |  |  |
| --- | --- | --- |
|  | No noise | Noise |
|  | Individuals | Representatives | Individuals | Representatives |
| Cooperation (0-10) |  |  |  |  |
|  Round 1 | 5.83 (3.13) | 4.68 (2.92) | 5.57 (3.25) | 4.93 (3.03) |
|  Rounds 2-35 (mean) | 6.13 (2.60) | 6.15 (2.49) | 5.81 (2.55) | 4.96 (2.73) |
| Partner impressions (1-7) |  |  |  |  |
|  Benign Impressions | 4.26 (0.75) | 4.06 (0.85) | 4.25 (0.88) | 4.03 (0.95) |
|  MinDiff | 4.40 (1.27) | 4.11 (1.28) | 4.28 (1.22) | 3.89 (1.42) |
|  MaxJoint | 4.50 (1.35) | 4.22 (1.38) | 4.27 (1.53) | 3.96 (1.54) |
|  MaxOther | 3.18 (1.08) | 2.89 (0.99) | 3.11 (0.99) | 2.76 (1.03) |
|  MaxOwn | 3.81 (1.25) | 4.52 (1.17) | 4.07 (1.34) | 4.47 (1.21) |
|  MaxRel | 4.23 (1.27) | 4.63 (1.31) | 4.12 (1.40) | 4.57 (1.20) |

Table 2. *Conditional Process Analyses: Testing the Effect of Noise on the Magnitude of the Mediators’ Association with Cooperation (Effect A × C).*

|  |  |
| --- | --- |
|  | Mediator |
|  | Benign Impressions | MinDiff | MaxOther | MaxOwn | MaxRel |
|  | *F* | *p* | *F* | *p* | *F* | *p* | *F* | *p* | *F* | *p* |
| Noise (A) | 5.63 | .018 | 3.49 | .063 | 3.96 | .047 | 2.59 | .109 | 4.93 | .027 |
| Interaction type (B) | 0.46 | .498 | 0.54 | .816 | 0.05 | .830 | 0.25 | .618 | 0.50 | .480 |
| A × B | 1.68 | .196 | 2.78 | .097 | 3.74 | .054 | 3.22 | .074 | 2.42 | .121 |
| Mediator (C) | 15.15 | < .001 | 26.26 | < .001 | 23.66 | < .001 | 3.24 | .073 | 3.66 | .057 |
| A × C | 2.77 | .097 | 11.23 | .001 | 0.00 | .987 | 3.09 | .080 | 5.04 | .026 |

*Note.* The dependent variable in each analysis is mean cooperation. Denominator degrees of freedom equal 277.

**Interaction type**

**Cooperation**

**Mediator**

**Noise**

*Figure 1.*  The conditional process model tested in this experiment.